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INDEX AND ABSTRACTS TO PUBLICATIONS

THE EPA DRILLING FLUID HAZARD ASSESSMENT RESEARCH PROGRAM

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ABOUT THIS PUBLICATION

THIS VOLUME SUMMARIZES RESULTS OF AN ONGOING RESEARCH PROGRAM. FROM 1976 TO THE PRESENT TIME, ERLGB CONDUCTED A RESEARCH PROGRAM TO EVALUATE THE POTENTIAL IMPACT OF DRILLING FLUIDS ON THE MARINE ENVIRONMENT. THE EXTRAMURAL PORTION OF THIS STUDY IS ESSENTIALLY COMPLETE; HOWEVER, THE IN-HOUSE EFFORT IS CONTINUING. THE EFFORT WAS A COMPOSITE OF IN-HOUSE AND EXTRAMURAL ACTIVITIES, ADAPTIVE ENVIRONMENTAL ASSESSMENTS (AEA) AND A FINAL HAZARD ASSESSMENT EFFORT (IN AGENCY REVIEW). DR. NORMAN RICHARDS DIRECTED THE PROGRAM FROM 1976 TO 1981 WHEN DR. T. W. DUKE BECAME PROJECT LEADER.

OVER THAT TIME PERIOD 100 REPORTS, PUBLICATIONS AND JOURNAL ARTICLES IN THE PEER-REVIEWED LITERATURE HAVE BEEN PRODUCED. THIS PUBLICATION LISTS THE TITLE, JOURNAL OR PLACE OF PUBLICATION AND, (WHEN AVAILABLE), AN ABSTRACT OF THE PUBLICATION CONTENT (SEE PAGE 1). ADDITIONALLY, AN AUTHOR INDEX (SEE PAGE 87) AND A KEY WORD INDEX (SEE PAGE 68) ARE PROVIDED.

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ATEMA, JELLE, DALE F. LEAVITT, DIANA E. BARSHAW, AND M. CARMELA CUOMO. 1982. EFFECTS OF DRILLING MUDS ON BEHAVIOR OF THE AMERICAN LOBSTER, HOMARUS AMERICANUS, IN WATER COLUMN AND SUBSTRATE EXPOSURES. CAN. J. FISH. AQUAT. SCI. 39(5):675-689. (ERL,GB X298*).

STUDIES WERE CONDUCTED TO EXPLORE THE EFFECTS OF DRILLING MUDS ON VARIOUS ASPECTS OF LOBSTER BEHAVIOR DIRECTLY RELATED TO SURVIVAL IN THE FIELD. TOXICITY OF DIFFERENT DRILLING MUDS VARIED FROM IMMEDIATELY LETHAL TO ADULT LOBSTERS TO APPARENTLY HARMLESS TO POSTLARVAL STAGES, WITH A VARIETY OF INTERMEDIATE EFFECTS. BOTH THE CHEMICAL TOXICITY IN THE WATER COLUMN AND THE PHYSICAL EFFECTS OF COVERING THE SUBSTRATE WITH DRILLING MUD WERE STUDIED, AND BOTH INTERFERED WITH NORMAL LOBSTER BEHAVIOR. THE STUDIES ARE MAINLY CONCERNED WITH POSTLARVAL LOBSTERS (STAGES VI AND V), I.E., JUST AFTER SETTLING ON THE BOTTOM. THEY WERE TESTED IN 36-D CHRONIC EXPOSURES (7MG/L) AND IN SEMINATURAL AQUARIA WITH 1 MM LAYERS OF DRILLING MUD COVERING THE SUBSTRATE. TOXICITY IN THE WATER COLUMN MANIFESTED ITSELF IN FEEDING AND MOLTING DELAYS, SEVERE DELAYS IN SHELTER CONSTRUCTION, INCREASED WALKING AND SWIMMING, UNPROVOKED TAIL FLIPPING, AND LETHARGY. A NATURAL BAY MUD USED AS A CONTROL CAUSED NO SUCH EFFECTS. PHYSICAL EFFECTS OF SUBSTRATE COVER WERE APPARENT IN EXPERIMENTS WITH 1-, 2-, 4-MM LAYERS OF DRILLING MUD AND SIMILAR LAYERS OF A MIXTURE OF BENTONITE AND BARITE COVERING A NATURAL MUD SUBSTRATE. IN DEPTHS OF 4 MM BOTH KINDS OF SUBSTRATE COVER CAUSED SEVERE DELAYS IN SHELTER CONSTRUCTION AND IN QUALITY OF BURROWS CONSTRUCTED. THUS, SUBSTRATES WITH 4-MM TO PERHAPS AS LITTLE AS 1-MM COVERING OF DRILLING MUD MAY CAUSE INCREASED EXPOSURE OF LOBSTERS TO PREDATORS AND CURRENTS, RESULTING IN THE SUBSTRATE BECOMING UNSUITABLE FOR LOBSTER SETTLING AND SURVIVAL.

AUBLE, GREGOR T., AUSTIN K. ANDREWS, RICHARD A. ELLISON, DAVID B. HAMILTON, RICHARD A. JOHNSON, JAMES E. ROELLE, AND DAVID R. MARMOREK. 1982. RESULTS OF AN ADAPTIVE ENVIRONMENTAL ASSESSMENT MODELING WORKSHOP CONCERNING POTENTIAL IMPACTS OF DRILLING MUDS AND CUTTINGS ON THE MARINE ENVIRONMENT. EPA-600/9-82-019, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 64P.
AVAIL. FROM NTIS, SPRINGFIELD, VA: PB83-114155.

THE WORKSHOP WAS STRUCTURED AROUND CONSTRUCTION OF A MODEL SIMULATING FATE AND EFFECTS OF DISCHARGES FROM A SINGLE RIG INTO OPEN WATER AREAS OF THE GULF OF MEXICO, AND DISCUSSION OF FACTORS THAT MIGHT PRODUCE DIFFERENT FATE AND EFFECTS IN ENCLOSED AREAS SUCH AS BAYS AND ESTUARIES. THE SIMULATION MODEL WAS COMPOSED OF FOUR CONNECTED SUBMODELS. A DISCHARGE/FATE SUBMODEL DEALT WITH THE DISCHARGE CHARACTERISTICS OF THE RIG AND THE SUBSEQUENT FATE OF DISCHARGED MATERIAL, THREE EFFECTS SUBMODELS THEN CALCULATED BIOLOGICAL RESPONSES AT DISTANCES AWAY FROM THE RIG FOR THE WATER COLUMN, SOFT BOTTOM BENTHOS (ASSUMING THE RIG WAS LOCATED OVER A SOFT BOTTOM ENVIRONMENT), AND HARD BOTTOM BENTHOS (ASSUMING THE RIG WAS LOCATED OVER A HARD BOTTOM ENVIRONMENT). THE MODEL FOCUSED ON DIRECT LINKAGES BETWEEN THE DISCHARGE AND VARIOUS ORGANISMS RATHER THAN ON HOW THE MARINE ECOSYSTEM ITSELF IS INTERCONNECTED.

BOBBIE, R.J., D.C. WHITE, AND P.H. BENSON. 1980. BIOCHEMICAL ANALYSIS OF THE RESPONSE OF THE MARINE MICROFOULING COMMUNITY STRUCTURE TO CLEANING PROCEDURES DESIGNED TO MAINTAIN HEAT TRANSFER EFFICIENCY. IN: PROCEEDINGS OF THE FIFTH INTERNATIONAL CONGRESS OF MARINE CORROSION AND FOULING. L. ARITO, EDITOR, GRAFICAS ORBE S.L., BARCELONA, SPAIN. PP. 391-400. (ERL,GB X184*).

THE MICROFOULING COMMUNITY THAT DEVELOPS IN ALUMINUM PIPES SUBJECT TO FLOWING SEA WATER IS MARKEDLY AFFECTED BY A MECHANICAL CLEANING PROCEDURE EMPLOYED TO MAINTAIN THE EFFICIENT HEAT TRANSFER PROPERTIES NECESSARY IN THE CONDENSER SYSTEM OF THE OCEAN THERMAL ENERGY CONVERSION SYSTEM. SENSITIVE MEASURES OF THE MICROBIAL BIOMASS, SUCH AS THE EXTRACTABLE LIPID PHOSPHATE, THE EXTRACTABLE PALMITIC ACID AND THE TOTAL ORGANIC CARBON SHOW GOOD CORRELATING WITH THE HEAT TRANSFER EFFICIENCY (RF) IN THE EARLY STAGES OF FREE FOULING. AFTER MECHANICAL CLEANING WITH EITHER MANUALLY OPERATED BRUSHES OR THE M.A.N. SYSTEM, MEASURES OF THE TOTAL BIOMASS SUCH AS TOTAL ORGANIC CARBON SHOW REASONABLE CORRELATION TO THE (RF). AFTER CLEANING, MEASURES OF CELLULAR BIOMASS SUCH AS LIPID PHOSPHATE OF LIPID PALMITIC ACID DO NOT CORRELATE WITH THE RF AND THE RATIOS OF TOTAL ORGANIC CARBON. MECHANICAL CLEANING CHANGES THE COMMUNITY STRUCTURE OF THE MICROBES. THE MORPHOLOGY OF THE POPULATION BY SCANNING ELECTRON MICROSCOPY (SEM) REVEALS SELECTIVE REMOVAL OF THE LARGER AND MORPHOLOGICALLY MORE COMPLEX MICROEUKARYOTES WITH RETENTION OF A COMMUNITY ENRICHED IN BACTERIA. EXAMINATION OF THE FATTY ACID COMPOSITION OF THE COMMUNITY SHOWS CLEANING-INDUCED SELECTIVITY NOT ONLY FOR THE BACTERIAL PROKARYOTES BUT FOR A SPECIFIC PROPORTION OF THE BACTERIA. A POPULATION DIFFERENCE BETWEEN THE BACTERIA RETAINED AFTER MANUAL BRUSHING AND CONTINOUS BRUSHING WITH THE M.A.N. SYSTEM CAN ALSO BE DEMONSTRATED. SEM MORPHOLOGY, THE RELATIONSHIP BETWEEN RF AND MEASURES OF TOTAL AND CELLULAR BIOMASS, THE INCREASE IN THE RATIO OF TOTAL ORGANIC CARBON TO CELLULAR BIOMASS AND THE STEADY INCREASE IN A MICROBIAL POPULATION ENRICHED IN LINOLEIC ACID ALL POINT TO AN ACCUMULATION OF EXTRACELLULAR BIOPOLYMER WITH THE CLEANING PROCEDURES. WITH INTERMITTENT CLEANING THE EXOPOLYMER ACCUMULATION ENHANCES THE COLONIZATION BY THE MICROEUKARYOTES BETWEEN THE CLEANING CYCLES.

BOBBIE, RONALD J., AND DAVID C. WHITE. 1980. CHARACTERIZATION OF BENTHIC MICROBIAL COMMUNITY STRUCTURE BY HIGH RESOLUTION GAS CHROMATOGRAPHY OF FATTY ACID METHYL ESTERS. APPL. ENVIRON. MICROBIOL. 39(6):1212-1222. (ERL,GB X009*).

FATTY ACIDS ARE A WIDELY STUDIED GROUP OF LIPIDS OF SUFFICIENT TAXONOMIC DIVERSITY TO BE USEFUL IN DEFINING MICROBIAL COMMUNITY STRUCTURE. THE EXTRAORDINARY RESOLUTION OF GLASS CAPILLARY GAS-LIQUID CHROMATOGRAPHY CAN BE UTILIZED TO SEPARATE AND TENTATIVELY IDENTIFY LARGE NUMBERS OF FATTY ACID METHYL ESTERS DERIVED FROM THE LIPIDS OF ESTUARINE DETRITUS AND MARINE BENTHIC MICROBIOTA WITHOUT THE BIAS OF SELECTIVE METHODS REQUIRING CULTURE OR RECOVERY OF THE MICROBES. THE GAS-LIQUID CHROMATOGRAPHIC ANALYSES ARE BOTH REPRODUCIBLE AND HIGHLY SENSITIVE, AND THE RECOVERY OF FATTY ACIDS IS QUANTITATIVE. THE ANALYSES CAN BE AUTOMATED, AND THE DIAGNOSTIC TECHNIQUE OF MASS SPECTRAL FRAGMENTATION ANALYSIS CAN BE READILY APPLIED. SPLITLESS INJECTION ON GLASS CAPILLARY GAS CHROMATOGRAPHIC COLUMNS DETECTED BY MASS SPECTRAL SELECTIVE ION MONITORING PROVIDES AN ULTRASENSITIVE AND DEFINITIVE MONITORING SYSTEM. RECIPROCAL MIXTURES OF BACTERIA AND FUNGI, WHEN EXTRACTED AND ANALYZED, SHOWED PROGRESSIVE CHANGES OF DISTINCTIVE FATTY ACID METHYL ESTERS DERIVED FROM THE LIPIDS. BY MANIPULATING THE ENVIRONMENT OF AN ESTUARINE DETRITAL MICROBIAL COMMUNITY WITH ANTIBIOTICS AND CULTURE CONDITIONS, IT WAS POSSIBLE TO PRODUCE A COMMUNITY GREATLY ENRICHED IN EUCARYOTIC FUNGI, AS EVIDENCED BY SCANNING ELECTRON MICROSCOPIC MORPHOLOGY. THE FATTY ACID METHYL ESTERS FROM THE LIPIDS IN THE FUNGUS-ENRICHED DETRITUS SHOWED ENRICHMENT OF THE C18 DIENOIC AND THE C18 AND C20 POLYENOIC ESTERS. MANIPULATION OF THE DETRITAL MICROBIOTA THAT INCREASED THE PROCARYOTIC POPULATION RESULTED IN AN ABSENCE OF LARGE STRUCTURES TYPICAL OF FUNGAL MYCELIA OR DIATOMS, AS EVIDENCED BY SCANNING ELECTRON MICROSCOPY, AND A SIGNIFICANTLY LARGER PROPORTION OF ANTEISO- AND ISO-BRANCHED C15 FATTY ACID ESTERS, C17 CYCLOPROPANE FATTY ACID ESTERS, AND THE CIS-VACCENIC ISOMER OF THE C18 MONOENOIC FATTY ACID ESTERS. AS DETERMINED BY THESE TECHNIQUES, A MARINE SETTLING COMMUNITY SHOWED GREATER DIFFERENCES IN BACTERIAL AS CONTRASTED TO MICROEUCARYOTIC POPULATIONS WHEN COMPARED WITH THE MICROBIAL COMMUNITIES OF BENTHIC CORES.

BOBBIE, R.J., J.S. NICKELS, G.A. SMITH, S.D. FAZIO, R.H. FINDLAY, W.M. DAVIS, AND D.C. WHITE. 1981. EFFECT OF LIGHT ON BIOMASS AND COMMUNITY STRUCTURE OF ESTUARINE DETRITAL MICROBIOTA. APPL. ENVIRON. MICROBIOL. 42(1):150-158. (ERL,GB X189*).

COMPARISON OF ESTUARINE DETRITAL MICROBIOTA GROWN WITH AND WITHOUT LIGHT IN THE ABSENCE OF MACROSCOPIC GRAZING SHOWED SHIFTS IN THE COMMUNITY STRUCTURE THAT ENABLED CORRELATION BETWEEN VARIOUS BIOCHEMICAL MEASURES. ANALYSIS OF THESE BIOCHEMICAL MEASURES SHOWED THAT GROWTH IN LIGHT INDUCES THE SMALLEST INCREASES IN PROCARYOTIC ATTRIBUTES SUCH AS MURAMIC ACID; WALL GLUCOSAMINE; LIPID PHOSPHATE; TOTAL EXTRACTABLE ADENOSINE NUCLEOTIDES; SHORT-BRANCHED, CYCLOPROPANE, AND CISVACCENIC FATTY ACIDS; LIPID GLUCOSE AND MANNOSE; THE INCORPORATION OF ACETATE INTO LIPID; AND THE FORMATION OF DEOXYRIBONUCLEIC ACID FROM THYMIDINE. MEASURES OF THE MICROFAUNA SUCH AS LIPID INOSITOL AND THE Y-LINOLENIC SERIES OF POLYENOIC FATTY ACIDS ALSO INCREASED MINIMALLY IN THE LIGHT-GROWN MICROBIOTA. MEASURES OF SULFOLIPID SYNTHESIS, LIPID GLYCEROL, TOTAL EXTRACTABLE PALMITATE, 18-CARBON POLYENOIC FATTY ACIDS, AND TOTAL POLYENOIC FATTY ACIDS LONGER THAN 20 CARBONS INCREASED 10- TO 15-FOLD IN ALGAE AND FUNGI. CHLOROPHYLL A, LIPID GALACTOSE, AND THE 16- AND 20- CARBON POLYENOIC FATTY ACIDS CHARACTERISTIC OF DIATOMS INCREASED MAXIMALLY IN THE LIGHT. THIS INCREASE OF DIATOM MEASURE CORRELATED WITH THE SHEETS OF DIATOMS DETECTED BY SCANNING ELECTRON MICROSCOPY.

BOOKHOUT, CAZLYN G., ROBERT MONROE, RICHARD FORWARD, AND JOHN D. COSTLOW, JR. 1982. EFFECTS OF SOLUBLE FRACTIONS OF USED LIGHT-WEIGHT LIGNOSULFONATE TYPE MUD AND HEXAVALENT CHROMIUM ON THE COMPLETE LARVAL DEVELOPMENT OF CRABS, RHITHROPANOPEUS HARRISII AND CALLINECTES SAPIDUS. EPA-600/3-82-018, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 64P.
AVAIL. FROM NTIS, SPRINGFIELD, VA: PB82-197203.

THE MUD AQUEOUS FRACTIONS (MAF) AND SUSPENDED PARTICULATE PHASE (SPP) OF LIGNOSULFONATE TYPE MUD WERE NONTOXIC TO THE COMPLETE LARVAL DEVELOPMENT OF RHITHROPANOPEUS HARRISII. FIVE PERCENT MAF AND SPP WERE NOT TOXIC TO CALLINECTES SAPIDUS. DIFFERENTIAL SURVIVAL OF C. SAPIDUS LARVAE OCCURRED FROM 5 TO 50% MAF AND SPP. NO LARVAE REACHED THE 1ST CRAB STAGE IN 100% MAF AND SPP. STATISTICAL ANALYSES OF THE DATA ON SURVIVAL, MORTALITY AND BEHAVIOR ARE PRESENTED. SURVIVAL OF R. HARRISII FROM HATCHING TO 1ST CRAB STAGE OCCURRED IN 1.1 TO 29.1 PPM NA(2)CRO(4). ESTIMATED LC50 FOR COMPLETE ZOEAL DEVELOPMENT WAS 17.8 PP, NA(2)CRO(4) AND WAS 13.7 FOR DEVELOPMENT TO 1ST CRAB STAGE. A CONCENTRATION OF 1.1 PPM WAS NONTOXIC, 7.2 AND 14.5 NA(2)CRO(4) WERE SUBLETHAL AND CONCENTRATIONS OF 29.1 TO 58.1 PPM WERE ACUTELY TOXIC. LOW CONCENTRATIONS OF NA(2)CRO(4) CAUSED AN INCREASE IN SWIMMING SPEED AND HIGH CONCENTRATIONS CAUSED A DECLINE. SURVIVAL OF CALLINECTES SAPIDUS OCCURRED IN 1.1 TO 4.7 NA(2)CRO(4). THE LC50 FOR COMPLETE ZOEAL DEVELOPMENT WAS ESTIMATED TO BE 2.9 PPM AND THE LC50 FOR DEVELOPMENT TO 1ST CRAB STAGE WAS ESTIMATED TO BE 1.0 PPM. STATISTICAL ANALYSES OF THE DATA ON SURVIVAL, DURATION AND MORTALITY OF LARVAE ARE PRESENTED.

BOOKHOUT, C.G., R.J. MONROE, R.B. FORWARD, JR., AND J.D. COSTLOW, JR. 1984. EFFECTS OF SOLUBLE FRACTIONS OF DRILLING FLUIDS ON DEVELOPMENT OF CRABS, RHITHROPANOPEUS HARRISII AND CALLINECTES SAPIDUS. WATER AIR SOIL POLLUT. 21:183-197. (ERL,GB X374*).

THE MUD AQUEOUS FRACTION (MAP) AND SUSPENDED PARTICULATE PHASE (SPP) OF LOW-DENSITY LIGNOSULFONATE TYPE MUD WITH FERROCHROME ADDED WERE NONTOXIC TO LARVAE DURING THE COMPLETE LARVAL DEVELOPMENT OF RHITHROPANOPEUS HARRISII. FIVE PERCENT (5000 PPM, 0.5% V/V MUD IN WATER) MAP AND SPP WERE NOT TOXIC TO CALLINECTES SAPIDUS. SURVIVAL OF C. SAPIDUS LARVAE DECREASED AS CONCENTRATIONS OF MAF AND SPP INCREASED FROM 5% (5000 PPM, 0.5 V/V MUD IN WATER) TO 50% (50,000 PPM, 5% V/V MUD IN WATER). NO LARVAE REACHED THE 1ST CRAB STAGE IN 100% (100000 PPM, 10% V/V MUD IN WATER) MAF AND SPP. STATISTICAL ANALYSIS OF THE DATA ON SURVIVAL, MORTALITY, AND BEHAVIOR ARE PRESENTED. BLUE CRAB LARVAL BEHAVIOR IS AFFECTED BY EXPOSURE TO MAF AND SPP WITH THE GENERAL EFFECT BEING A DECLINE IN SWIMMING SPEED. A SIGNIFICANT REDUCTION WAS ONLY OBSERVED IN 100% MAF BUT WAS NOTICED IN 5, 25, 50, AND 100% SPP.

BOTERO, LEONOR, AND JELLE ATEMA. 1982. BEHAVIOR AND SUBSTRATE SELECTION DURING LARVAL SETTLING IN THE LOBSTER HOMARUS AMERICANUS. J. CRUSTACEAN BIOL. 2(1):59-69. (ERL,GB X399*).

DURING THE MOLT FROM THIRD- TO FOURTH-STAGE, LARVAE OF HOMARUS AMERICANUS METAMORPHOSE INTO THEIR ADULT FORM AND PIGMENTATION. IN THE COURSE OF THE FOURTH STAGE, THEIR PELAGIC LIFE CHANGES TO A BENTHIC EXISTENCE. ARTIFICIAL SUBSTRATE CHOICE EXPERIMENTS AND QUALITATIVE ILLUMINATION EXPERIMENTS SHOW THAT DURING THE EARLY FOURTH STAGE THE PHOTOTACTIC RESPONSE REVERSES FROM POSITIVE TO NEGATIVE. TOGETHER WITH POSITIVE THIGMOTAXIS, THIS RESULTS IN A CHOICE OF DARK CREVICES. AMONG NATURAL SUBSTRATE CHOICES, PREFERENTIAL SETTLEMENT OCCURRED ON MACROALGAL-COVERED ROCKS, FOLLOWED BY ROCKS ON SAND, MUD, AND SAND. MOREOVER, WHEN NO CHOICE WAS GIVEN, SETTLING OCCURRED MOST RAPIDLY ON MACROALGAL-COVERED ROCKS (34 H), FOLLOWED BY SCATTERED ROCKS ON SAND (38 H), AND MUD (62 H); NO SETTLING OCCURRED ON SAND EVEN TWO WEEKS AFTER THE LAST ANIMAL AHD SETTLED ON ALL OTHER SUBSTRATES. THESE ANIMALS CONTINUED TO EXPLORE THE SAND SUBSTRATE WITH DIVES TO THE BOTTOM. ALTHOUGH MUD WAS NOT A PREFERRED SUBSTRATE IN CHOICE TESTS, THE ANIMALS THAT CHOSE MUD AND THOSE THAT WERE PRESENTED ONLY WITH MUD SETTLED SUCCESSFULLY AND WERE IMMEDIATELY EFFICIENT IN THEIR BURROWING BEHAVIOR, CONSTRUCTING U-SHAPED TUNNELS WHEN IN THE CENTER OF THE AQUARIUM WITHOUT USING A PEBBLE OR ROCK AS A STARTING POINT. THESE LABORATORY TESTS CONFIRM FIELD OBSERVATIONS THAT LOBSTERS CAN SUCCESSFULLY EXPLOIT A VARIETY OF SUBSTRATES. THEY SHOW THAT A SUBSTRATE CAN BE MANIPULATED TO MAKE SUITABLE BURROWS.

BRANNON, ANITA C. 1978. BARIUM, STRONTIUM AND CALCIUM IN THE EXOSKELETAL AND SOFT TISSUES OF THE GRASS SHRIMP, PALAEMONETES PUGIO, IN RELATION TO THE MOLT CYCLE. M.S. THESIS. UNIVERSITY OF WEST FLORIDA, PENSACOLA, FL. 73P. (ERL,GB X309*).

EXPERIMENTS WERE CONDUCTED USING THE GRASS SHRIMP, PALAEMONETES PUGIO, TO INVESTIGATE THE RELATIVE ACCUMULATION, STORAGE AND EXOSKELETAL DEPOSITION OF BARIUM, STRONTIUM AND CALCIUM. BARIUM WAS DETERMINED BY FLAMELESS ATOMIC ABSORPTION SPECTROSCOPY USING PYROLYTICALLY COATED GRAPHITE TUBES. STONTIUM AND CALCIUM WERE DETERMINED BY FLAME ATOMIC ABSORPTION SPECTROSCOPY. EXOSKELETAL CALCIUM DEPOSITION IN PALAEMONETES PUGIO BEGAN IMMEDIATELY AFTER ECDYSIS AND PROCEEDED AT A CONSTANT RATE. BARIUM AND STRONTIUM ARE DEPOSITED IN THE EXOSKELETON ALONG WITH CALCIUM. THE DEGREE OF DEPOSITION OF BARIUM AND STRONTIUM VARIED DURING THE COURSE ON MINERALIZATION OF THE EXOSKELETON. THE EXOSKELETAL TISSUES SHOWED DISCRIMINATION IN FAVOR OF BARIUM AND AGAINST STRONTIUM. BY CONTRAST, THE HEPATOPANCREAS AND ABDOMINAL MUSCLE SHOWED DISCRIMINATION IN FAVOR OF BOTH STRONTIUM AND BARIUM RELATIVE TO CALCIUM. THESE DIFFERENCES IN MINERAL DISCRIMINATION BY EXOSKELETAL AND SOFT TISSUES SUGGEST THAT THE MECHANISM OF MINERAL DEPOSITION IN THE EXOSKELETON MAY BE DIFFERENT FROM THE MECHANISMS OF MINERAL UPTAKE BY SOFT TISSUES. THE UPTAKE AND TISSUE DISTRIBUTION OF BARIUM WAS STUDIED USING BA-133. THE LEVEL OF ACCUMULATION VARIED WITH THE STAGE IN THE MOLT CYCLE AND THE TISSUES EXAMINED. THE RELATIVE ACCUMULATION AMONG THE TISSUES WAS CARAPACE > HEPATOPANCREAS > ABDOMINAL MUSCLE. LONG TERM MAINTENANCE OF SHRIMP UNDER LABORATORY CONDITIONS LED TO DECREASES IN THE WEIGHT OF CAST EXUVIA, INCREASES IN THE CONCENTRATION OF CALCIUM IN THE ABDOMINAL EXOSKELETON, AND DECREASES IN THE CONCENTRATION OF CALCIUM IN THE ABDOMINAL MUSCLE. SHRIMP EXPOSED TO BARITE MEDIA ACCUMULATED BARIUM IN THEIR HEPATOPANCREAS, ABDOMINAL MUSCLE AND EXOSKELETON WITH ACCUMULATION INCREASING WITH THE DURATION OF THE EXPOSURE. EXPOSURE TO BARITE LED TO AN ALTERATION IN THE MINERAL COMPOSITION OF CAST EXUVIA WITH RELATIVE CONCENTRATIONS OF EXUVIA OF EXPERIMENTAL SHRIMP BEING CA > BA > SR AND THAT OF CONTROL SHRIMP BEING CA > SR > BA.

BRANNON, ANITA C., AND PHILIP J. CONKLIN. 1978. EFFECT OF SODIUM PENTACHLOROPHENATE ON EXOSKELETAL CALCIUM IN THE GRASS SHRIMP, PALAEMONETES PUGIO. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NEW YORK, NY. PP. 205-211. (ERL,GB X015*).

EXPOSURE OF THE GRASS SHRIMP, PALAEMONETES PUGIO, TO MEDIA CONTAINING SODIUM PENTACHLOROPHENATE (NA-PCP) LED TO AN APPARENT INCREASE IN THE DRY WEIGHT OF EXUVIA AS WELL AS AN INCREASE IN THE TOTAL QUANTITY OF CALCIUM. THE ACTUAL CALCIUM CONCENTRATION (MG CA/MG DRY EXOSKELETON) IN EXUVIA DID NOT VARY SIGNIFICANTLY IN RELATION TO NA-PCP EXPOSURE. WHETHER THE OBSERVED CHANGES IN EXUVIA FROM SHRIMP EXPOSED TO NA-PCP ARE DUE TO A DECREASE IN THE RESORPTION OF THE OLD EXOSKELETON PRECEEDING ECDYSIS REMAINS TO BE CLARIFIED.

BRANNON, ANITA C., AND K. RANGA RAO. 1979. BARIUM, STRONTIUM AND CALCIUM LEVELS IN THE EXOSKELETON, HEPATOPANCREAS AND ABDOMINAL MUSCLE OF THE GRASS SHRIMP, PALAEMONETES PUGIO: RELATION TO MOLTING AND EXPOSURE TO BARITE. COMP. BIOCHEM. PHYSIOL. A COMP. PHYSIOL. 63A:261-274. (ERL,GB X016*).

1. THE BA, SR AND CA LEVELS IN THE EXOSKELETAL AND SOFT TISSUES OF THE GRASS SHRIMP, PALAEMONETES PUGIO, WERE DETERMINED IN RELATION TO ECDYSIS, POSTECDYSIAL MINERALIZATION OF THE CUTICLE AND EXPOSURE TO MEDIA CONTAINING BARITE. 2. THE EXOSKELETAL TISSUES DISCRIMINATED IN FAVOR OF BA AGAINST SR, RELATIVE TO CA. THE HEPATOPANCREAS AND ABDOMINAL MUSCLE DISCRIMINATED IN FAVOR OF BOTH BA AND SR. 3. THE BA/CA AND SR/CA RATIOS OF THE EXOSKELETAL AND SOFT TISSUES VARIED DURING THE MOLT CYCLE. 4. LONG TERM (106 DAYS) EXPOSURE OF SHRIMP TO EITHER SEAWATER (10 % SALINITY) OR SEAWATER CONTAINING 500 MG BARITE/L LED TO A DECREASE IN THE CA CONCENTRATION IN THE ABDOMINAL MUSCLE AND AN INCREASE IN THE CA CONCENTRATION IN THE EXOSKELETON. 5. WHEN EXPOSED TO MEDIA CONTAINING BARITE THE SHRIMP INGESTED PARTICULATE BARITE. 6. THE SHRIMP EXPOSED TO BARITE MEDIA ACCUMULATED HIGHER LEVELS OF BA IN THEIR EXOSKELETAL AND SOFT TISSUES THAN CONTROL SHRIMP IN SEAWATER. THE RELATIVE CONCENTRATIONS OF THE MINERALS IN THE EXUVIA OF BARITE-EXPOSED SHRIMP WERE CA>BA>SR, WHILE THOSE OF CONTROL SHRIMP WERE: CA>SR>BA.

CANTELMO, F.R., AND K.R. RAO. 1978. EFFECT OF PENTACHLOROPHENOL (PCP) ON MEIOBENTHIC COMMUNITIES ESTABLISHED IN AN EXPERIMENTAL SYSTEM. MAR. BIOL. 46(1):17-22. (ERL,GB X029*).

AQUARIA CONTAINING CLEAN SAND RECEIVED A CONTINUOUS SUPPLY OF SEAWATER FROM SANTA ROSA SOUND, FLORIDA, USA, MIXED WITH KNOWN CONCENTRATIONS (7, 76 AND 622 MG 1-1) OF PENTACHLOROPHENOL (PCP). AFTER 9 WEEKS, NEMATODES ACCOUNTED FOR 87% OF THE TOTAL MEIOFAUNA. NEMATODE BIOMASS AND DENSITIES WERE GREATEST IN AQUARIA EXPOSED TO 76 MG PCP 1-1 AND WERE LEAST IN AQUARIA EXPOSED TO 622 MG PCP 1-1. EPISTRATE FEEDERS WERE ABUNDANT IN CONTROL AQUARIA AND AQUARIA EXPOSED TO 7 AND 76 MG PCP 1-1, BUT NOT IN AQUARIA EXPOSED TO 622 MG PCP 1-1. SELECTIVE DEPOSIT FEEDERS WERE NOT ABUNDANT IN THE CONTROL AQUARIA AND AQUARIA EXPOSED TO 7 MG PCP 1-1, BUT COMPRISED 19% OF THE NEMATODES IN AQUARIA EXPOSED TO 76 MG PCP 1-1 AND 61% IN AQUARIA EXPOSED TO 622 MG PCP 1-1.

CANTELMO, ANGELA C., AND K. RANGA RAO. 1978. EFFECTS OF PENTACHLOROPHENOL (PCP) AND 2,4-DINITROPHENOL (DNP) ON THE OXYGEN CONSUMPTION OF TISSUES FROM THE BLUE CRAB, CALLINECTES SAPIDUS, UNDER DIFFERENT OSMOTIC CONDITIONS. COMP. BIOCHEM. PHYSIOL. C COMP. PHARMACOL. 60C(2):215-219. (ERL,GB X028*).

1. THE EFFECTS OF ACCLIMATION TO 300 AND 940 MILLIOSMOLE SEAWATER AND AN ACUTE HYPO-OSMOTIC STRESS ON THE WEIGHT-SPECIFIC OXYGEN CONSUMPTION OF THE GILLS, MUSCLE AND HEPATOPANCREAS OF THE BLUE CRAB, CALLINECTES SAPIDUS, WERE DETERMINED. 2. THE GILL AND MUSCLE TISSUES EXHIBITED AN INCREASE IN OXYGEN CONSUMPTION ON ACCLIMATION OF CRABS TO A LOW SALINITY OR WHEN THE TISSUES WERE SUBJECTED TO AN ACUTE HYPO-OSMOTIC STRESS. SIMILAR TREATMENTS DID NOT ALTER THE OXYGEN CONSUMPTION OF THE HEPATOPANCREAS. 3. AT A CONCENTRATION OF 5 X 10-3 M, PENTACHLOROPHENOL (PCP) AND 2,4-DINITROPHENOL (DNP) CAUSED INHIBITION OF OXYGEN CONSUMPTION IN THE TISSUES EXAMINED. THE EXTENT OF THIS INHIBITION OF OXYGEN CONSUMPTION WAS INDEPENDENT OF THE METABOLIC ACTIVITY OF THE TISSUES.

CANTELMO, FRANK R., AND K. RANGA RAO. 1978. EFFECTS OF PENTACHLOROPHENOL ON THE MEIOBENTHIC NEMATODES IN AN EXPERIMENTAL SYSTEM. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NEW YORK, NY. PP. 165-174. (ERL,GB X026*).

AQUARIA CONTAINING CLEAN SAND RECEIVED A CONTINUOUS SUPPLY OF SEAWATER FROM SANTA ROSA SOUND, FLORIDA, MIXED WITH KNOWN QUANTITIES OF PCP FOR NINE WEEKS (MAY 10 - JULY 12, 1976) FOR THE FIRST EXPERIMENT AND DOWICIDE G-ST FOR THIRTEEN WEEKS (DECEMBER 27, 1976 - MARCH 28, 1977) FOR THE SECOND EXPERIMENT. THE MEASURED CONCENTRATIONS OF PCP IN THE FORMER EXPERIMENT WERE 776 AND 622 MG/L WHILE THE CONCENTRATIONS AT 1.8, 15.8 AND 161 MG/L WERE USED IN THE LATTER EXPERIMENT. AT EHE END OF EACH EXPERIMENT THE MEIOFAUNA ESTABLISHED IN THE CONTROL AND EXPERIMENTAL AQUARIA WERE EXAMINED. NEMATODES WERE THE DOMINANT GROUP AND AVERAGED 83% OF ALL THE MEIOFAUNA ENCOUNTERED. CONCENTRATIONS OF 1.8, 7 AND 15.8 MG PCP/L DID NOT AFFECT THE BIOMASS AND DENSITY OF NEMATODES. AN INTERMEDIATE CONCENTRATION OF PCP (76 MG/L) CAUSED AN INCREASE IN BIOMASS AND DENSITY OF NEMATODES COMPARED TO CONTROL AQUARIA. HIGHER CONCENTRATIONS OF PCP (161 AND 622 MG/L) CAUSED A DECREASE IN BIOMASS AND DENSITY OF NEMATODES COMPARED TO CONTROL AQUARIA. MARKED CHANGES IN NEMATODE SPECIES COMPOSITION AND SHIFTS IN NEMATODE FEEDING TYPES WERE NOTICED IN THE AQUARIA EXPOSED TO 161 AND 622 MG PCP/L. NEMATODES CLASSIFIED AS EPISTRATE FEEDERS WERE MOST ABUNDANT IN THE CONTROL AQUARIA AND THOSE EXPOSED TO 1,8, 7, 15.8 AND 76 MG PCP/L. DEPOSIT FEEDERS WERE RELATIVELY ABUNDANT AMONG THE NEMATODES IN AQUARIA EXPOSED TO 161 AND 622 MG PCP/L. THE ALTERATIONS IN NEMATODES OBSERVED IN THIS INVESTIGATION APPEARED TO BE DUE TO THE VARIATIONS IN MACROBENTHIC FAUNA AND FOOD (ALGAE) SUPPLY CAUSED BY THE BIOCIDAL EFFECTS OF PCP AND ALSO DUE TO THE TOXIC EFFECTS OF PCP ON MEIOFAUNA.

CANTELMO, ANGELA C., PHILIP J. CONKLIN, FERRIS R. FOX, AND K. RANGA RAO. 1978. EFFECTS OF SODIUM PENTACHLOROPHENATE AND 2,4-DINITROPHENOL ON RESPIRATION IN CRUSTACEANS. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NEW YORK, NY. PP. 251-263. (ERL,GB X027*).

THE OXYGEN CONSUMPTION OF THE GRASS SHRIMP, PALAEMONETES PUGIO, WAS DETERMINED AT DIFFERENT STAGES OF THE MOLT CYCLE. AT EACH STAGE OF THE MOLT CYCLE, THE OXYGEN CONSUMPTION VARIED IN RELATION TO PERIODS OF ACTIVITY. IN ORDER TO MINIMIZE THE ERRORS IN ESTABLISHING BASAL (CONTROL) RATES OF OXYGEN CONSUMPTION, MEASUREMENTS WERE MADE OVER EXTENDED PERIODS (1 TO 24 HOURS). IN CONTRAST TO THE PREVIOUS REPORTS OF PROGRESSIVE INCREASES IN OXYGEN CONSUMPTION DURING PROECDYSIAL STAGES IN OTHER CRUSTACEANS, WE NOTED SIGNIFICANT INCREASES IN OXYGEN CONSUMPTION JUST PRIOR TO AND DURING THE ACTUAL SHEDDING OF EXOSKELETON (ECDYSIS) IN GRASS SHRIMP. THE EFFECTS OF SODIUM PENTACHLOROPHENATE (NA-PCP) ON OXYGEN CONSUMPTION VARIED DEPENDING ON THE STAGE OF THE MOLT CYCLE, CONCENTRATION OF NA-PCP AND EXTENT OF PRE-EXPOSURE OF SHRIMP TO NA-PCP. AT CONCENTRATIONS OF 1.5 AND 5.0 PPM, NA-PCP DID NOT ALTER THE OXYGEN CONSUMPTION OF SHRIMP IN INTERMOLT AND PROECDYSIAL STAGES OF THE MOLT CYCLE. LATE PROECDYAIAL SHRIMP EXPOSED TO 5.0 PPM NA-PCP EXHIBITED AN INCREASE IN OXYGEN CONSUMPTION IN RELATION TO ECDYSIS TO THE SAME LEVEL AS THAT OF CONTROL SHRIMP. HOWEVER, FOLLOWING ECDYSIS, THE SHRIMP EXPOSED TO 5.0 PPM NA-PCP EXHIBITED A DRAMATIC DECLINE IN OXYGEN CONSUMPTION AND DIED WITHIN THREE HOURS. THIS INCREASED SENSITIVITY DURING THE EARLY POSTECDYSIAL PERIOD APPEARED TO BE RELATED TO AN INCREASE IN THE UPTAKE OF NA-PCP AT THIS STAGE COMPARED TO INTERMOLT AND PROECDYSIAL STAGES. A DECLINE IN OXYGEN CONSUMPTION AS NOTED ABOVE COULD BE INDUCED IN INTERMOLT SHRIMP BY USING HIGHER CONCENTRATIONS OF NA-PCP. EXPOSURE OF SHRIMP TO 10 OR 12 PPM NA-PCP, OR TO 5 PPM FOLLOWED BY 20 PPM NA-PCP CAUSED AN INITIAL INCREASE IN OXYGEN CONSUMPTION AND A SUBSEQUENT DECLINE LEADING TO DEATH. THE SURVIVAL TIME OF INTERMOLT SHRIMP PRETREATED WITH 5 PPM NA-PCP WAS LONGER THAN THAT OF SHRIMP EXPOSED DIRECTLY TO 10 OR 20 PPM NA-PCP. ALTHOUGH 20 PPM 2,4-DINITROPHENOL (DNP) CAUSED AN INITIAL INCREASE IN OXYGEN CONSUMPTION IN INTERMOLT SHRIMP, THIS WAS NOT FOLLOWED BY ANY DECLINE IN OXYGEN CONSUMPTION OR DEATH DURING A 24-HOUR EXPOSURE. THE EFFECTS OF NA-PCP AND DNP ON TISSUE RESPIRATION IN VITRO WERE STUDIED USING THE BLUE CRAB, CALLINECTES SAPIDUS. AT CONCENTRATIONS OF 1 X 10-6 M AND 5 X 10-5 M, THESE COMPOUNDS DID NOT ALTER THE OXYGEN CONSUMPTION OF THE MUSCLE, GILL AND HEPATOPANCREAS. AT A CONCENTRATION OF 5 X 10-3 M, BOTH NA-PCP AND DNP CAUSED AN INHIBITION OF OXYGEN CONSUMPTION OF ISOLATED TISSUES.

CANTELMO, FRANK R., M.E. TAGATZ, AND K. RANGA RAO. 1979. EFFECT OF BARITE ON MEIOFAUNA IN A FLOW-THROUGH EXPERIMENTAL SYSTEM. MAR. ENVIRON. RES. 2(4):301-309. (ERL,GB X151).

THE EFFECTS OF BARITE (94-96% BASO4), A MAJOR CONSTITUENT OF DRILLING MUDS USED IN MARINE OIL DRILLING OPERATIONS, ON MEIOFAUNA WERE STUDIED IN AN EXPERIMENTAL FLOW-THROUGH SYSTEM. AQUARIA CONTAINING SAND OR VARYING PROPORTIONS OF BARITE AND SAND RECEIVED A CONTINUOUS SUPPLY OF UNFILTERED SEAWATER FROM SANTA ROSA SOUND, FLORIDA, FOR TEN WEEKS. AT THE END OF THIS PERIOD THE COMPOSITION, BIOMASS AND VERTICAL DISTRIBUTION OF THE MEIOFAUNA WERE DETERMINED. MOST OF THE MEIOFAUNA (>99%) OCCURRED IN THE HIGHLY AEROBIC UPPER 2 CM PORTION OF THE SUBSTRATUM. ROTIFERA, FORAMINIFERA, HYDROZOA, TURBELLARIA, OSTRACODA, POLYCHAETA AND BIVALVIA DID NOT EXHIBIT SIGNIFICANT DIFFERENCES BETWEEN CONTROL AND EXPERIMENTAL AQUARIA. HOWEVER, THE DENSITIES OF NEMATODA, COPEPODA AND COPEPODA NAUPLII VARIED WITH THE SUBSTRATE COMPOSITION. THE MEIOFAUNAL DENSITIES IN THE AQUARIA CONTAINING 1:10 OR 1:3 MIXTURES OF BARITE AND SAND WERE GREATER THAN THAT IN AQUARIA CONTAINING SAND ALONE. A MARKED DECREASE IN MEIOFAUNAL DENSITY WAS EVIDENT IN AQUARIA CONTAINING 5.5 CM OF SAND COVERED WITH A 0.5 CM LAYER OF BARITE.

CAPUZZO, JUDITH M., AND JENNIFER G. SMITH DERBY. 1982. DRILLING FLUID EFFECTS TO DEVELOPMENTAL STAGES OF THE AMERICAN LOBSTER. EPA-600/4-82-039, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 52P.
AVAIL. FROM NTIS, SPRINGFIELD, VA: PB82-220740.

LABORATORY EXPERIMENTS WERE CONDUCTED TO EVALUATE THE IMPACT OF DRILLING OPERATIONS FOR OIL EXPLORATION ON POPULATIONS OF THE AMERICAN LOBSTER (HOMARUS AMERICANUS). THE EFFECTS OF USED, WHOLE DRILLING FLUIDS ON THE LARVAL STAGES OF THE LOBSTER WERE ASSESSED IN CONTINUOUS FLOW BIOASSAY EXPERIMENTS. THE FIVE DRILLING FLUIDS TESTED WERE SHOWN TO VARY MARKEDLY IN THEIR TOXICITY, WITH LC-50 VALUES RANGING FROM 74 PPM TO >500 PPM. SUBLETHAL EXPOSURES TO DRILLING FLUIDS RESULTED IN REDUCTIONS IN GROWTH RATES, MOLTING FREQUENCIES, RESPIRATION RATES, FEEDING RATES, AND GROWTH EFFICIENCIES. REDUCED O:N RATIOS AND INCREASED PROTEIN:LIPID RATIOS DEMONSTRATED A CHANGE IN THE ENERGETICS OF THE LARVAL LOBSTERS AS A RESULT OF DRILLING FLUID EXPOSURE. RESULTS SHOW THAT IT IS PRIMARILY THE CHEMICAL AND NOT THE PHYSICAL FEATURES OF DRILLING FLUIDS THAT WERE RESPONSIBLE FOR THE DETRIMENTAL EFFECTS OBSERVED. THE DRILLING FLUIDS TESTED THAT HAD A DIESEL COMPONENT WERE MORE TOXIC THAN THOSE WITHOUT THIS COMPONENT, ALTHOUGH DIRECT CORRELATIONS BETWEEN PERCENT DIESEL AND RELATIVE TOXICITY COULD NOT BE MADE. THE PHENOL AND METAL CONTENT OF THE DRILLING FLUIDS MAY HAVE ALSO CONTRIBUTED TO THEIR TOXICITY. FIELD DISPERSION STUDIES ON DRILLING FLUIDS ARE DISCUSSED IN TERMS OF POTENTIAL IMPACT AREAS.

CONKLIN, P. J., AND K. R. RAO. IN PREP. COMPARATIVE TOXICITY OF OFFSHORE AND OIL-ADDED DRILLING MUDS TO LARVAE OF THE GRASS SHRIMP, PALAEMONETES INTERMEDIUS. ARCH. ENVIRON. CONTAM. TOXICOL. (ERL,GB X471).

CONKLIN, PHILIP J., AND K. RANGA RAO. 1978. TOXICITY OF SODIUM PENTACHLOROPHENATE (NA-PCP) TO THE GRASS SHRIMP, PALAEMONETES PUGIO, AT DIFFERENT STAGES OF THE MOLT CYCLE. BULL. ENVIRON. CONTAM. TOXICOL. 20(2):275-279. (ERL,GB X021*).

PENTACHLOROPHENOL (PCP) AND ITS SALT, SODIUM PENTACHLOROPHENATE (NA-PCP) ARE WIDELY USED AS BIOCIDES (BEVENUE AND BECKMAN 1967). PREVIOUS INVESTIGATIONS INDICATE THAT ADULT CRUSTACEANS ARE MORE TOLERANT THAN FISH TO PCP AND NA-PCP (GOODNIGHT 1942; KAILA AND SAARIKOSKI 1977). THE TOXICITY DATA FOR CRUSTACEANS ARE BASED ON SHORT TERM (USUALLY 96 HOURS OR LESS) BIOASSAYS ON INDIVIDUALS WHOSE PHYSIOLOGICAL STATUS IN RELATION TO THE MOLT CYCLE WAS UNKNOWN. SINCE CHANGES IN THE PERMEABILITY OF CUTICLES ARE EXPECTEDF TO OCCUR IN RELATION TO THE CYCLIC SHEDDING, SECRETION AND HARDENING OF THE EXOSKELETON IN CRUSTACEANS (PASSANO 1960) IT IS IMPORTANT TO EVALUATE THE TOXICITY OF PESTICIDES AT KNOWN STAGES OF THE MOLT CYCLE. ALTHOUGH THERE ARE REPORTS OF AN APPARENT INCREASE IN THE SENSITIVITY OF ADULT CRUSTACEANS DURING OR SOON AFTER MOLTING (ECDYSIS) TO TOXICANTS SUCH AS COPPER (HUBSCHMAN 1967), AROCLOR 1254 (DUKE ET AL. 1970; NIMMO ET AL. 1971) AND METHOXYCHLOR (ARMSTRONG ET AL. 1976) THERE HAVE BEEN NO TOXICOLOGICAL EVALUATIONS IN RELATION TO THE DIFFERENT STAGES OF THE MOLT CYCLE. THE CRUSTACEAN MOLT CYCLE IS DIVIDED INTO FIVE MAJOR STAGES (A THROUGH E) AND SEVERAL SUBSTAGES (DRACH 1939) WHICH CAN BE IDENTIFIED BY DISTINCT MORPHOLOGICAL CRITERIA. THE AIM OF THIS INVESTIGATION WAS TO EVALUATE THE TOXICITY OF NA-PCP TO THE GRASS SHRIMP, PALAEMONETES PUGIO, AT SPECIFIC STAGES OF THE MOLT CYCLE USING STANDARD 96 HOUR BIOASSAYS.

CONKLIN, PHILIP J., AND K. RANGA RAO. 1978. TOXICITY OF SODIUM PENTACHLOROPHENATE TO THE GRASS SHRIMP, PALAEMONETES PUGIO, IN RELATION TO THE MOLT CYCLE. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NEW YORK, NY. PP. 181-192. (ERL,GB X040*).

THE TOXICITY OF SODIUM PENTACHLOROPHENATE (NA-PCP) TO THE GRASS SHRIMP, PALAEMONETES PUGIO, WAS EVALUATED AT DIFFERENT STAGES OF THE MOLT CYCLE. IN 96-HOUR BIOASSAYS, THE SHRIMP IN LATER STAGES OF THE PROECDYSIAL PERIOD EXHIBITED A GREATER SENSITIVITY TO NA-PCP THAN THAT EXHIBITED BY SHRIMP IN THE INTERMOLT AND EARLY PROECDYSIAL STAGES OF THE MOLT CYCLE. THE SHRIMP IN LATER PROECDYSIAL STAGES GENERALLY MOLTED (UNDERWENT ECDYSIS) DURING THE 96-HOUR TEST PERIOD AND DIED SHORTLY AFTER ECDYSIS. THE 96-HOUR LC50 VALUE OBTAINED FOR THESE SHRIMP (0.436 PPM) IS THE LOWEST OF ALL THE LC50 VALUES REPORTED PREVIOUSLY FOR ADULT CRUSTACEANS AND IS COMPARABLE TO THOSE FOR FISH AND LARVAL CRUSTACEANS. THE INCREASED SENSITIVITY TO NA-PCP DURING THE EARLY POSTECDYSIAL PERIOD WAS ALSO APPARENT IN A LONG-TERM (66 DAYS) TEST. THE OBSERVED POSTECDYSIAL MORTALITY OF SHRIMP EXPOSED TO 1.0 PPM NA-PCP WAS NOT DEPENDENT ON THE DURATION OF EXPOSURE OF SHRIMP TO NA-PCP DURING THE PROECDYSIAL PERIOD. STUDIES WITH 14C-PCP INDICATE THAT AN ABRUPT INCREASE IN THE UPTAKE OF PCP DURING THE PERIOD SHORTLY AFTER ECDYSIS MAY CAUSE INCREASED MORTALITIES DURING THIS PERIOD.

CONKLIN, PHILIP J., DANIEL G. DOUGHTIE, AND K. RANGA RAO. 1980. EFFECTS OF BARITE AND USED DRILLING MUDS ON CRUSTACEANS, WITH PARTICULAR REFERENCE TO THE GRASS SHRIMP, PALAEMONETES PUGIO. IN: SYMPOSIUM: RESEARCH ON ENVIRONMENTAL FATE AND EFFECTS OF DRILLING FLUIDS AND CUTTINGS, JAN. 21-24, 1980, LAKE BUENA VISTA, FL., VOL. 2. AMERICAN PETROLEUM INSTITUTE, WASHINGTON, DC. PP. 912-943. (ERL,GB X226*).

WHEN EXPOSED TO MEDIA CONTAINING BARITE OR USED DRILLING MUD, THE GRASS SHRIMP PALAEMONETES PUGIO INGESTED THE SETTLED BARITE AND DRILLING MUD PARTICLES. ULTRASTRUCTURAL STUDIES ON THE MIDGUT OF SHRIMP EXPOSED FOR A 30-DAY PERIOD TO 100 OR 500 PPM BARITE-CONTAINING MEDIA SHOWED THAT PROLONGED INGESTION OF BARITE CAUSES MARKED PERTURBATIONS IN THE POSTERIOR MIDGUT EPITHELIUM. WHAT EFFECTS THE INGESTION OF WHOLE DRILLING MUD PARTICLES HAS ON THE DIGESTIVE EPITHELIA REMAINS TO BE STUDIED. DEPENDING ON THE TYPE OF PARTICULATE MATERIALS AVAILABLE IN THE MEDIUM AT THE SAME TIME OF MOLTING, THE GRASS SHRIMP INCORPORATED SAND GRAINS, BARITE, OR DRILLING MUD PARTICLES INTO ITS STATOCYCTS--THE EQUILIBRIUM RECEPTORS LOCATED IN THE BASAL ANTENNULAR SEGMENT. WHETHER THE PHYSIOLOGY OF THESE SENSE ORGANS WOULD BE AFFECTED BY THE INCORPORATION OF BARITE AND DRILLING MUD PARTICLES MERITS FURTHER INVESTIGATION. A COMPARATIVE STUDY OF THE TOXICITY OF 18 DIFFERENT SAMPLES OF USED (SPENT) DRILLING MUDS FROM AN EXPLORATORY DRILLING RIG IN A LOCAL ESTUARY REVEALED THAT, DURING A 96-HR TEST PERIOD, NONE OF THE MUDS WAS TOXIC TO INTERMOLT GRASS SHRIMP AT MUD CONCENTRATION OF 1000 UL/L (10 AND 100 PPM). BUT AS A CONCENTRATION OF 1000 UL/L (1000 PPM), SIX OF THESE MUDS CAUSED 30 TO 60% MORTALITY OF INTERMOLT GRASS SHRIMP DURING A 96-HR TEST PERIOD, WHILE ONE MUD CAUSED 100% MORTALITY. TOXICITY TESTS WITH MOLTING GRASS SHRIMP YIELDED LC 50 VALUES OF 363 TO 739 UL/L FOR FIVE OF THE MUD SAMPLES. A FLOW-THROUGH SYSTEM WAS EMPLOYED FOR ASSESSING THE TOXICITY OF DRILLING MUD DURING THE MOLT CYCLE OF PALAEMONETES AND THE LIFE CYCLE OF MYSIDOPSIS BAHIA. MYSIDS ARE FOUND TO BE MORE SENSITIVE THAN GRASS SHRIMP TO DRILLING MUD EXPOSURE. IN LIFE CYCLE TESTS WITH MYSIDS, THE LC 50 FOR ONE OF THE MUDS WAS 50 UL/L. THE LC 50 VALUES OBTAINED WITH TESTS INVOLVING MOLTING GRASS SHRIMP AND MYSIDS ARE SEVERAL MAGNITUDES LOWER THAN THE PREVIOUSLY REPORTED LC 50 VALUES FOR FISHES. THESE RESULTS EMPHASIZE THE NEED FOR EMPLOYING SENSITIVE ORGANISMS AND LONG-TERM TESTS FOR ASSESSING THE TOXIC AND SUBLETHAL EFFECTS OF USED DRILLING MUDS.

CONKLIN, PHILIP J., AND K. RANGA RAO. 1982. EFFECTS OF TWO DITHIOCARBAMATES ON THE GRASS SHRIMP, PALAEMONETES PUGIO: MOLT-RELATED TOXICITY AND INHIBITION OF LIMB REGENERATION. ARCH. ENVIRON. CONTAM. TOXICOL. 11(4):431-435. (ERL,GB X210*).

THE EFFECTS OF TWO DITHIOCARBAMATE FORMULATIONS (AQUATREAT DNM-30 AND BUSAN 85) ON THE INITIATION AND PROGRESSION OF LIMB REGENERATION FOLLOWING THE REMOVAL OF THE LEFT FIFTH WALKING LEG (PEREIOPOD) WERE STUDIED WITH THE ESTUARINE GRASS SHRIMP, PALAEMONETES PUGIO. EXPOSURE TO EITHER AQUATREAT DNM-30 OR BUSAN 85 AFFECTED BOTH THE INITIATION AND PROGRESSION OF LIMB REGENERATION; THE SHRIMP EXHIBITED DOSE-RELATED INHIBITION OF REGENERATIVE GROWTH. THE RESULTANT EC(50) VALUES FOR INHIBITION OF REGENERATIVE LIMB GROWTH WERE WELL BELOW THE MEDIAN LETHAL CONCENTRATIONS (LC(50)S) FOR GRASS SHRIMP. IN TESTS WITH MOLTING GRASS SHRIMP, BUSAN 85 WAS MORE ACUTELY TOXIC THAN AQUATREAT DNM-30.

CONKLIN, P.J., D. DRYSDALE, D.G. DOUGHTIE, K.R. RAO, J.P. KAKAREKA, T.R. GILBERT, AND R.F. SHOKES. 1983. COMPARATIVE TOXICITY OF DRILLING MUDS: ROLE OF CHROMIUM AND PETROLEUM HYDROCARBONS. MAR. ENVIRON. RES. 10(2):105-125. (ERL,GB X398*).

SAMPLES OF USED DRILLING MUDS COLLECTED DURING THE COURSE OF A SINGLE WELL DRILLING OPERATION EXHIBITED DIFFERENT DEGREES OF ACUTE TOXICITY TO SHEEPSHEAD MINNOWS AND GRASS SHRIMP. FOR MOLTING GRASS SHRIMP (PALAEMONETES PUGIO), THE 96-H LC50'S WERE 360 TO 14,560 PPM (UL/LITER); MANY OF THESE VALUES WERE CONSIDERABLY LOWER THAN THOSE REPORTED FROM PREVIOUS DRILLING MUD ASSAYS. HOWEVER, WHEN SOME OF THE MUDS USED IN THIS STUDY WERE TESTED ON SHEEPSHEAD MINNOWS (CYPRINODON VARIEGATUS) THE RESULTING 96-H LC50'S (6,300 TO 100,000 PPM) WERE WELL WITHIN THE RANGE OF PREVIOUSLY REPORTED VALUES. ALTHOUGH A NUMBER OF THE DRILLING MUD SAMPLES HAD RELATIVELY HIGH AMOUNTS OF CHROMIUM DUE TO THE ADDITION OF SODIUM CHROMATE, THERE WAS A LOW CORRELATION BETWEEN CHROMIUM CONCENTRATION AND TOXICITY. IN ONLY THREE DRILLING MUDS COULD CHROMIUM CONTENT ALONE ACCOUNT FOR THE OBSERVED TOXICITIES. FURTHERMORE, CHEMICAL /ANALYSIS REVEALED THE PRESENCE OF NO. 2 FUEL OIL-LIKE PETROLEUM HYDROCARBONS IN THE MUD SAMPLES. BASED ON THE RESULTS OF TOXICITY TESTS WITH NO. 2 FUEL OIL AND THE CONCENTRATIONS OF OIL PRESENT IN THE MUDS, THE TOXICITY OF THE MUD SAMPLES TO GRASS SHRIMP APPEARS TO BE LARGELY ATTRIBUTABLE TO THE PETROLEUM HYDROCARBON CONTENT.

CONKLIN, PHILIP J., AND K. RANGA RAO. 1983. COMPARATIVE TOXICITY OF WASTE DRILLING FLUIDS TO A CRUSTACEAN (PALAEMONETES PUGIO) AND A FISH (CYPRINODON VARIEGATUS) (ABSTRACT). IN: PROCEEDINGS OF THE NINTH ANNUAL AQUATIC TOXICITY WORKSHOP: NOV. 1-5, 1982, CAN. TECH. REP. FISH. AQUAT. SCI. 1163. W. C. MCKAY, EDITOR, DEPT. OF FISHERIES AND OCEANS, OTTAWA, ONTARIO. PP. 205. (ERL,GB X476*).

THE ACUTE TOXICITY OF A SERIES OF 18 DRILLING FLUIDS (MUDS) FROM AN EXPLORATORY DRILLING OPERATION WAS EVALUATED IN TESTS USING 28-DAY OLD JUVENILE SHEEPSHEAD MINNOWS (CYPRINODON VARIEGATUS) AND GRASS SHRIMP (PALAEMONTES PUGIO.) GRASS SHRIMP THAT MOLTED DURING THE TESTS WERE ESPECIALLY SENSITIVE TO THE DRILLING MUDS; THE 96-HR LC50S (363 TO 14,565 PPM MUD BY VOLUME) ARE CONSIDERABLY LOWER THAN THE PREVIOUSLY REPORTED TOXICITY VALUES FOR DRILLING MUDS. SHEEPSHEAD MINNOWS WERE CONSIDERABLY LESS SENSITIVE TO THE MUDS THAN WERE GRASS SHRIMP. ALTHOUGH A NUMBER OF THE DRILLING MUDS CONTAINED RELATIVELY HIGH AMOUNTS OF CHROMIUM, IN MOST INSTANCES THE OBSERVED TOXICITIES DID NOT APPEAR TO BE ATTRIBUTABLE TO CHROMIUM ALONE. HOWEVER, THERE WAS A SIGNIFICANT CORRELATION BETWEEN THE AMOUNT OF OIL PRESENT IN THE MUDS AND THEIR TOXICITY TO GRASS SHRIMP.

CONNOR, SETH JOHN. 1983. EFFECTS OF DRILL MUD ON THE FREE AMINO ACID POOL OF ACROPORA CERVICORNIS. M.S. THESIS. TEXAS A&M UNIVERSITY, COLLEGE STATION, TX. 51P. (ERL,GB X466*).

FOUR SITU EXPERIMENTS WERE CONDUCTED TO TEST THE EFFECTS OF A USED DRILL MUD ON THE FREE AMINO ACID POOL OF ACROPORA CERVICORNIS. TWENTY-SIX HOUR EXPOSURES TO 19, 38, AND 76 PPM DRILL MUD CAUSED SIGNIFICANT REDUCTIONS IN TOTAL NINHYDRIN POSITIVE SUBSTANCES (NPS). TISSUE DEGRADATION AND ZOOXANTHELLAE LOSS WERE ASSOCIATED WITH THE LARGEST REDUCTIONS IN NPS AT THE 380 PPM MUD EXPOSURE LEVEL. EXPOSURES TO KAOLIN SOMETIMES PRODUCED SIGNIFICANT REDUCTIONS IN NPS. EIGHTEEN AMINO ACIDS WERE IDENTIFIED AS ELEMENTS OF THE FREE AMINO ACID (FAA) POOL: ASPARTATE, THREONINE, SERINE, GLUTAMATE/GLUTAMINE, GLYCINE, ALANINE, CITRULLINE, VALINE, METHIONINE, LEUCINE, TYROSINE, PHENYLALANINE, ORNITHINE, LYSINE, HISTIDINE, ARGININE, CYSTEIC ACID, AND PROLINE. OF THESE, THE FIRST SIX LISTED ACCOUNTED FOR OVER 90% OF THE FAA POOL. GLYCINE WAS THE MOST ABUNDANT. MUD EXPOSURES RESULTED IN SIGNIFICANTLY LOWER OR HIGHER LEVELS OF ASPARTATE, THREONINE, SERINE, GLUTAMATE/GLUTAMINE, GLYCINE, AND ALANINE. NO CLEAR CASE OF RECOVERY WAS NOTED FOR NPS OR FAA LEVELS.

CRAWFORD, RICHARD B., AND JONATHAN D. GATES. 1981. DRILLING FLUID EFFECTS ON TELEOST AND ECHINODERM DEVELOPMENT. BULL. MT. DESERT ISL. BIOL. LAB. 20:10-14. (ERL,GB X242*).

AS A CONSEQUENCE OF PETROLEUM DRILLING OFFSHORE, LARGE QUANTITIES OF DRILLING FLUIDS (MUDS) ARE INTRODUCED INTO THE ENVIRONMENT. THESE DRILLING FLUIDS ARE AQUEOUS SUSPENSIONS OF A VARIETY OF COMPONENTS PUMPED DOWN THE CENTER OF THE DRILL BIT. THE FLUID COMPOSITION IS VARIED AS NEEDS OF THE DRILLING OPERATION ARE ENCOUNTERED, SUCH AS LUBRICATION, COOLING, ANTIBACTERIAL ACTION, SUSPENSION OF DRILL CUTTINGS, PREVENTION OF INTRUSION OF SEAWATER INTO THE BORE HOLE, AND CAPTURE OF H2S. THE IMPACT OF DRILLING FLUIDS ON MARINE AND ESTUARINE ANIMALS ARE DISCUSSED. THIS DISCHARGE CAN AMOUNT TO SIGNIFICANTLY LARGE QUANTITIES (E.G., 2,000 TONS PER HOLE) IN THE VICINITY OF A DRILLING PLATFORM.

CRAWFORD, RICHARD B., AND JONATHAN D. GATES. 1981. EFFECTS OF A DRILLING FLUID ON THE DEVELOPMENT OF A TELEOST AND AN ECHINODERM. BULL. ENVIRON. CONTAM. TOXICOL. 26(2):207-212. (ERL,GB X297*).

THE DATA ON EFFECTS OF DRILLING FLUID ON EMBRYO DEVELOPMENT IN FUNDULUS AND A SAND DOLLAR REPRESENT AN INITIAL SURVEY ON VERY GENERAL ASPECTS OF EMBRYOGENESIS. IT IS CLEAR THAT THIS DRILLING FLUID SAMPLE CONTAINS TOXIC MATERIAL, AFFECTING THE DEVELOPMENT OF THE TELEOST AND THE FERTILIZATION AND DEVELOPMENT OF THE SAND DOLLAR. IT SHOULD BE NOTED THAT NO ONE SAMPLE IS REPRESENTATIVE OF ALL DRILLING FLUIDS. THE COMPONENTS OF THE FLUID ARE ALTERED TO MEET THE MOMENTARY NEEDS OF THE DRILLING OPERATION. FOR EXAMPLE, THIS SAMPLE IS MODERATELY HIGH IN CHROMIUM (2400 MG/G), ZINC (163 MG/G) AND LEAD (66.6 MG/G) BUT LOW IN BARIUM CONTENT (7.31%). THE RANGE OF VARIABILITY AMONG DRILLING FLUIDS FOR THESE COMPONENTS CAN BE FOUND TO BE APPROXIMATELY 50 TO 5500 MG/G FOR CR, 50 TO 600 MG/G FOR ZN, 25 TO 120 MG/G FOR PB, AND 1 TO 35% FOR BA. THIS VARIABILITY IS NOT MENTIONED TO SUGGEST THE ACTIVE COMPONENTS, OF WHICH WE HAVE NO KNOWLEDGE, BUT ONLY TO ILLUSTRATE THE "NON-TYPICAL" NATURE OF ANY ONE SAMPLE.

CRAWFORD, RICHARD B. 1983. EFFECTS OF DRILLING FLUIDS ON EMBRYO DEVELOPMENT. EPA-600/3-83-021, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 30P.

TOXICITY OF USED DRILLING FLUIDS TO EMBRYO DEVELOPMENT WAS INVESTIGATED TO ASCERTAIN THE LIMITS OF SAFE USAGE OF THESE FLUIDS IN MARINE ENVIRONMENTS. EMBRYOS USED AS TEST SYSTEMS WERE OF THE TELEOST, FUNDULUS HETEROCLITUS, AND FOUR ECHINODERMS ECHINARACHNIUS PARMA, STRONGYLOCENTROTUS PURPURATUS, LYTECHINUS PICTUS, LYTECHINUS VARIEGATUS. THE DRILLING FLUIDS TESTED CAME FROM VARIOUS SOURCES; 24 DIFFERENT SAMPLES WERE EVALUATED. IN ADDITION, SEVERAL COMMERCIAL DRILLING FLUID COMPONENTS WERE EXAMINED IN THE TEST SYSTEMS INCLUDING A SYNTHETIC REFERENCE MUD. STUDIES DEMONSTRATED THAT NO SINGLE DRILLING FLUID IS "TYPICAL" AND THAT THE QUANTITATIVE EFFECTS OF EMBRYOS VARY CONSIDERABLY FROM ONE FLUID TO ANOTHER. SOME DRILLING FLUIDS ARE QUITE TOXIC TO ONE OR MORE OF THE EMBRYO SYSTEMS, REQUIRING DILUTIONS OF OVER 10(5) TO BECOME "SAFE". OTHERS ARE RELATIVELY INNOCUOUS, REQUIRING VERY LITTLE DILUTION TO ACHIEVE A CONCENTRATION IN WHICH EMBRYO DEVELOPMENT CAN PROCEED NORMALLY. ALSO, THE EFFECTS ON DEVELOPMENT SHOW VARIATION FROM ONE FLUID TO ANOTHER, THUS INDICATING THAT A VARIETY OF COMPONENTS OR COMPOUNDS ARE RESPONSIBLE FOR TOXIC MANIFESTATIONS.

D'ASARO, CHARLES N. 1982. CYCLING OF XENOBIOTICS THROUGH MARINE AND ESTUARINE SEDIMENTS. EPA-600/3-82-074, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 40P.

THE RESULTS OF FIVE BROADLY DEFINED PROJECTS ARE REPORTED: CYCLING OF XENOBIOTICS WAS STUDIED WITH A PHOTO-BIOASSAY SYSTEM, THAT USED TIME-LASPE PHOTOGRAPHY TO EVALUATE EFFECTS OF KEPONE AND SODIUM PENTACHLOROPHENATE ON FEEDING ACTIVITY OF THE LUGWORM, ARENICOLA CRISTATA. RADIO-LABELED METHYL PARATHION WAS USED TO DEMONSTRATE FATE AND EFFECT IN MICROCOSMS INHABITED BY LUGWORMS. UPTAKE AND DEPURATION OF CHRYSENE BY LUGWORMS WAS EVALUATED IN A FLOW-THROUGH SYSTEM. A TOXIC SEDIMENT BIOASSAY SYSTEM WAS DEVELOPED TO PROVIDE A MEANS TO TEST EFFECTS OF DREDGE SPOIL. THE SYSTEM INCLUDED MICROCOSMS THAT HELD MYSID SHRIMP, MYSIDOPSIS BAHIA; OYSTERS, CRASSOSTREA VIRGINICA; AND LUGWORMS, ARENICOLA CRISTATA. CRITERIA OF EFFECT WERE SURVIVAL OF MYSIDS, SHELL DEPOSITION AND BIOACCUMULATION BY OYSTERS, SUBSTRATE REWORKING AND BIOACCUMULATION BY LUGWORMS, AND SETTLEMENT OF ZOOPLANKTON. KEPONE-SORBED SEDIMENT AND DREDGE SPOIL FROM JAMES RIVER AND HOUSTON SHIP CANAL WERE TESTED FOR 28 DAYS. LONG-TERM TESTS (100 DAYS), WITH THE SAME SYSTEMS, WERE USED TO EVALUATE EFFECTS OF A SPECIFIC DRILLING MUD FROM AN ACTIVE EXPLORATORY PLATFORM. PREDATOR-PREY TESTS OF SUBLETHAL EFFECTS OF XENOBIOTICS DEMONSTRATED EFFECT IN ONE-PREY AND TWO-PREY SYSTEMS. THE EFFECTS OF METHYL PARATION ON PREDATOR-PREY RELATIONSHIPS BETWEEN GRASS SHRIMP, PALAEMONETES PUGIO; JUVENILE SHEEPHEAD MINNOWS, CYPRINODON VARIEGATUS; AND GULF KILLIFISH, FUNDULUS GRANDIS, WERE DEMONSTRATED. THE EFFECTS OF METHYL PARATHION ON THE PREDATOR PREY RELATIONSHIPS BETWEEN PALAEMONETES PUGIO, AND PINFISH, LAGODON RHOMOBIODES, WAS ALSO DEMONSTRATED. A METHOD THAT COULD BE USED TO EVALUATE EFFECTS XENOBIOTICS ON PREDATOR-PREY RELATIONSHIPS BETWEEN CRYPTICALLY SHADED FLOUNDER AND PINFISH PREY WAS DEVELOPED. EVALUATION OF SUBLETHAL EFFECTS, SUCH AS AVOIDANCE OF POLLUTION GRADIENTS, WAS STUDIED IN A TROUGH-TYPE AVOIDANCE-REPSONSE SYSTEM. THE SYSTEM RECORDED REPSONSES AUTOMATICALLY AND INDEPENDENTLY OF AN OBSERVER. TESTS WITH PINFISH DEMONSTRATED THAT THEY WILL AVOID CHLORINE-PRODUCED OXIDANTS. THE SYSTEM WAS MODIFIED TO DEMONSTRATED TOXICANT-INDUCED CHANGES IN CYCLIC BURROWING ACTIVITY BY PINK SHRIMP, PENAEUS DUORARUM, EXPOSED TO METHYL PARATHION. USEFULNESS OF SMALL-SCALE MICROCOSMS WAS EVALUATED BY DEVELOPING METHODS TO CULTURE POLYCHAETES AND CRUSTACEANS. VARIOUS ASPECTS OF THE BIOLOGY OF SELECTED SPECIES WERE STUDIED.

DAVIS, W.M., AND D.C. WHITE. 1980. FLUOROMETRIC DETERMINATION OF ADENOSINE NUCLEOTIDE DERIVATIVES AS MEASURES OF THE MICROFOULING, DETRITAL AND SEDIMENTARY MICROBIAL BIOMASS AND PHYSIOLOGICAL STATUS. APPL. ENVIRON. MICROBIOL. 40(3):539-548. (ERL,GB X186*).

ADENOSINE, ADENINE, CYCLIC ADENOSINE MONOPHOSPHATE (AMP), AMP, NICOTINAMID ADENINE DINUCLEOTIDE, ADENOSINE DIPHOSPHATE, AND ADENOSINE TRIPHOSPHATE (ATP) WERE RECOVERED QUANTITATIVELY FROM AQUEOUS PORTIONS OF LIPID EXTRACTS OF MICROFOULING, DETRITAL, AND SEDIMENTARY MICROBIAL COMMUNITIES. THESE COULD BE DETECTED QUANTITATIVELY IN THE PICOMOLAR RANGE BY FORMING THEIR 1-N6-ETHENO DERIVATIVES AND ANALYZING BY HIGH-PRESSURE LIPID CHROMATOGRAPHY WITH FLOURESCENT DETECTION. LIPID EXTRACTION AND SUBSEQUENT ANALYSIS ALLOWED THE SIMULTANEOUS MEASUREMENT OF THE MICROBIAL COMMUNITY STRUCTURE, TOTAL MICROBIAL BIOMASS WITH THE QUANTITATIVE RECOVERY OF THE ADENINE-CONTAINING CELLULAR COMPONETS, WHICH WERE PROTECTED FROM ENZYMATIC DESTRUCTION. THIS EXTRACTION AND FLOURESCENT DERIVATIZATION METHOD SHOWED EQUIVALENCY WITH THE LUCIFERIN-LUCIFERASE METHOD FOR BACTERIAL ATP MEASUREMENTS. QUICK-FREEZING SAMPLES IN THE FIELD WITH DRY ICE-ACETONE PRESERVED THE ATP AND ENERGY CHARGE (A RATIO OF ADENOSINE NUCLEOTIDES) FOR ANALYSIS AT REMOTE LABORATORIES. THE METABOLIC LABILITY OF ATP IN ESTUARINE DETRITAL AND MICROFOULING COMMUNITIES, AS WELL AS BACTERIAL MONOCULTURES OF CONSTANT BIOMASS, SHOWED ATP TO BE A PRECARIOUS MEASURE OF BIOMASS UNDER SOME CONDITIONS. COMBINATIONS OF ADENOSINE AND ADENINE NUCLEO-TIDES GAVE BETTER CORRELATIONS WITH MICROBIAL BIOMASS MEASURED AS EXTRACTABLE LIPID PHOSPHATE IN THE DETRITAL AND MICROFOULING MICROBIAL COMMUNITIES THAN DID ATP ALONE. STRESSES SUCH AS ANOXIA OF FILTERATION ARE REFLECTED IN THE RAPID ACCUMULATION OF INTRACELLULAR ADENOSINE AND THE EXCRETION OF ADENOSINE AND AMP INTO THE SURROUNDING MILIEU. INCREASES IN AMP AND ADENOSINE MAY PROVE TO BE MORE SENSITIVE INDICATORS OF METABOLIC STATUS THAN THE ENERGY CHARGE.

DERBY, CHARLES D., AND JELLE ATEMA. 1981. INFLUENCE OF DRILLING MUDS ON THE PRIMARY CHEMOSENSORY NEURONS IN WALKING LEGS OF THE LOBSTER, HOMARUS AMERICANUS. CAN. J. FISH. AQUATIC SCI. 38(3):268-274. (ERL,GB X241*). AVAIL. FROM NTIS, SPRINGFIELD, VA: PB82-128190.

THE EFFECTS OF WHOLE DRILLING MUDS ON THE NORMAL ACTIVITY OF WALKING LEG CHEMOSENSORY NEURONS WERE EXAMINED USING EXTRACELLULAR NEUROPHYSIOLOGICAL RECORDING TECHNIQUES. EXPOSURE OF LEGS FOR 3-5 MIN TO 10-MG/L DRILLING MUD SUSPENDED IN SEAWATER ALTERED RESPONSES TO FOOD ODORS OF 29% OF THE CHEMORECEPTORS EXAMINED (DATA POLLED FOR THE TWO DRILLING MUDS TESTED); SIMILAR EXPOSURE TO 100-MG/L DRILLING MUD RESULTED IN INTERFERENCE WITH 44% OF ALL RECEPTORS STUDIES. THE EFFECTS OF BOTH OF THESE CONCENTRATIONS ARE STATISTICALLY SIGNIFICANT, ALTHOUGH THEY ARE NOT DIFFERENT FROM EACH OTHER. INTERFERENCE WAS USUALLY MANIFESTED AS A MARKED REDUCTION IN THE NUMBER OF ACTION POTENTIALS IN A RESPONSE. IN ONE PREPARATION, THE EXPOSURE TO DRILLING MUD CAUSED A CHANGE IN THE TEMPORAL PATTERN OF THE SPIKES WITHOUT AFFECTING THE TOTAL NUMBER OF SPIKES. OTHER CHEMOSENSORY NEURONS WERE EXCITED BY 10-MG/L DRILLING MUD ITSELF. HOWEVER, NOT ALL CHEMORECEPTORS ARE AFFECTED BY THESE DRILLING MUDS SINCE RESPONSES TO FEEDING STIMULI WERE RECORDED FROM THE LEGS OF LOBSTERS THAT HAD BEEN EXPOSED TO DRILLING MUD FOR 4-8 D BEFORE THE NEUROPHYSIOLOGICAL EXPERIMENTS.

DERBY, CHARLES D., AND JELLE ATEMA. 1982. NARROW-SPECTRUM CHEMORECEPTOR CELLS IN THE WALKING LEGS OF THE LOBSTER HOMARUS AMERICANUS: TASTE SPECIALIST. J. COMP. PHYSIOL. A SENS. NEURAL. BEHAV. PHYSIOL. 146(2):181-189. (ERL,GB X341*).

THE PRESENT STUDY DESCRIBES THE SPECIFICITY OF CHEMORECEPTORS IN THE WALKING LEGS OF THE LOBSTER HOMARUS AMERICANUS. THE RESULTS INDICATE THAT THE PERIPHERAL CODING SYSTEM OF THIS SPECIES IS BASED AT LEAST IN PART ON NARROWLY-TUNED CHEMORECEPTOR CELLS, WHICH REPRESENTS ONE OF THE MOST EXTREME CASES TO DATE OF A CHEMOSENSORY SYSTEM BASED ON LABELED LINE CODING. THE CHEMORECEPTORS IN THE LEGS OF LOBSTERS FUNCTION IN THE LOCALIZATION AND HANDLING OF FOOD (DERBY AND ATEMA 1982B). MULTI-UNIT NEUROPHYSIOLOGICAL ANALYSIS FO THESE RECEPTORS HAS DEMONSTRATED THAT CERTAIN AMINO ACIDS AND AMINES ARE HIGHLY EXCITATORY STIMULI, SOME PEPTIDES AND PROTEINS ARE MODEREEERATELY EXCITATORY, WHEREAS CARBOHYDRATES, ALCOHOLS, NUCLEOSIDES, AND NUCLEOTIDES ARE IN GENERAL ONLY SLIGHTLY EXCITATORY (DERBY AND ATEMA 1982A). BY SINGLE-UNIT EXRTRACELLULAR RECORDING TECHNIQUES, THE SPECIFICTY OF SINGLE PRIMARY CHEMORECEPTORS CELLS IS DSESCRIBED HERE IN DETAIL.

DODGE, RICHARD E., AND ALINA SZMANT-FROELICH. IN PRESS. EFFECTS OF DRILLING FLUIDS ON REEF CORALS: A REVIEW. IN: WASTES IN THE OCEAN, VOLUME IV: ENERGY WASTES IN THE OCEAN. I.W. DUEDALL, EDITOR, JOHN WILEY & SONS, INC., NEW YORK, NY. (ERL,GB 480).

THIS CHAPTER REVIEWS RESEARCH ON THE EFFECTS OF DRILLING MUD ON CORAL REEF COMMUNITIES, CONCENTRATION ON THE MAJOR REEF FAUNA: THE REEF-BUILDING OR HERMATYPIC CORALS. DRILLING MUD IS AN EFFLUENT INTRODUCED TO THE MARINE ENVIRONMENT IN LARGE QUANTITES DURING A TYPICAL OFFSHORE DRILLING OPERATION. CONCERN OVER ITS POSSIBLE DETRIMENTAL EFFECTS, WHEN DRILLING ACTIVITIES ARE NEAR CORAL REEFS, HAS BEEN THE IMPETUS FOR THE WORK TO BE DISCUSSED. THE TOPIC IS OF RECENT ORIGIN; UNTIL 1977, THERE WERE NO LITERATURE REPORTS OF DRILLING MUD - CORAL STUDIES.

DODGE, R.E. 1982. EFFECTS OF DRILLING MUD ON THE REEF-BUILDING CORAL MONTASTREA ANNULARIS. MAR. BIOL. 71(2):141-147. (ERL,GB 473*). AVAIL. FROM NTIS, SPRINGFIELD, VA: PB83-182956.

THE SKELETAL EXTENSION AND CORALLITE SHAPE OF INDIVIDUALS OF THE CARIBBEAN AND ATLANTIC REEF-BUILDING CORAL MONTASTREA ANNULARIS (ELLIS AND SOLANDER) WERE MEASURED AFTER MORE THAN SIX WEEK'S CONTINUOUS FLOW-THROUGH EXPOSURE IN LABORATORY AQUARIA TO TREATMENTS OF 0, 1, 10 AND 100-PPM (UL 1E-1) DRILLING MUD. LINEAR INCREASE OF THE SKELETON (EXTENSION RATE) AND FOSSA LENGTH WERE SIGNIFICANTLY DEPRESSED IN THE 100-PPM TREATMENT. CHRONIC EXPOSURE TO 100-PPM DRILLING MUD IMPAIRS CORAL SKELETAL GROWTH RATE AND POSSIBLY INTERFERES WITH SEDIMENT REJECTION CAPABILITY BY LOWERING CALICAL RELIEF.

DODGE, RICHARD E. 1982. GROWTH CHARACTERISTICS OF REEF-BUILDING CORALS WITHIN AND EXTERNAL TO A NAVAL ORDINANCE RANGE: VIEQUES, PUERTO RICO. IN: REEF AND MAN: PROCEEDINGS OF THE FOURTH INTERNATIONAL CORAL REEF SYMPOSIUM, MANILA, PHILIPPINES, 18-22, MAY, 1981. EDGARDO D. GOMEZ, ET AL., EDITOR, MARINE SCIENCE CENTER, UNIVERSITY OF THE PHILIPPINES, QUEZON CITY, PHILIPPINES. PP. 241-248. (ERL,GB X424*).

THE SKELETAL GROWTH OF REEF-BUILDING CORALS IS KNOWN TO BE SENSITIVE TO THE ENVIRONMENT. IN PARTICULAR, HIGH LEVELS OF SEDIMENTAION AND TURBIDITY LEAD TO DECREASED GROWTH RATE, SUPPRESSED GROWTH VARIATION, AND ULTIMATELY, CORAL DEATH BECAUSE OF REDUCED ILLUMINATION NECESSARY TO ZOOXANTHELLAE AND/OR INCREASED ENERGY EXPENDITURE BY THE CORAL ANIMAL TO REMOVE IMPACTED SEDIMENTS. TO ASSESS THE EFFECT OF NAVAL ORDINANCE RANGE USAGE AT VIEQUES, PUERTO RICO, SPECIMENS OF MONTASTREA ANNUALRIS WERE COLLECTED FROM REEFS ADJACENT TO AND REMOVED FROM THE RANGE AREA. GROWTH WAS MEASURED FROM ANNUAL INCREASMENTS REVEALED BY X-RADIOGRAPHY OF MEDIAL SLABS OF THE CORAL SKELETONS. MEAN GROWTH RATES AND GROWTH VARIANCES WERE CALCULATED FOR EACH STATION OR STATION GROUPING OVER THE COMMON TIME PERIOD 1970-1977. STATISTICAL COMPARISON OF THE GROWTH DATA REVEALS A GENERAL SIMILARITY BETWEEN RANGE AND CONTROL STATIONS. THIS EVIDENCE COUPLED WITH QUANTITATIVE CORAL ABUNDANCE AND DIVERSTIY DATA OF OTHERS INDICATE A LACK OF ANOMALOUS AND ADVERSE SEDIMENTATION/TURBIDITY CONDITIONS AFFECTING CORALS ON REEFS NEARBY THE RANGE AREA. CHRONOLGIES OF CORAL BAND WIDTHS COMPARED TO HISTORICAL RECORDED ENVIRONMENTAL DATA INDICATES THAT A MAJOR NATURAL PARAMETER WHICH CONTROLS CORAL GROWTH IN VIEQUES IS ANNUAL WATER TEMPERATURE VARIATIONS.

DODGE, RICHARD E., AND JUDITH C. LANG. 1983. ENVIRONMENTAL CORRELATES OF HERMATYPIC CORAL (MONTASTREA ANNULARIS) GROWTH ON THE EAST FLOWER GARDENS BANK, NORTHWEST GULF OF MEXICO. LIMNOL. OCEANOGR. 28(2):228-240. (ERL,GB X378*).

TIME SERIES OF ANNUAL LINEAR GROWTH INCREASMENTS FROM 12 MONTASTREA ANNULARIS (E. AND S.) HERMATYPIC CORALS COLLECTED AT THE EAST FLOWER GARDENS BANK REEF IN THE NORTHWESTERN GULF OF MEXICO HAVE A COMMON PATTERN. THIS IS BEST EXPRESSED IN AN INDEX MASTER CHRONOLOGY (AVERAGE BY YEAR OF THE ANNUAL PERCENTAGE DEVIATIONS FROM THE MEAN OF EACH CORAL). COMPARISONS WITH TIME SERIES OF ENVIRONMENTAL DATA INDICATE THAT CORAL EXTENSION RATES VARY POSITIVELY WITH SEASONAL (FEBRUARY THROUGH MAY - 4 MONTHS) SURFACE WATER TEMPERATURE AND NEGATIVELY WITH ANNUAL DISCHARGE OF THE ATCHAFALAYA RIVER. WE PROPOSE THE SECULAR VARIATIONS OF WATER TEMPERATURE AND OTHER PARAMETERS ARE THE MAJOR LONG-TERM CONTROLS OF CORAL GROWTH IN THE AREA. OUR DATA DO NOT SUPPORT THE VIEW THAT SINKING OF THE FLOWER GARDENS REEF, CAUSED BY CATASTROPHIC COLLAPSE OF THE UNDERLYING SUBSTRATE, HAS BEEN A PRIME INFLUENCE ON THE CORALS.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1978. ULTRASTRUCTURAL CHANGES INDUCED BY SODIUM PENTACHLOROPHENATE IN THE GRASS SHRIMP, PALAEMONETES PUGIO, IN RELATION TO THE MOLT CYCLE. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NEW YORK, NY. PP. 213-250. (ERL,GB X060*).

INTERMOLT (STAGE C) GRASS SHRIMP WERE EXPOSED TO 1.0 PPM NA-PCP FOR THE DURATION OF A MOLT CYCLE. GILLS, HEPATOPANCREAS, MIDGUT (PORTION OF THE DIGESTIVE TRACT SURROUNDED BY HEPATOPANCREAS) AND HINDGUT (PORTION OF THE DIGESTIVE TRACT IN THE ABDOMEN) FROM CONTROL AND EXPERIMENTAL SHRIMP AT KNOWN STAGES OF THE MOLT CYCLE WERE EXAMINED AT THE ULTRASTRUCTURAL LEVEL. ALTHOUGH SIGNS OF PATHOLOGY WERE EVIDENT IN LATE PROECDYSIAL SHRIMP, EXTENSIVE PATHOLOGICAL CHANGES WERE NOT OBSERVED UNTIL AFTER ECDYSIS. THE EXTENT OF PATHOLOGICAL CHANGES VARIED WITH THE TISSUE EXAMINED AND THE INTERVAL BETWEEN ECDYSIS AND THE TIME OF FIXATION FOR ELECTRON MICROSCOPY. THE FOLLOWING ULTRASTRUCTURAL CHANGES WERE SEEN IN THE GILL EPITHELIUM OF SHRIMP EXPOSED TO NA-PCP: FORMATION OF FLUID FILLED INVAGINATION OF THE INTERMICROVILLAR APICAL MEMBRANE, INCREASE IN LYSOSOMAL ACTIVITY AND EVENTUAL CYTOPLASMIC AND NUCLEAR DEGENERATION. THE PODOCYTES IN THE GILL AXIS, THE GRANULAR SECRETORY CELLS AND THE TEGUMENTAL GLAND CELLS ALSO EXHIBITED MITOCHONDRIAL SWELLING, NUCLEAR PYKNOSIS AND EVENTUAL CYTOPLASMIC DEGENERATION. THE CELLS LINING THE LUMEN OF THE MIDGUT AND HINDGUT OF SHRIMP EXPOSED TO NA-PCP EXHIBITED SWELLING OF THE APICAL MEMBRANE OFTEN ACCOMPANIED BY RUPTURE, LOSS OF MICROVILLI FROM APICAL FOCI AND INCREASED LYSOSOMAL ACTIVITY. PATHOLOGICAL CHANGES NOTED IN THE HEPATOPANCREATIC CELLS OF THE EXPERIMENTAL SHRIMP WERE: HIGH AMPLITUDE SWELLING OF MITOCHONDRIA INCLUDING VESICULATION OF CRISTAE, PRESENCE OF MYELIN BODIES WITHIN MITOCHONDRIA AND ROUGH ENDOPLASMIC RETICULUM, INCREASE OF AUTOPHAGIC ACTIVITY AND LOSS OF MICROVILLI.

DOUGHTIE, D.G., AND K. RANGA RAO. 1979. COMPARATIVE ULTRASTRUCTURE OF THREE TYPES OF TEGUMENTAL GLANDS IN THE GILLS OF THE GRASS SHRIMP, PALAEMONETES PUGIO (ABSTRACT). AM. ZOOL. 19(3):890. (ERL,GB X236*).

A UNICELLULAR GLAND AND TWO TYPES OF MULTICELLULAR ROSETTE TEGUMENTAL GLANDS OCCUR IN THE GILL AXIS OF PALAEMONETES. IN ONE TYPE OF ROSETTE GLAND, THE SECRETORY CELLS HAVE A DEEPLY INFOLDED BASAL PLASMALEMMA AND NUMEROUS MITOCHONDRIA; THIS GLAND APPEARS TO BE INNERVATED. IN THE OTHER TYPE OF ROSETTE GLAND, THE SECRETORY CELLS HAVE A RELATIVELY SMOOTH BASAL PLASMALEMMA AND FEW MITOCHONDRIA; BUT THEY POSSESS EXTENSIVE RER AND MANY GOLGI BODIES. ACCESSORY CELLS, THE HILLOCK AND CANAL CELLS, OCCUR IN ASSOCIATION WITH BOTH TYPES OF ROSETTE GLANDS. THE ROSETTE GLANDS AND THE UNICELLULAR GLANDS ARE EXOCRINE; THE SECRETIONS BEING TRANSPORTED THROUGH CUTICULARIZED DUCTULES. THE HILLOCK AND CANAL CELLS FORM THE FIBROUS BASAL REGION AND EPICUTICULAR APICAL REGION OF THE DUCTULE, RESPECTIVELY. TRANSITORY CILIARY STRUCTURES ASSOCIATED WITH DUCTULE REFORMATION ARE SEEN IN THE UNICELLULAR GLANDS AND THE DEVELOPING ROSETTE GLANDS, BUT NOT IN THE FULLY DEVELOPED ROSETTE GLANDS.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1979. ULTRASTRUCTURE OF AN EXOCRINE DERMAL GLAND IN THE GILLS OF THE GRASS SHRIMP, PALAEMONETES PUGIO: OCCURRENCE OF TRANSITORY CILIARY AXONEMES ASSOCIATED WITH THE SLOUGHING AND REFORMATION OF THE DUCTULE. J. MORPHOL. 161(3):281-307. (ERL,GB X150).

EXOCRINE DERMAL GLANDS, COMPARABLE TO THE CLASS 3 GLANDULAR UNITS OF INSECTS, ARE FOUND IN THE GILLS OF THE GRASS SHRIMP, PALAEMONETES PUGIO. THE DERMAL GLANDS ARE COMPOSED OF THREE CELLS: SECRETORY CELL, HILLOCK CELL AND CANAL CELL. ORIGINATING AS A COMPLEX INVAGINATION OF THE APICAL CYTOPLASM OF THE GRANULAR SECRETORY CELL, A DUCT ASCENDS THROUGH THE HILLOCK AND CANAL CELLS TO THE CUTICULAR SURFACE. THE DUCT IS DIVISABLE INTO FOUR REGIONS: THE SECRETORY APPARATUS IN THE GRANULAR SECRETORY CELL, THE LOCULAR COMPLEX, THE HILLOCK REGION WITHIN THE HILLOCK CELL AND THE CANAL WITHIN THE CANAL CELL. A TUBULAR DUCTULE IS CONTAINED WITHIN THE LATTER TWO REGIONS. AS THE DUCTULE ASCENDS TO THE CUTICULAR SURFACE, ITS CONSTITUTION GRADUALLY CHANGES FROM ONE OF A FIBROUS MATERIAL TO ONE WHICH POSSESSES LAYERS OF EPICUTICLE. DURING THE PROECDYSIAL PERIOD, THE DUCTULE IS EXTRUDED INTO THE ECDYSIAL SPACE AND THIS IS FOLLOWED BY THE SECRETION OF A NEW DUCTULE. CHARACTERIZED ONLY BY A BASAL BODY AND ROOTLETS THROUGHOUT MOST OF THE INTERMOLT CYCLE, THE CILIARY ORGANELLES GIVE RISE TO TEMPORARY AXONEMIC PROCESSES WHICH ASCEND THROUGH THE DUCTULE TOWARD THE ECDYSIAL SPACE AT THE ONSET OF PROECDYSIS. SUSEQUENTLY, THE OLD DUCTULE IS SLOUGHED OFF AND A NEW DUCTULE IS REFORMED AROUND THE CILIARY AXONEMES. FOLLOWING THIS REFORMATION, THE CILIARY AXENEMES DEGENERATE. THE FUNCTION OF CYTOPLASMIC PROCESSES, DERIVED FROM THE APICAL CYTOPLASM OF THE SECRETORY CELL, IS ALSO DISCUSSED.

DOUGHTIE, D.G., AND K.R. RAO. 1981. CILIARY STRUCTURES IN THE BRANCHIAL UNICELLULAR GLANDS OF THE GRASS SHRIMP, PALAEMONETES PUGIO. EXPERIENTIA (BASEL). 37(5):502-503. (ERL,GB X423*).

A UNICELLULAR EXOCRINE GLAND POSSESSING AN EPICUTICLAR DUCTULE OCCURS IN GRASS SHRIMP GILLS. THIS GLAND DISPLAYS ULTRASTRUCTURAL CHANGES IN RELATION TO THE MOLT CYCLE. THESE CHANGES INCLUDE AN INCREASE IN THE QUANTITY OF SECRETORY GRANULES DURING LATE PREMOLT, AND THE DEVELOPMENT OF CILIARY AXONEMES IN RELATION TO DUCTULE FORMATION.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1981. SYNCYTIAL NATURE AND PHAGOCYTIC ACTIVITY OF THE BRANCHIAL PODOCYTES IN THE GRASS SHRIMP, PALAEMONETES PUGIO. TISSUE & CELL. 13(1):93-104. (ERL,GB X234*).

THE MORPHOLOGY OF THE BRANCHIAL PODOCYTES IN THE GRASS SHRIMP, PALAEMONETES PUGIO, WAS INVESTIGATED IN RELATION TO THE MOLT CYCLE. THE PODOCYTES ARE LOCATED IN THE EFFERENT HEMOLYMPH CHANNELS IN THE GILL AXIS, AND POSSESS A SPECIALIZED PLASMALEMMA CONSISTING OF INTERDIGITATION PEDICEL PROCESSES WHICH ARE BRIDGED BY THIN DIAPHRAGMS. THE TOPOGRAPHY OF THE PLASMALEMMAL SURFACE SUGGESTS THAT THESE CELLS, LIKE SIMILAR CELLS IN OTHER ARTHROPODS, FUNCTION IN THE ULTRAFILTRATION OF MICRO- AND MACRO- MOLECULAR SUBSTANCES FROM THE HEMOLYMPH. ADDITIONALLY, THE BRANCHIAL PODOCYTES EXHIBIT PHAGOCYTIC ACTIVITY. THIS ACTIVITY, THOUGH EVIDENT DURING THE PREMOLT PERIOD, IS MOST PROMINENT DURING THE EARLY POSTMOLT PERIOD. AMONG THE CELL TYPES SUBJECTED TO PHAGOCYTOSIS BY PODOCYTES ARE THE SECRETORY CELLS OF THE TRICELLULAR AND ROSETTE-TYPE DERMAL GLANDS AND THE EPITHELIAL CELLS OF THE GILL AXIS. DURING THE LATE PREMOLT AND EARLY POSTMOLT PERIODS, THE PODOCYTES OFTEN APPEAR AS SYNCYTIA, CONTAINING AS MANY AS FOUR NUCLEI. THE EXACT INTERRELATIONSHIPS BETWEEN PHAGOCYTOSIS AND SYNCYTIAL FORMATION REMAIN TO BE ASCERTAINED. THESE ASPECTS AND THE POSSIBLE AMBULATORY ABILITIES OF THE BRANCHIAL PODOCYTES ARE DISCUSSED.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1982. ROSETTE GLANDS IN THE GILLS OF THE GRASS SHRIMP, PALAEMONETES PUGIO. I. COMPARATIVE MORPHOLOGY, CYCLICAL ACTIVITY, AND INNERVATION. J. MORPHOL. 171(1):41-67. (ERL,GB X238*). AVAIL. FROM NTIS, SPRINGFIELD, VA: PB82-207846.

TWO TYPES OF EXOCRINE ROSETTE GLANDS (CALLED TYPE A AND TYPE B), LOCATED IN THE GILL AXES OF THE GRASS SHRIMP, PALAEMONETES PUGIO, ARE DESCRIBED. THE TYPE A GLANDS ARE EMBEDDED WITHIN THE LONGITUDINAL MEDIAN SEPTUM OF THE GILL AXES, WHEREAS THE TYPE B GLANDS TYPICALLY PROJECT INTO THE EFFERENT HEMOLYMPH CHANNELS OF THE GILL AXES. ALTHOUGH BOTH GLANDS HAVE CERTAIN COMMON CHARACTERISTICS (I.E., A VARIABLE NUMBER OF RADIALLY ARRANGED SECRETORY CELLS, A CENTRAL INTERCALARY CELL, AND A CANAL CELL THAT FORMS THE CUTICULAR DUCTULE LEADING TO THE BRANCHIAL SURFACE), THEY DIFFER IN THE FOLLOWING RESPECTS. THE TYPE B GLAND IS INNERVATED, BUT THE TYPE A GLAND IS NOT; AXONAL PROCESSES, CONTAINING BOTH GLANDULAR (CA. 900-1300 A) AND AGRANULAR (CA. 450-640 A) VESICLES, OCCUR AT A JUNCTURE BETWEEN ADJACENT SECRETORY CELLS AND THE CENTRAL CELL OF THE TYPE B GLAND. THE SECRETORY CELLS OF TYPE A AND TYPE B GLANDS DIFFER IN THEIR SYNTHETIC POTENTIAL AND MEMBRANE SPECIALIZATIONS. THESE DIFFERENCES ARE MORE PRONOUNCED IN WELL-DEVELOPED, MATURE GLANDS, MOST FREQUENTLY ENCOUNTERED IN LARGER (24-28 MM, TOTAL LENGTH) GRASS SHRIMP, THAN IN THE UNDERDEVELOPED, IMMATURE GLANDS THAT ARE MOST ABUNDANT IN SMALLER (14-18 MM, TOTAL LENGTH) GRASS SHRIMP. THUS, IN MATURE GLANDS, THE SECRETORY CELLS OF THE TYPE A ROSETTE GLANDS ARE CHARACTERIZED BY EXTENSIVE RER, ABUNDANT GOLGI, AND NUMEROUS SECRETORY GRANULES, WHEREAS THE SECRETORY CELLS OF THE TYPE B GLAND ARE CHARACTERIZED BY EXTENSIVELY INFOLDED AND INTERDIGITATED BASAL PLASMALEMMAS AND BY THE PRESENCE OF NUMEROUS MITOCHONDRIA. IN GENERAL, BOTH TYPES OF GLANDS EXHIBIT INCREASED SECRETORY ACTIVITY SOON AFTER ECDYSIS. THE CENTRAL AND CANAL CELLS IN BOTH GLANDS SEEM TO HAVE A ROLE IN THE MODIFICATION OF THE SECRETED MATERIALS. THE POSSIBLE FUNCTIONS ASSIGNED TO THE TYPE A GLAND AND THE TYPE B GLAND INCLUDE PHENOL-OXIDASE SECRETION AND OSMOREGULATION, RESPECTIVELY.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1982. ROSETTE GLANDS IN THE GILLS OF THE GRASS SHRIMP, PALAEMONETES PUGIO. II. PREMOLT DUCTULE REFORMATION: REPLACEMENT OF CILIARY PROCESSES BY CYTOPLASMIC PROCESSES IN RELATION TO GLAND MATURATION. J. MORPHOL. 171(1):69-77. (ERL,GB X239*).

THE EVENTS ASSOCIATED WITH PREMOLT REFORMATION OF THE CUTICULARIZED DUCTULE IN THE UNDERDEVELOPED (IMMATURE) BRANCHIAL ROSETTE GLANDS, WHICH ARE COMMON IN THE GILLS OF SMALL (14-18 MM, TOTAL LENGTH) GRASS SHRIMP, ARE DESCRIBED AND CONTRASTED WITH THE EVENTS OF DUCTULE REFORMATION IN THE FULLY DEVELOPED (MATURE) ROSETTE GLANDS MOST COMMON IN LARGER SHRIMP. IN IMMATURE ROSETTE GLANDS TWO CILIARY PROCESSES EMERGE FROM EACH OF THE COMPONENT SECRETORY CELLS AND ASCEND INTO THE BASAL LUMINAL REGION OF THE OLD DUCTULE. SUBSEQUENTLY A NEW DUCTULE IS FORMED AROUND THE OLD DUCTULE, AND THE CILIARY PROCESSES DISAPPEAR EITHER BECAUSE OF DEGENERATION OR RETRACTION. THE TRANSITORY CILIARY PROCESSES APPEAR TO PREVENT THE OLD DUCTULE. SUCH TRANSITORY CILIARY PROCESSES, HOWEVER, ARE NOT FOUND IN ASSOCIATION WITH PREMOLT DUCTULE REFORMATION IN THE MATURE ROSETTE GLANDS; IN THEIR PLACE ARE SEEN A NUMBER OF MICROVILLI-LIKE CYTOPLASMIC PROCESSES, WHICH EMANATE FROM THE APICES OF THE SECRETORY CELLS AND FROM THE CHANNELS OF THE CENTRAL CELL. THESE CYTOPLASMIC PROCESSES IN MATURE GLANDS, LIKE THE CILIARY PROCESSES IN IMMATURE GLANDS, ARE TRANSITORY AND APPEAR TO PREVENT THE COLLAPSE OF THE OLD DUCTULE. CYTOPLASMIC PROCESSES COMPARABLE TO THOSE IN MATURE GLANDS, BUT RELATIVELY FEW IN NUMBER AND ORIGINATING ONLY FORM THE SECRETORY CELLS, ARE SEEN TOGETHER WITH CILIARY PROCESSES IN SOME IMMATURE GLANDS. THE RELATIVE ABUNDANCE OF CYTOPLASMIC PROCESSES IN THE MATURE GLANDS, COUPLED WITH THE OBSERVATION THAT TRANSITORY CILIARY PROCESSES OCCUR IN IMMATURE GLANDS BUT NOT IN MATURE GLANDS, SUGGESTS THAT, DURING GLANDULAR MATURATION, TRANSITORY CILIARY PROCESSES ARE REPLACE BY TRANSITORY CYTOPLASMIC PROCESSES.

DOUGHTIE, DANIEL G., PHILIP J. CONKLIN, AND K. RANGA RAO. 1983. CUTICULAR LESIONS INDUCED IN GRASS SHRIMP EXPOSED TO HEXAVALENT CHROMIUM. J. INVERTEBR. PATHOL. 42(2):249-258. (ERL,GB X434*).

ADULT GRASS SHRIMP WERE EXPOSED TO FOUR CONCENTRATIONS (0.5, 1.0, 2.0, 4.0 PPM) OF HEXAVALENT CHROMIUM FOR 28 DAYS. AT THE END OF THE EXPOSURE PERIOD, OVER FIFTY PERCENT OF THE SURVIVING SHRIMP POSSESSED CUTICULAR LESIONS THAT HAD MANY OF THE GROSS CHARACTERISTICS OF "SHELL DISEASE". THESE LESIONS WERE USUALLY ASSOCIATED WITH ARTICULATIONS OF THE APPENDAGES AND ABDOMEN. FURTHERMORE, IT WAS FOUND THAT AT INCREASING LEVELS OF CHROMIUM EXPOSURE, THERE WAS A PROPORTIONATE INCREASE IN THE LOSS OF LIMBS SUCH THAT NEARLY 50% OF THE LIMBS WERE LOST IN GRASS SHRIMP EXPOSED TO THE HIGHEST TEST CONCENTRATION OF CHROMIUM. HISTOLOGICAL AND ULTRASTRUCTURAL EXAMINATION OF NUMEROUS LESIONS DEMONSTRATED A RANGE OF DEGENERATIVE FEATURES WITHIN THE SUBCUTICULAR EPITHELIUM THAT INCLUDED CYTOPLASMIC VACUOLIZATION, MITOCHONDRIAL SWELLING, CHROMATIN EMARGINATION AND THE PRESENCE OF UNUSUAL NUCLEAR INCLUSIONS THAT APPEAR TO INDICATE DIRECT CHROMIUM TOXICITY. ADDITIONALLY A MARKED RETARDATION IN NEW EPICUTICLE AND EXOCUTICLE FORMATION WAS OBSERVED IN VIABLE TISSUES ASSOCIATED WITH LESIONS IN LATE PREMOLT SHRIMP. IT IS PROPOSED THAT CHROMIUM INTERFERES WITH THE NORMAL FUNCTIONS OF SUBCUTICULAR EPITHELIUM, PARTICULARLY CUTICLE FORMATION, AND SUBSEQUENTLY CAUSES STRUCTURAL WEAKNESSES OR PERFORATIONS TO DEVELOP IN THE CUTICLE OF NEWLY MOLTED SHRIMP. BECAUSE OF THESE CHROMIUM-INDUCED EXOSKELETAL DEFICIENCIES, A VIADUCT FOR PATHOGENIC ORGANISMS (E.G., BACTERIA) AND DIRECT CHROMIUM INFLUX IS FORMED THAT PERPETUATES LESION DEVELOPMENT.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1983. ULTRASTRUCTURAL AND HISTOLOGICAL STUDY OF DEGENERATIVE CHANGES IN THE ANTENNAL GLANDS, HEPATOPANCREAS, AND MIDGUT OF GRASS SHRIMP EXPOSED TO TWO DITHIOCARBAMATE BIOCIDES. J. INVERTEBR. PATHOL. 41(3):281-299. (ERL,GB X395*).

HISTOLOGICAL AND ULTRASTRUCTURAL ALTERATIONS OBSERVED IN THE ANTENNAL GLANDS, HEPATOPANCREAS, AND MIDGUT OF GRASS SHRIMP EXPOSED TO EITHER A 50% POTASSIUM DIMETHYLDITHIOCARBAMATE BIOCIDE (BUSAN-85; 5-60 PPB) FOR 14 DAYS, OR TO A DIFFERENT BIOCIDE, COMPOSED OF 15% SODIUM DIMETHYLDITHIOCARBAMATE AND 15% SODIUM ETHYLENE BIODITHIOCARBAMATE (AQUATREAT DNM-30), FOR 3-4 DAYS (60-140 PPB) AND 28-35 DAYS (40-120 PPB), WERE COMPARED AND CONTRASTED WITH THE NORMAL MORPHOLOGICAL FEATURES IN CONTROL SHRIMP. ONLY THOSE EXPERIMENTAL SHRIMP THAT EXHIBITED VARIOUS DEGREES OF BRANCHIAL ABNORMALITY WERE EXAMINED. ALTHOUGH THE ALTERATIONS IN BUSAN-EXPOSED SHRIMP WERE GENERALLY MORE PRONOUNCED, THE ANTENNAL GLANDS OF 32 OUT 36 EXPERIMENTAL SHRIMP EXHIBITED ABNORMALITIES THAT WERE MANIFESTED PRIMARILY AS INCREASED SECRETORY ACTIVITY BY THE LABYRINTH CELLS. IN DITHIOCARBAMATE-EXPOSED SHRIMP WITH "BLACK GILLS," THE LABYRINTH EPITHELIUM EXHIBITED MODERATE NUCLEAR HYPERTROPHY, APPARENT CELL SLOUGHING, INTENSE SECRETORY ACTIVITY, AND OCCASIONAL MELANIZED LESIONS; ALTERATIONS IN THE ANTENNAL GLAND COELOMOSAC INCLUDED NUCLEAR PYKNOSIS, A GENERAL DETERIORATION OF PODOCYTE ORGANIZATION, AND AN UNUSUAL INCREASE IN HEMOLYMPH DENSITY ADJACENT TO AFFECTED TISSUES. ALTHOUGH THERE WAS AN APPARENT INCREASE IN MITOTIC ACTIVITY IN THE HEPATOPANCREATIC TUBULES OF SHRIMP EXPOSED TO AQUATREAT FOR 28-35 DAYS, DEGENERATIVE CHANGES WERE MOST FREQUENT AND EXTENSIVE IN THE HEPATOPANCREAS AND MIDGUT OF DITHIOCARBAMATE-EXPOSED SHRIMP WITH "BLACK GILLS." THESE OBSERVED CHANGES INCLUDED THE DIMINUTION OF THE BASAL MIDGUT AND HEPATOPANCREATIC FIXED PHAGOCYTES, DEVELOPMENT OF MITOCHONDRIAL INCLUSIONS AND MEGAMITOCHONDRIA, LOSS OF CYTOPLASMIC DENSITY, HEPATOPANCREATIC NUCLEAR PYKNOSIS, AND IRREVERSIBLE DEGENERATION OF HEPATOPANCREATIC TUBLUE APICES. THIS STUDY SUGGESTS THAT SOME OF THE OBSERVED ABNORMAL/PATHOLOGICAL CHANGES ARE THE INDIRECT CONSEQUENCE OF BRANCHIAL DEGENERATION. A NUMBER OF POSSIBLE DEFENSIVE REACTIONS TO DITHIOCARBAMATE POISONING, INCLUDING HETEROSTASIS, PHAGOCYTOSIS, ENCAPSULATION, AND THE POSSIBLE PARTICIPATION OF RESERVE INCLUSION CELLS ARE PROPOSED.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1983. ULTRASTRUCTURAL AND HISTOLOGICAL STUDY OF DEGENERATIVE CHANGES LEADING TO BLACK GILLS IN GRASS SHRIMP EXPOSED TO A DITHIOCARBAMATE BIOCIDE. J. INVERTEBR. PATHOL. 41(1):33-50. (ERL,GB X384*).

PATHOLOGIC "MILKY" AND BROWN-BLACK GILLS OF GRASS SHRIMP, PALAEMONETES PUGIO, EXPOSED TO LOW LEVELS (5 TO 60 PPB) OF A 50% POTASSIUM-DIMETHYLDITHIOCARBAMATE BIOCIDE (BUSAN-85) FOR 14 DAYS WERE STUDIED USING LIGHT AND ELECTRON MICROSCOPY. IN SHRIMP EXPOSED TO 5 PPB BUSAN-85, A GRADATION OF DEGENERATIVE CHANGES COULD BE ASCERTAINED BOTH WITHIN THE GILLS OF INDIVIDUAL SHRIMP AND AMONG THE GILLS OF DIFFERENT SHRIMP. PRIMARY DEGENERATIVE CHANGES, FIRST EVIDENT IN THE APICAL EPITHELIUM OF THE LAMELLAR PLATES, INCLUDED: SWOLLEN MITOCHONDRIA, DILATED ROUGH ENDOPLASMIC RETICULUM, THE APPEARANCE OF A DENSE GRAINY MATERIAL WITHIN THE SUBCUTICULAR SPACES AND OF PARACRYSTALLINE ELEMENTS WITHIN THE EPITHELIAL CYTOPLASM, THE FORMATION OF AUTOPHAGOSOMES, AND A LOSS OF MEMBRANE CONTINUITY. GRANULAR HEMOCYTES MIGRATED INTO THE SUBCULTULAR SPACES AND APPEARED TO PHAGOCYTOSE THE GRAINY MATERIAL, WHILE OTHER HEMOCYTES PHAGOCYTOSED AND ENCAPSULATED THE PATHOLOGICAL EPITHELIUM. LATER, THE LAMELLAR TIPS BECAME CONGESTED WITH NUMEROUS INTERDIGITATING HEMOCYTES WHICH FORMED A "PLUG". A NEW EPITHELIUM, DERIVED PARTLY FROM MITOSIS OF BASAL LAMELLAR TISSUES, DEVELOPED SUBJACENT TO THE PLUG AND CONTRIBUTED TO THE FORMAION OF AN ABNORMAL AND SOMETIMES PERFORATED CUTICLE DURING PREMOLT. AT ECDYSIS, THE HEMOCYTE PLUGS IN THE APICAL REGION OF THE LAMELLA WERE SLOUGHED RESULTING IN MARKEDLY TRUNCATED AND SWOLLEN LAMELLAE. THIS PROCESS OF PATHOLOGICAL LAMELLAR REDUCTION APPEARS TO BE AN IMPORTANT DEFENSE MECHANISM IN RESPONSE TO BRANCHIAL TRAUMA CAUSED BY EXPOSURE TO ENVIRONMENTAL CONTAMINANTS.

DOUGHTIE, DANIEL G., AND K. RANGA RAO. 1984. HISTOPATHOLOGICAL AND ULTRASTRUCTURAL CHANGES IN THE ANTENNAL GLAND, MIDGUT, HEPATOPANCREAS, AND GILL OF GRASS SHRIMP FOLLOWING EXPOSURE TO HEXAVALENT CHROMIUM. J. INVERTEBR. PATHOL. 43(1):89-108. (ERL,GB X400*).

GRASS SHRIMP, PALAEMONETES PUGIO, WERE EXPOSED FOR ONE MONTH TO SUBACUTE CONCENTRATIONS OF HEXAVALENT CHROMIUM (0.5, 1.0, 2.0, 4.0 PPM) AFTER WHICH THE GILLS, MIDGUT, HEPATOPANCREAS, AND ANTENNAL GLANDS WERE EXAMINED FOR HISTOPATHOLOGICAL AND ULTRASTRUCTURAL CHANGES. PATHOLOGICAL CHANGES WERE GREATEST IN THE ANTENNAL GLANDS, FOLLOWED BY HEPATOPANCREAS, GILLS, AND MIDGUT. SEVERE CHANGES OCCURRED IN SOME SHRIMP, EVEN AT 0.5 PPM CHROMIUM. CELLS OF ALL TISSUES FREQUENTLY HAD BOTH SWOLLEN MITOCHONDRIA AND ROUGH ENDOPLASMIC ETICULUM. SMALL, SPHERICAL OR RING-LIKE INTRANUCLEAR INCLUSIONS, POSSIBLE INDICATIVE OF CELLULAR HYPERACTIVITY OR MANIFESTIONS OF CHROMIUM AND/OR PROTEIN COMPLEXES, WERE MOST PREVALENT IN THE HEPATOPANCREAS AND ANTENNAL GLANDS BUT ALSO OCCURRED IN THE MIDGUT AND GILLS. OTHER MAJOR DEGENERATIVE CHANGES IN THE ANTENNAL GLANDS WERE RESTRICTED TO THE LABYRINTH AND INCLUDED DIMINUTION OF BASAL PLASMALEMMAL INFOLDINGS AND CYTOPLASMIC DENSITY, NUCLEAR HYPERTROPHY FOLLOWED BY WIDESPREAD NUCLEAR PYKNOSIS AND EPITHELIAL DESQUAMATION. IN SEVERELY ALTERED HEPATOPANCREAS HYPERTROPHY WAS INDICATED FOR THE BASAL LAMINAE, NUCLEI, POSSIBLE FOR THE NUCLEOLI. THERE WAS AN APPARENT REDUCTION IN MITOTIC EVENTS AND MANY OBSERVED MITOTIC NUCLEI WERE ABNORMAL. ABNORMAL MIDGUT HYPERTROPHY WAS PRESENT IN ONLY EIGHT OF TWENTY EXAMINED SHRIMP, EXPOSED TO 0.5 AND 1.0 PPM CHROMIUM. FURTHER, THE GILLS OF ONLY 10 OF THE 40 EXAMINED CHROMIUM-EXPOSED SHRIMP POSSESSED ABNORMAL FEATURES DETECTABLE WITH LIGHT MICROSCOPY. ULTRASTRUCTURAL ANALYSIS OF THE LATTER INDICATED AN INCREASE IN LYSOSOMES AND A DECREASE IN CYTOPLASMIC DENSITY. IN ADDITION, THERE WAS A PRONOUNCED DIMINUTION IN THE DEGREE OF LAMELLAR, SUBCUTICULAR PLASMALEMMAL INFOLDING. THIS LATTER FEATURE IS POSTULATED TO BE A MECHANISM FOR THE REGULATION OF CHROMIUM INFLUX. POSSIBLE EXPLANATIONS FOR MOST OBSERVED ALTERATIONS IN THE ABOVE TISSUES ARE PROPOSED.

DUKE, THOMAS W., AND PATRICK R. PARRISH. IN PREP. IMPACT OF DRILLING FLUIDS ON THE MARINE ENVIRONMENT (ABSTRACT). TO BE PRESENTED AT THE FIFTH INTERNATIONAL OCEAN DISPOSAL SYMPOSIUM, SEPT. 10-14, 1984, CORVALLIS, OR. (ERL,G8 507).

DRILLING FLUIDS, ALSO CALLED MUDS, ARE ESSENTIAL TO DRILLING PROCESSES IN THE EXPLORATION AND PRODUCTION OF OIL AND GAS FROM THE U.S. OUTER CONTINENTAL SHELF (OCS). THESE FLUIDS ARE USUALLY DISCHARGED FROM DRILLING PLATFORMS INTO SURROUNDING WATERS OF THE OCS AND AS SUCH ARE REGULATED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT SYSTEM. THIS PAPER PRESENTS A SUMMARY OF RESEARCH FINDINGS FROM A PROGRAM CARRIED OUT BY THE EPA ENVIRONMENTAL RESEARCH LABORATORY OF GULF BREEZE, FLORIDA, TO EVALUATE THE POTENTIAL IMPACT OF DRILLING FLUIDS ON THE MARINE ENVIRONMENT. THE FINDINGS WERE DEVELOPED THROUGH COOPERATIVE EFFORTS OF SCIENTISTS FROM GOVERNMENT, ACADEMIA, AND INDUSTRY. RESULTS SHOW THAT DRILLING FLUIDS CAN BE TOXIC TO MARINE ORGANISMS AT CERTAIN CONCENTRATIONS AND EXPOSURE REGIMES. FUTHERMORE, THE FLUIDS CAN ADVERSELY AFFECT BENTHOS THROUGH PHYSICAL CONTACT BY BURYING OR ALTERING SUBSTRATE CONDITIONS. SEVERAL MARINE SPECIES WERE TESTED, INCLUDING CORALS (MONTASTREA ANNULARIS), LOBSTERS (HOMARUS AMERICANUS), MYSIDS (MYSIDOPSIS BAHIA), GRASS SHRIMP (PALAEMONETES INTERMEDIUS), AND CLAMS (MERCENARIA MERCENARIA). SUBLETHAL, AS WELL AS LETHAL, RESPONSES RESULTED FROM EXPOSURE TO VARIOUS DRILLING FLUIDS. FOR EXAMPLE, EXPOSURE OF THE LEGS OF LIVE LOBSTERS TO 10 PARTS PER MILLION (PPM) AND 100 PPM FOR 3 TO 5 MINUTES CAUSED DIMINISHED RESPONSE BY THE LOBSTERS TO FOOD ODORS BY 29% AND 44% RESPECTIVELY. THE CONCENTRATIONS CAUSING 50% MORTALITY (LC50'S) IN 96 H, FOR LARVAL LOBSTERS EXPOSED TO FIVE DRILLING FLUIDS, WERE FROM 74 PPM TO 500 PPM, AND SUBLETHAL EXPOSURES RESULTED IN ALTERATION OF NORMAL GROWTH AND RESPIRATION RATES. CORALS EXPOSED TO 100 PPM OF USED DRILLING FLUID DEMONSTRATED SIGNIFICANTLY REDUCED CALCIFICATION RATE, RESPIRATION RATE, AND GROSS PHOTOSYNTHESIS. WHEN MYSIDS, GRASS SHRIMP, AND CLAMS WERE SUBJECTED SEPARATELY TO USED FLUIDS, THE 96-H LC50'S VARIED FROM 25 TO >1,500 PPM. MORTALITY WAS SIGNIFICANTLY (0.05) CORRELATED WITH "DIESEL" OIL CONTENT OF THE USED FLUIDS. AN EXPERIMENTAL MACROBENTHIC COMMUNITY EXPOSED TO DRILLING FLUIDS EXHIBITED STRUCTURAL CHARACTERISTICS DIFFERENT FROM CONTROL COMMUNITIES. MODELS PREDICTING THE ENVIRONMENTAL CONCENTRATIONS OF DRILLING FLUIDS UNDER VARIOUS ENVIRONMENTAL CONDITIONS ARE DISCUSSED.

DUKE, THOMAS M. IN PRESS. POTENTIAL IMPACT OF DRILLING FLUIDS ON ESTUARINE PRODUCTIVITY. IN: PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON THE UTILIZATION OF COASTAL ECOSYSTEMS: PLANNING, POLLUTION, AND PRODUCTIVITY, NOV. 22-27, 1982, RIO GRANDE, BRAZIL. (ERL,GB 449).

THIS PAPER DISCUSSES THE POTENTIAL EFFECTS OF DRILLING FLUIDS ON SEMI-ENCLOSED BODIES OF WATER SUCH AS ESTUARIES. DRILLING FLUIDS HAVE BEEN DISCHARGED INTO OUTER CONTINENTAL SHELF WATERS FOR MANY YEARS BUT THERE IS SOME CONCERN OF POTENTIAL ECOLOGICAL IMPACT WHEN DRILLING FLUID ARE DISCHARGED NEAR CORAL REEFS OR IN BAYS AND ESTUARIES. THE CONCERN IS BASED ON POTENTIAL ADVERSE EFFECTS OF THE FLUIDS TO CORALS, SHELLFISH, FISH, GRASS BEDS AND GENERAL PRODUCTIVITY. POTENTIAL EFFECTS CAN BE EVALUATED THROUGH A HAZARD ASSESSMENT PROCESS THAT INVOLVES EFFECTS AND EXPOSURE MEASUREMENTS. A SUGGESTED HAZARD ASSESSMENT INVOLVING THE ADAPTIVE ENVIRONMENTAL ASSESSMENT APPROACH (AEA) IS PRESENTED. THE COMPONENTS OF THE AEA APPROACH ARE DESCRIBED AND EVALUATED. IN DEVELOPING THE HAZARD ASSESSMENT, A REVIEW IS MADE OF EXISTING EFFECTS DATA. A PRESENTATION IS MADE OF ISSUES OF CONCERN SUCH AS: RESUSPENSION OF DRILLING FLUIDS IN SHALLOW, WIND-DRIVEN ESTUARIES, RESTRICTION OF LIGHT PENETRATION TO PRIMARY PRODUCERS BY SUSPENDED SEDIMENTS, CHANGES IN BENTHIC COMMUNITIES AND THEIR SUBSTRATES, AND DIRECT TOXICITY OF THE FLUIDS TO ORGANISMS.

DUKE, THOMAS W. 1982. SUMMARY OF EPA DRILLING FLUID RESEARCH ACTIVITIES. IN: PROCEEDINGS: THIRD ANNUAL GULF OF MEXICO INFORMATION TRANSFER MEETING, AUGUST 24-26, 1982, NEW ORLEANS, LA. U.S. DEPARTMENT OF THE INTERIOR MINERALS MANAGMENT SERVICE, NEW ORLEANS, LA. PP. 85-89. (ERL,GB 461*). AVAIL. FROM NTIS, SPRINGFIELD, VA: P383-147769.

DRILLING-FLUID RELATED RESEARCH AT THE U.S. EPA ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, IS SUMMARIZED. THE PROGRAM IS CONDUCTED PRIMARILY THROUGH CONTRACTS, GRANTS, AND SOME INHOUSE PROJECTS DESIGNED TO ASSESS THE POTENTIAL HAZARD TO THE MARINE ENVIRONMENT FROM FLUIDS DISCHARGED IN OFFSHORE OIL AND GAS DRILLING AND EXPLORATIONS.

DUKE, T.W., P.R. PARRISH, R.M. MONTGOMERY, S.D. MACAULEY, J.M. MACAULEY, AND G.M. CRIPE. 1984. ACUTE TOXICITY OF EIGHT LABORATORY-PREPARED GENERIC DRILLING FLUIDS TO MYSIDS (MYSIDOPSIS BAHIA). EPA-600/3-84-067, U.S ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 11P.
AVAIL. FROM NTIS, SPRINGFIELD, VA: PB84-199850.

ACUTE TOXICITY TESTS WERE CONDUCTED DURING AUGUST-SEPTEMBER 1983 WITH EIGHT LABORATORY-PREPARED GENERIC DRILLING FLUIDS (ALSO CALLED MUDS) AND MYSIDS (MYSIDOPSIS BAHIA) AT THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FLORIDA. TWO OF THE DRILLING FLUIDS WERE TESTED AT THE ENVIRONMENTAL RESEARCH LABORATORY, NARRAGANSETT, RHODE ISLAND, TO CONFIRM THE VALIDITY OF THE TESTS CONDUCTED AT GULF BREEZE. THE TEST MATERIAL WAS THE SUSPENDED PARTICULATE PHASE (SPP) OF EACH DRILLING FLUID. THE SPP WAS PREPARED BY MIXING VOLUMETRICALLY 1 PART DRILLING FLUID WITH 9 PARTS SEAWATER AND ALLOWING THE RESULTING SLURRY TO SETTLE FOR ONE HOUR. THE MATERIAL THAT REMAINED IN SUSPENSION WAS THE SPP. TOXICITY OF THE SPP OF THE DRILLING FLUIDS RANGED FROM A 96-HOUR LC50 (THE CONCENTRATION LETHAL TO 50% OF THE TEST ANIMALS AFTER 96 HOURS OF EXPOSURE) OF 2.7% FOR A KCl POLYMER MUD TO 65.4% FOR A LIGHTLY TREATED LIGNOSULFONATE MUD. NO MEDIAN EFFECT (50% MORTALITY) WAS OBSERVED IN THREE DRILLING FLUIDS -- A NON-DISPERSED MUD, A SPUD MUD, AND A SEAWATER-FRESHWATER GEL MUD.

DUKE, THOMAS W., AND PATRICK R. PARRISH. 1984. RESULTS OF THE DRILLING FLUIDS RESEARCH PROGRAM SPONSORED BY THE GULF BREEZE ENVIRONMENTAL RESEARCH LABORATORY, 1976-1984, AND THEIR APPLICATION TO HAZARD ASSESSMENT. EPA-600/4-84-055, UNITED STATES. ENVIRONMENTAL PROTECTION AGENCY. ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 94P.

THE ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FLORIDA, CARRIED OUT A RESEARCH PROGRAM FROM 1976-1984 TO EVALUATE THE POTENTIAL IMPACT OF DRILLING FLUIDS ON THE MARINE ENVIRONMENT. RESEARCH EFFORTS WERE ACCOMPLISHED MAINLY THROUGH COOPERATIVE AGREEMENTS WITH ACADEMIC INSTITUTIONS AND CONTRACTS WITH PRIVATE LABORATORIES; PROGRAM DIRECTION AND TOXICITY TESTING WITH USED AND GENERIC DRILLING FLUIDS WERE PROVIDED BY THE GULF BREEZE LABORATORY. RESULTS OF RESEARCH ACTIVITIES REPORTED FROM THIS RESEARCH PROGRAM SHOWED THAT DRILLING FLUIDS ARE TOXIC TO MARINE ANIMALS AT CERTAIN CONCENTRATIONS AND EXPOSURE REGIMES. FURTHER, DRILLING FLUIDS CAN ADVERSELY AFFECT ANIMALS, ESPECIALLY BENTHOS, THROUGH PHYSICAL CONTACT BY BURYING OR ALTERING SUBSTRATE COMPOSITION. THE FLUIDS, OR COMPONENTS OF THE FLUIDS, ALSO CAN EXERT EFFECTS BY DISRUPTING ESSENTIAL PHYSIOLOGICAL FUNCTIONS OF ORGANISMS. WHILE SOME COMPONENTS (PENTACHLOROPHENOL, FOR EXAMPLE) THAT ARE TOXIC ARE NO LONGER PERMITTED FOR FLUIDS RELEASED ON THE OCS, RESEARCH INDICATED THAT A "DIESEL" CONTAMINANT IS A TOXIC COMPONENT OF USED FLUIDS RECENTLY COLLECTED FROM THE GULF OF MEXICO. TESTS ALSO SHOWED THAT THE ADDITION OF #2 FUEL OIL (DIESEL) OR MINERAL OIL INCREASED THE TOXICITY OF LABORATORY-PREPARED DRILLING FLUIDS. MODELS DEVELOPED TO PREDICT THE IMPACT OF DRILLING FLUIDS ON OPEN, WELL-MIXED, AND RELATIVELY DEEP (>20 METERS) MARINE ENVIRONMENTS SUGGESTED THAT UNDER NORMAL OPERATING CONDITIONS MOST DETECTABLE ADVERSE EFFECTS SHOULD BE LIMITED TO WITHIN SEVERAL HUNDRED METERS OF THE POINT OF DISCHARGE. POSSIBLE EXCEPTIONS TO THIS GENERALIZATION COULD OCCUR WHEN DRILLING CONDITIONS DIFFER FROM NORMAL OR WHEN DRILLING RIGS ARE LOCATED NEAR SENSITIVE BIOLOGICAL AREAS, SUCH AS CORAL REEFS, OR IN POORLY FLUSHED AREAS. INCOMPLETE RESEARCH DATA WERE ACQUIRED IN SOME AREAS, AND FURTHER RESEARCH WOULD BE DESIRABLE IN OTHER AREAS. FOR EXAMPLE, MODELS DEVELOPED TO PREDICT THE FATE AND EFFECTS OF DRILLING FLUIDS SHOULD BE FIELD TESTED TO VALIDATE THE ASSUMPTIONS AND INPUTS INTO THE MODELS. SPECIAL EMPHASIS SHOULD BE PLACED ON DISCHARGES FROM MULTIPLE DEVELOPMENT RIGS. ALSO, DATA AND METHODOLOGY ARE NEEDED ON THE EFFECTS OF ADDITIVES, PARTICULARLY BIOCIDES AND CHEMICALS TO IMPROVE LUBRICITY, ON THE TOXICITY OF DRILLING FLUIDS. ADDITIONAL INFORMATION ON SUBLETHAL AND CHRONIC EFFECTS OF THE DRILLING FLUIDS ON SENSITIVE LIFE STAGES OF ORGANISMS, PARTICULARLY BENTHIC ORGANISMS, WOULD BE USEFUL IN PREPARING HAZARD ASSESSMENTS. ANOTHER AREA FOR FUTURE RESEARCH IS THE IMPACT OF DRILLING FLUIDS THAT CONTAIN DIESEL OIL, OR CHEMICALS USED IN PLACE OF DIESEL OIL, ON STRUCTURE AND FUNCTION OF BENTHIC COMMUNITIES.

ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 1984. INDEX AND ABSTRACTS TO PUBLICATIONS: THE EPA DRILLING FLUID HAZARD ASSESSMENT RESEARCH PROGRAM. U.S. ENVIRONMENTAL PROTECTION AGENCY. ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 94P. (ERL,GB SR-112).

THIS VOLUME SUMMARIES RESULTS OF AN ONGOING RESEARCH PROGRAM. FROM 1976 TO THE PRESENT TIME, ERLGB CONDUCTED A RESEARCH PROGRAM TO EVALUATE THE POTENTIAL IMPACT OF DRILLING FLUIDS ON THE MARINE ENVIRONMENT. THE EXTRAMURAL PORTION OF THIS STUDY IS ESSENTIALLY COMPLETE; HOWEVER, THE IN-HOUSE REPORT IS CONTINUING. THE EFFORT WAS A COMPOSITE OF IN-HOUSE AND EXTRAMURAL ACTIVITIES, ADAPTIVE ENVIRONMENTAL ASSESSMENTS (AEA) AND A FINAL HAZARD ASSESSMENT EFFORT (IN AGENCY REVIEW). DR. NORMAN RICHARDS DIRECTED THE PROGRAM FROM 1976 TO 1981 WHEN DR. T. W. DUKE BECAME PROJECT LEADER. OVER THAT TIME PERIOD 100 REPORTS, PUBLICATIONS AND JOURNAL ARTICLES IN THE PEER-REVIEWED LITERATURE HAVE BEEN PRODUCED. THIS PUBLICATION LISTS THE TITLE, JOURNAL OR PLACE OF PUBLICATION AND, (WHEN AVAILABLE), AN ABSTRACT OF THE PUBLICATION CONTENT. ADDITIONALLY, AN AUTHOR INDEX AND A KEY WORD INDEX ARE PROVIDED.

FARR, JAMES A. 1978. ORIENTATION AND SOCIAL BEHAVIOR IN THE SUPRALITTORAL ISOPOD LIGIA EXOTICA (CRUSTACEA: ONISCOIDEA). BULL. MAR. SCI. 28(4):659-666. (ERL,GB X071*).

LIGIA EXOTICA IS AGGREGATIVE, TENDING TO SEEK OUT CONSPECIFICS. IT IS HYPOTHESIZED THAT LIGIA MUST SEEK NEW SHELTERS REPEATEDLY WITH CHANGING TIDES BECAUSE OF THEIR RESTRICTED WATER REQUIREMENTS, AND THAT ATTRACTION TO CONSPECIFICS ALREADY IN A SUITABLE HABITAT IS AN ADDITIONAL ORIENTATIONAL MECHANISM TO THOSE EXTERNAL ENVIRONMENTAL FACTORS INFLUENCING MICROHABITAT SELECTION. EXPERIMENTS ON OBJECT ORIENTATION DEMONSTRATED A STRONG TENDENCY TO MOVE TOWARD CONTRASTING LANDMARKS, THE RESULT BEING OCCUPATION OF ROCKY AREAS ON THE SHORELINE. BRIEF DESCRIPTIONS OF SEXUAL AND AGONISTIC BEHAVIOR ARE INCLUDED.

FAZIO, STEVEN D., WILLIAM R. MAYBERRY, AND DAVID C. WHITE. 1979. MURAMIC ACID ASSAY IN SEDIMENTS. APPL. ENVIRON. MICROBIOL. 38(2):349-350. (ERL,GB X073*).

AN IMPROVED CHROMATOGRAPHIC ASSAY FOR MURAMIC ACID WHICH IS SUFFICIENTLY SENSITIVE FOR MARINE SANDY SEDIMENTS IS DESCRIBED; IT INVOLVES ACID HYDROLYSIS, THIN-LAYER CHROMATOGRAPHY, AND GAS-LIQUID CHROMATOGRAPHY.

FEDERLE, THOMAS W., AND DAVID C. WHITE. 1982. PRESERVATION OF ESTUARINE SEDIMENTS FOR LIPID ANALYSIS OF BIOMASS COMMUNITY STRUCTURE OF MICROBIOTA. APPL. ENVIRON. MICROBIOL. 44(5):1166-1169. (ERL,GB X381*).

VARIOUS METHODS WERE TESTED FOR PRESERVING ESTUARINE SEDIMENTS IN THE FIELD BEFORE BIOCHEMICAL ANALYSIS OF THE MICROBIOTA. TOTAL MICROBIAL BIOMASS WAS DETERMINED AS LIPID PHOSPHATE (LP), AND THE FATTY ACIDS OF THE MICROBIAL LIPID WERE USED AS INDICATORS OF COMMUNITY STRUCTURE. CONTROL SAMPLES WERE SIEVED TO REMOVE MACROINVERTEBRATES AND PLANT MATERIALS AND WERE EXTRACTED IMMEDIATELY IN THE FIELD. OTHER SAMPLES WERE PRESERVED BOTH BEFORE AND AFTER SIEVING AND STORED FOR 5 DAYS BEFORE ANALYSIS. FREEZING RESULTED IN A 50% DECLINE IN LP AND SIGNIFICANT DECREASES IN MANY FATTY ACIDS. REFRIGERATION RESULTED IN A 19% DECREASE IN LP BUT NO CHANGE IN THE FATTY ACIDS. SAMPLES PRESERVED WITH FORMALIN BEFORE SIEVING EXHIBITED NO SIGNIFICANT CHANGE IN LP BUT SUBSTANTIAL INCREASES IN MANY FATTY ACIDS, WHICH WERE PROBABLY DERIVED FROM THE MACROINVERTEBRATES. SIEVED SAMPLES PRESERVED WITH FORMALIN SHOWED A 17 TO 18% DECLINE IN LP BUT NO CHANGE IN THE FATTY ACIDS. IDEALLY, SAMPLES SHOULD BE SIEVED AND EXTRACTED IMMEDIATELY IN THE FIELD. HOWEVER, SHORT-TERM REFRIGERATION AND LONGER-TERM PRESERVATION OF SIEVED SAMPLES WITH FORMALIN MAY BE ACCEPTABLE COMPROMISES.

FEDERLE, THOMAS W., ROBERT J. LIVINGSTON, DUANE A. MEETER, AND DAVID C. WHITE. 1983. MODIFICATIONS OF ESTUARINE SEDIMENTARY MICROBIOTA BY EXCLUSION OF EPIBENTHIC PREDATORS. J. EXP. MAR. BIOL. ECOL. 73(1):81-94. (ERL,GB 467*).

THE ABILITY OF EPIBENTHIC PREDATORS (CRABS AND FISHES) TO INFLUENCE BIOMASS AND COMMUNITY STRUCTURE OF SEDIMENTARY MICROBIOTA WAS INVESTIGATED IN ST. GEORGE SOUND-APALACHICOLA BAY SYSTEM, FLORIDA, U.S.A. REPLICATE AREAS (4 M SQUARED) OF MUD-FLAT SEDIMENT WERE CAGED IN THE FIELD TO CONFINE AND EXCLUDE PREDATORS. UNCAGED AREAS WERE USED AS CONTROLS. THE MICROBIOTA (PROKARYOTES AND MICROEUKARYOTES) OF THE SEDIMENTS WAS CHARACTERIZED AT WEEKS 0, 2, AND 6 BY MEASURING CONCENTRATIONS OF PHOSPHOLIPID AND ANALYZING FATTY ACIDS OF THE MICROBIAL LIPIDS EXTRACTED FROM THE SEDIMENTS. DATA WERE ANALYZED USING ANALYSIS OF VARIANCE AND STEP-WISE DISCRIMINANT ANALYSIS. AFTER 2 WK, THE MICROBIOTA OF THE PREDATOR EXCLUSION TREATMENT WAS SIGNIFICANTLY DIFFERENT FROM THAT IN CONTROL AND PREDATOR INCLUSION TREATMENTS. AFTER 6 WK, THESE DIFFERENCES BECAME MORE PRONOUNCED. THERE WERE NO DEMONSTRABLE CAGING EFFECTS THAT COULD ACCOUNT FOR TREATMENT DIFFERENCES. RESULTS INDICATED THAT REMOVAL OF PREDATORS HAD A PROFOUND EFFECT ON MICROBIAL COMMMUNITIES IN ESTUARINE SEDIMENTS. THUS, THE TOP TROPHIC LEVEL (EPIBENTHIC PREDATORS) HAD AN IMPORTANT ROLE IN REGULATING THE STRUCTURE OF THE LOWEST TROPHIC LEVEL (THE MICROBIOTA).

FEDERLE, THOMAS W., MEREDITH A. HULLAR, ROBERT J. LIVINGSTON, DUANE A. MEETER, AND DAVID C. WHITE. 1983. SPATIAL DISTRIBUTION OF BIOCHEMICAL PARAMETERS INDICATING BIOMASS AND COMMUNITY COMPOSITION OF MICROBIAL ASSEMBLIES IN ESTUARINE MUD FLAT SEDIMENTS. APPL. ENVIRON. MICROBIOL. 45(1):58-63. (ERL,GB X371*).

THE SPATIAL DISTRIBUTION OF COMMUNITIES WAS EXAMINED IN ESTUARINE MUD FLAT SEDIMENTS BY THE BIOCHEMICAL ANALYSIS OF THE LIPIDS AND LIPID COMPONENTS EXTRACTED FROM THE SEDIMENTS. TOTAL PHOSPHOLIPID WAS USED AS A MEASURE OF TOTAL BIOMASS, AND FATTY ACIDS WERE USED AS INDICATORS OF COMMUNITY COMPOSITION. COMPARISONS WERE MADE AMONG 2- BY 2-M (LOCATION) AND 0.2- BY 0.2-M (CLUSTER) SAMPLING PLOTS BY USING A NESTED ANALYSIS OF VARIANCE TO DESIGN AN OPTIMAL SAMPLING STRATEGY TO DEFINE THE MICROBIAL CONTENT OF A LARGE, RELATIVELY HOMOGENOUS AREA. AT TWO OF THE THREE STATIONS, A 2- BY 2-M PLOT WAS REPRESENTATIVE OF THE STATION, BUT 0.2- BY 0.2-M AREAS WERE IN NO CASE REPRESENTATIVE OF THE STATION. THE BIOMASS MEASURED BY THE EXTRACTABLE PHOSPHOLIPID AND THE TOTAL LIPID PALMITIC ACID SHOWED EXCELLENT CORRELATION WITH THE FATTY ACID "SIGNATURES" CHARACTERISTIC OF BACTERIA, BUT SHOWED A LOWER CORRELATION WITH THE LONG-CHAIN POLYENOIC FATTY ACIDS CHARACTERISTIC OF THE MICROFAUNA.

FERRANTE, JOHN G. 1981. FATE AND EFFECTS OF WHOLE DRILLING FLUIDS AND FLUID COMPONENTS IN TERRESTRIAL AND FRESHWATER ECOSYSTEMS: A LITERATURE REVIEW. EPA-600/4-81-031, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 28P.
AVAIL. FROM NTIS, SPRINGFIELD, VA: PB81-197766.

DRILLING FLUIDS REPRESENT AN IMPORTANT ASPECT OF OFFSHORE AND LAND BASED DRILLING OPERATIONS. THE FLUIDS PERFORM A MULTIPLICITY OF FUNCTIONS, RANGING FROM LUBRICATING TO PREVENTION OF BLOWOUTS WHEN ENCOUNTERING HIGH PRESSURE. PERIODICALLY, THE FLUIDS MUST BE CHANGED OR THEY BECOME OLD AND THE SPENT FLUIDS ARE DISPOSED OF IN ON-LAND FACILITIES. INTRODUCTION INTO THE ENVIRONMENT OF THE CHEMICALLY COMPLEX FLUIDS HAS PROMPTED EFFECTS RESEARCH ADDRESSING TERRESTRIAL AND FRESHWATER HABITATS AND THEIR RESPECTIVE BIOLOGICAL COMPONENTS. STUDIES WITH TERRESTRIAL PLANTS IN LABORATORY AND FIELD EXPERIMENTS SHOW THAT THE FLUIDS AND SOME FLUID COMPONENTS EXHIBIT PHYTOTOXICITY PROPERTIES REDUCING SEED GERMINATION, GROWTH AND YIELD. PHYTOTOXICITY IN WHOLE DRILLING FLUIDS IS ATTRIBUTED TO SOLUBLE SALT CONCENTRATIONS. PREFERENCE/AVOIDANCE REACTIONS WERE OBSERVED IN EXPERIMENTS WITH WHOLE DRILLING FLUIDS ARE ALSO COLLATED AND DISCUSSED. THE RANGE OF LETHAL CONCENTRATIONS OF FLUID COMPONENTS IN TOXICITY STUDIES WAS FROM LESS THAN 1 TO 75,000 MG/L AND THAT FOR WHOLE DRILLING FLUIDS FROM 0.29 TO 85% BY VOLUME. VARIOUS REASONS FOR OBSERVED TOXICITY ARE DISCUSSED AND RECOMMENDATIONS MADE FOR FUTURE FRESHWATER AND TERRESTRIAL RESEARCH WITH DRILLING FLUIDS.

FINDLAY, ROBERT H., AND DAVID C. WHITE. 1983. POLYMERIC BETA-HYDROXYALKANOATES FROM ENVIRONMENTAL SAMPLES AND BACILLUS MEGATERIUM. APPL. ENVIRON. MICROBIOL. 45(1):71-78. (ERL,GB X380*).

THE PROCARYOTIC ENDOGENOUS STORAGE POLYMER KNOWN AS POLY-BETA-HYDROXYBUTYRATE IS ACTUALLY A MIXED POLYMER OF SHORT-CHAIN BETA-HYDROXY FATTY ACIDS. A METHOD FOR THE QUANTITATIVE RECOVERY OF THIS MIXED POLYMER, CALLED POLY-BETA-HYDROXYALKANOATE (PHA), WITH ANALYSIS BY CAPILLARY GAS-LIQUID CHROMATOGRAPHY SHOWED THE PRESENCE OF AT LEAST 11 SHORT-CHAIN BETA-HYDROXY ACIDS IN POLYMERS EXTRACTED FROM MARINE SEDIMENTS. POLYMERS EXTRACTED FROM BACILLUS MEGATERIUM MONOCULTURES WERE ALSO A COMPLEX MIXTURE OF BETA-HYDROXY ACIDS WITH CHAIN LENGTHS BETWEEN FOUR AND EIGHT CARBONS. LYOPHILIZED SEDIMENTS WERE EXTRACTED IN A MODIFIED SOXHLET EXTRACTOR, AND THE POLYMER WAS PURIFIED WITH ETHANOL AND DIETHYL ETHER WASHES. THE PURIFIED POLYMER WAS TREATED WITH ETHANOL-CHLOROFORM-HYDROBCHLORIC ACID (8.5:2.5:1) FOR 4 H AT 100 DEGREES CELSIUS, A TREATMENT WHICH RESULTED IN THE FORMATION OF THE ETHYL ESTERS OF THE THE CONSTITUENT BETA-HYDROXY ACIDS. SUBSEQUENT ASSAY OF THE PRODUCTS BY GAS-LIQUID CHROMATOGRAPHY INDICATED EXCELLENT REPRODUCIBILITY AND SENSITIVITY (DETECTION LIMIT, 100 FMOL). DISTURBING SEDIMENTS MECHANICALLY OR ADDING NATURAL CHELATORS INCREASED ALL MAJOR PHA COMPONENTS RELATIVE TO THE BACTERIAL BIOAMSS. GARDENING OF SEDIMENTARY MICROBES BY CLYMENELLA SP., AN ANNELID WORM, INDUCED DECREASES IN PHA, WITH CHANGES IN THE RELATIVE PROPORTION OF COMPONENT BETA-HYDROXY ACIDS. THE CONCENTRATION OF PHA RELATIVE TO THE BACTERIAL BIOMASS CAN REFLECT THE RECENT METABOLIC STATUS OF THE MICROBIOTA.

FOX, F.R., AND K. RANGA RAO. 1982. ACCUMULATION, TISSUE DISTRIBUTION AND DEPURATION OF BENZO(A)PYRENE AND BENZ(A)ANTHRACENE IN THE GRASS SHRIMP, PALAEMONETES PUGIO. IN: SYMPOSIUM: CARCINOGENIC POLYNUCLEAR AROMATIC HYDROCARBONS IN THE MARINE ENVIRONMENT, PENSACOLA BEACH, FLORIDA, 14-18 AUGUST, 1978. EPA-600/9-82-013, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. PP. 336-349. (ERL,GB X237*).

THE SHORT-TERM UPTAKE, TISSUE DISTRIBUTION, AND DEPURATION OF TWO POLYCYCLIC AROMATIC HYDROCARBONS, C-14-BENZO(A)PYRENE (BP) AND C-14-BENZ(A)ANTHRACENE (BA), WERE STUDIED UTILIZING THE GRASS SHRIMP, PALAEMONETES PUGIO, AT KNOWN STAGES OF THE MOLT CYCLE. PREMOLT SHRIMP ACCUMULATED LESS BP AND BA THAN INTERMOLT SHRIMP. THE NEWLY MOLTED SHRIMP ACCUMULATED MORE BA THAN INTERMOLT SHRIMP. AT EACH OF THE CONCENTRATIONS TESTED [1.25, 2.5, 5.0, 10.0 PARTS PER BILLION (PPB)], INTERMOLT SHRIMP ACCUMULATED BY SHRIMP INCREASED IN RELATION TO ENVIRONMENTAL LEVELS OF THESE COMPOUNDS. THE ACCUMULATION OF BP AND BA IN TISSUES EXAMINED WAS IN THE FOLLOWING ORDER: DIGESTIVE TRACT (STOMACH + INTESTINE)> HEPATOPANCREAS> CEPHALOTHORAX> ABDOMEN. ALL TISSUES ACCUMULATED MORE BA THAN BP. WHEN EXPOSED TO MEDIA CONTAINING 2.5 PPB BP OR 2.8 PPB BA, A RAPID UPTAKE BY SHRIMP WAS NOTED DURING THE FIRST 6-HR EXPOSURE, SUBSEQUENTLY UPTAKE WAS REDUCED FOR BP. HOWEVER, AT TERMINATION OF 96-HR EXPOSURE, SHRIMP EXHIBITED A TREND OF CONTINUAL ACCUMULATION OF BA AND BP. WHEN TRANSFERRED TO SEAWATER, SHRIMP APPEARED TO DEPURATE BA MORE RAPIDLY THAN BP. IN THE SHRIMP EXPOSED TO BA, THE LEVEL OF RADIOACTIVITY DECLINED BY 80% AFTER A 7-DAY DEPURATION; UNDER SIMILAR CONDITIONS, THE BP LEVEL (RADIOACTIVITY) DECLINED BY ONLY 35%.

FOX, FERRIS R., AND K. RANGA RAO. 1978. CHARACTERISTICS OF A CA(2+) -ACTIVATED ATPASE FROM THE HEPATOPANCREAS OF THE BLUE CRAB, CALLINECTES SAPIDUS. COMP. BIOCHEM. PHYSIOL. B COMP. BIOCHEM. 59B(3):327-331. (ERL,GB X077*).

1. SOME CHARACTERISTICS OF A CALCIUM-ACTIVATED ATPASE IN THE MICROSOMAL FRACTION (48,000 G PELLET) OF THE HEPATOPANCREAS FROM THE BLUE CRAB, CALLINECTES SAPIDUS, ARE INVESTIGATED. 2. THE ENZYME REQUIRED A HIGH CONCENTRATION OF CA PLUS 2 (20 MM) FOR MAXIMAL ACTIVITY. K PLUS 1 WAS NOT REQUIRED FOR ACTIVATION. MG PLUS 2 WAS LESS EFFECTIVE THAN CA PLUS 2 IN ACTIVATING THE ATPASE. THE ENZYME WAS ALSO ACTIVATED BY SR PLUS 2 OR BA PLUS 2 ALONE. THE MAXIMAL ACTIVITY EVOKED BY SR PLUS 2 WAS GREATER THAN THAT EVOKED BY CA PLUS 2, WHILE BA PLUS 2 WAS A RELATIVELY POOR ACTIVATOR. 3. THE KM OF THE ENZYME FOR ATP WAS 4.1 X 10-3 M. IN A RANGE OF 20 TO 70 DEGREES C, THE MAXIMAL ACTIVITY WAS NOTED AT 45-50 DEGREES C. THE ENZYME EXHIBITED MAXIMAL ACTIVITY AT PH 7.5. 4. THE CHARACTERISTICS OF THE BLUE CRAB HEPATOPANCREATIC MICROSOMAL ENZYME ARE DIFFERENT FROM THOSE OF CRUSTACEAN MYOSIN ATPASES, BUT ARE COMPARABLE TO THOSE OF THE CA PLUS 2 -TRANSPORT ATPASES FROM OTHER ANIMALS.

FOX, FERRIS R., AND K. RANGA RAO. 1978. EFFECTS OF SODIUM PENTACHLOROPHENATE AND 2,4-DINITROPHENOL ON HEPATOPANCREATIC ENZYMES IN THE BLUE CRAB, CALLINECTES SAPIDUS. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NEW YORK, NY. PP. 213-250. (ERL,GB X078*).

IN VIEW OF THE LACK OF INFORMATION ON THE MECHANISMS OF PCP-INDUCED TOXICITY IN CRUSTACEANS, THIS INVESTIGATION WAS UNDERTAKEN TO EVALUATE THE EFFECTS OF SODIUM PENTACHLOROPHENATE (NA-PCP) IN VIVO AND IN VITRO ON CERTAIN HEPATOPANCREATIC ENZYMES IN THE BLUE CRAB, CALLINECTES SAPIDUS. FUMARASE, MALATE DEHYDROGENASE AND SUCCINATE DEHYDROGENASE WERE INHIBITED BY NA-PCP AND DNP IN VIVO, WHEREAS ISOCITRATE DEHYDROGENASE WAS STIMULATED. OF THOSE TESTED, LACTIC DEHYDROGENASE WAS THE LEAST AFFECTED CYTOPLASMIC (SOLUBLE) ENZYME IN VIVO WHILE PYRUVATE KINASE AND GLUCOSE-6-PHOSPHATE DEHYDROGENASE WERE INHIBITED AT LEAST 50% BY NA-PCP. GLUTAMATE-PYRUVATE TRANSAMINASE WAS ALSO INHIBITED. NA-PCP AND DNP HAD AN INHIBITORY EFFECT ON THE VARIOUS ENZYMES TESTED IN VITRO AT CONCENTRATIONS OF 10-4 M OR HIGHER. IN GENERAL, THE MITOCHONDRIAL ENZYMES WERE MORE SUSCEPTIBLE THAN CYTOPLASMIC ENYMES TO DNP AND NA-PCP. THE CALCIUM ACTIVATED ATPASE FROM THE MICROSOMAL FRACTION OF THE CRAB HEPATOPANCREAS WAS INHIBITED BY NA-PCP AND DNP IN VITRO AND IN VIVO. NA-PCP WAS MORE POTENT THAN DNP IN INHIBITING THE ATPASE ACTIVITY. THE EFFECTS OF PCP ON THE BLUE CRAB ENZYMES HAVE BEEN COMPARED TO THE RESULTS OF PREVIOUS INVESTIGATIONS ON OTHER ORGANISMS.

GAETZ, C.T., A. GIESENSCHLAG, P.V. HAMILTON, D. KELLENBERGER, H. LEHMAN, M.J. RAY, J. SNYDER, AND R. SUMMERALL. 1977. APPLICABILITY OF NERITINA RECLIVATA (MOLLUSCA: GASTROPODA) TO LABORATORY ECOSYSTEMS USED IN POLLUTION RESEARCH (UNPUBLISHED). 103P. (ERL,GB X240*).

THE INTERTIDAL SNAIL NERITINA RECLIVATA WAS INVESTIGATED IN THE PENSACOLA ESTUARY BY SEVERAL INVESTIGATORS. FOR MOST OF THE STUDIES, AN INDEX OF SIZE FOR THE SNAIL WAS NECESSARY. SHELL LENGTH, THE STANDARD MEASUREMENT OF SIZE FOR GASTROPODS, COULD NOT BE MEASURED RELIABLY IN NERITINA DUE TO THE LARGE PROPORTION OF INDIVIDUALS WITH ERODED APICAL WHORLS. DRY TISSUE WEIGHT WAS FELT TO BE THE MOST INFORMATIVE MEASUREMENT OF SIZE BECAUSE SHELL COMPOSITION AND SIZE COULD VARY DEPENDING ON THE AVAILABILITY OF CALCIUM AND OTHER FACTORS. IN ORDER TO DETERMINE THE ACTUAL DRY TISSUE WEIGHT OF THE SNAILS WITHOUT HAVING TO ACTUALLY MEASURE IT FOR EACH SNAIL, STATISTICAL APPROACH WAS USED ON A SAMPLE GROUP OF SNAILS. THE OBJECT WAS TO DETERMINE THE SHELL AND OPERCULUM MEASUREMENTS WHICH BEST PREDICTED DRY TISSUE WEIGHT AND WHICH HOPEFULLY DID NOT REQUIRE THE SNAIL TO BE SACRIFICED TO MAKE THE MEASUREMENTS.

GILBERT, T.R. 1982. STUDY OF THE IMPACT OF DISCHARGED DRILLING FLUIDS ON THE GEORGES BANK ENVIRONMENT: PROGRESS REPORT NO. 2. 112P. (ERL,GB X463*).

STUDIED OF THE ENVIRONMENTAL EFFECTS OF DISCHARGED DRILLING MUDS CONDUCTED BETWEEN JUNE 1, 1980 AND MAY 1, 1981, HAVE INCLUDED CHEMICAL AND TOXICOLOGICAL ANALYSES OF MUDS AND MUD COMPONENTS. THE GOALS OF THESE STUDIED HAVE BEEN: 1) TO DETERMINE WHICH FORMS OF MARINE LIFE ARE MOST SENSITIVE TO MUD TOXICITY, AND 2) TO DETERMINE WHICH MUD CONSTITUENTS ARE MOST TOXIC. THESE STUDIES HAVE INCLUDED CHEMICAL CHARACTERIZATION OF USED DRILLING MUDS AND OF TOXICOLOGICAL TEST PHASES PRODUCED BY THESE MUDS; ASSESSMENT OF THE BIOACCUMULATION OF TRACE ELEMENTS IN ORGANISMS EXPOSED TO A SERIES OF MUDS ON THE STAGE I PLATFORM; DETERMINATION OF RACE ELEMENT DISTRIBUTIONS IN THE WATERS AND SEDIMENTS OF TEST TANKS BEING USED IN BEHAVIORAL STUDIES AT THE NATIONAL MARINE FISHERIES SERVICE (NMFS) LABORATORY AT SANDY HOOK, NEW JERSEY; BIOASSAYS WITH ESTUARINE (ACARTIA TONSA) AND STENOHALINE (CENTROPAHES TYPICUS) COPEPODS; STUDIES OF LARVAL DEVELOPMENT OF SEA SCALLOPS (PLACOPECTEN MAGELLANICUS AND ROCK CRABS (CANCER IRRORATUS) EXPOSED TO WATER-SOLUBLE MUD COMPONENTS, AND COLONIZATION AND REPOPULATION STUDIES OF SEDIMENTS CONTAINING DRILLING MUD SOLIDS.

GILBERT, T.R. 1982. SURVEY OF THE TOXICITIES AND CHEMICAL COMPOSITIONS OF USED DRILLING MUDS: PROGRESS REPORT NO. 3 (FOR THE PERIOD SEPTEMBER 1, 1981 - FEBRUARY 15, 1982). 51P. (ERL,GB X464*).

INVESTIGATIONS OF THE EFFECTS OF USED DRILLING MUDS CONDUCTED BETWEEN SEPT. 1981 AND FEB. 1982 HAVE INCLUDED DEVELOPMENT OF A PROTOCOL FOR LARVAL SHELLFISH BIOASSAYS AND ANALYSIS OF DATA FROM RECOLONIZATION STUDIES DONE IN THE SPRING OF 1981. BIOASSAY DEVELOPMENT INVOLVED THE CONSTRUCTION OF A SYSTEM TO HOLD, CONDITION AND SPAWN ADULT MERCENARIA MERCENARIA AND THE ESTABLISHMENT OF A PROTOCOL FOR TESTING LARVAE. INITIAL EXPERIMENTS INDICATE THAT THE METHODOLOGY IS DEPENDABLE AND EFFECTIVE. RESULTS FROM LABORATORY- AND FIELD-BASED EXPERIMENTS IN THE RECOLONIZATION STUDY SHOWED THAT P.E.S.A. DRILLING MUD ADVERSELY AFFECTED RECOLONIZATION ONLY WHEN LAYERED ON TOP OF DEFAUNATED SEDIMENTS.

GILBERT, T.R. 1983. SURVEY OF THE TOXICITIES AND CHEMICAL COMPOSITIONS OF USED DRILLING MUDS: DATA SUMMARY, JANUARY 1, 1983 (UNPUBLISHED). 31P. (ERL,GB X465*).

THE DATA PRESENTED IN THIS SUMMARY ARE THE RESULTS OF A ONE-YEAR STUDY OF THE TOXICITIES AND CHEMICAL COMPOSITIONS OF USED DRILLING FLUIDS. A MORE COMPLETE FINAL REPORT WILL BE SUBMITTED IN FEBRUARY 1983. THE SPECIFIC OBJECTIVES OF THIS PROJECT WERE TO DEVELOP A SENSITIVE SUBLETHAL LARVAL BIOASSAY TO TEST LIQUID PHASE AND SUSPENDED SOLID-PHASE DRILLING FLUID-SEAWATER MIXTURES AND TO DEVELOP A NOVEL SOLID-PHASE BIOASSAY BASED ON LARVAL SETTLING. MERCENARIA MERCENARIA LARVAE WAS USED AS THE TEST ORGANISM IN ALL THE EXPERIMENTS. IN ADDITION, CHEMICAL ANALYSIS WAS PERFORMED TO HELP ELUCIDATE THE COMPOSITION OF USED DRILLING FLUIDS AND HOPEFULLY TO IDENTIFY THE TOXIC COMPONENTS. THE PRESENTATION OF THE RESULTS IS DIVIDED INTO THREE SECTIONS. FIRST, THE RESULTS OF LIQUID AND SUSPENDED SOLID-PHASE BIOASSAYS ARE PRESENTED. SECOND, THE RESULTS OF CHEMICAL ANALYSES ARE GIVEN. IN THE SECTION THE CONCENTRATION AND CHEMICAL FORMS OF SEVERAL ELEMENTS IN THE DRILLING FLUID-SEAWATER MIXTURES ARE PRESENTED IN TABLE II THROUGH VI. THIS IS FOLLOWED BY BULK CHARACTERISTICS OF THE WHOLE DRILLING FLUID USED IN THESE STUDIES (TABLE VII). TABLES VIII AND IX CONTAIN DATA ON ORGANIC COMPONENTS IN THE WHOLE MUDS INCLUDING # 2 DIESEL FUEL CONTENT. THE THIRD AND FINAL SECTION OF THIS REPORT COVERS THE WORK DONE ON THE SOLID-PHASE BIOASSAY, USING LARVAL SETTLING.

HAMILTON, P.V. 1980. SHELL SPINATION IN MELONGENA CORONA: SUBSPECIES CHARACTERISTIC OR SIZE RELATED?. MALACOL. REV. 13(1/2):84-86. (ERL,GB X313*).

IT IS CONCLUDED THAT THE SIPHONAL SPINES OF MELINGENA CORONA ARE ACQUIRED ONTOGENETICALLY AND, CONSEQUENTLY, THAT THE POSSESSION OF SIPHONAL SPINES IS NOT A VALID MORPHOLOGICAL CHARACTER ON WHICH TO BASE A SUBSPECIES DISTINCTION IN THIS SPECIES. RECOGNITION OF THE DISTINCT SUBSPECIES M.C. CORONA AND M.C. JOHNSTONEI IS NOT WARRANTED, SINCE CLENCH & TURNER'S (1956) DISTINCTION IS BASED PRIMARILY ON THE PRESENCE OF SIPHONAL SPINES.

HAMILTON, PAUL V. 1981. BEHAVIORAL ASSAYS FOR EFFECTS OF DRILLING MUDS ON MARINE ANIMALS. EPA-600/4-81-050, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 52P.

THIS REPORT DESCRIBES AN ELECTRONIC METHOD FOR MONITORING THE SHELL MOVEMENTS AND WATER PUMPING OF BIVALVED MOLLUSCS, DATA ON THE INFLUENCE OF WHOLE DRILLING MUD AND OTHER PARTICULATE MATERIALS ON THE SHELL MOVEMENTS OF SCALLOPS (OBTAINED USING THE ELECTRONIC MONITOR), AND A SUBMERSIBLE MONITORING UNIT (SMU) FOR RECORDING THESE BEHAVIORS FROM BIVALVES HELD IN FIELD CONDITIONS. THE ELECTRONIC MONITOR EMPLOYS INTEGRATED CIRCUIT CHIPS AND RECEIVES INPUT FROM INDUCTANCE TRANSDUCER (SHELL MOVEMENTS) AND THERMISTOR (WATER PUMPING) SENSORS. WHOLE DRILLING MUD CAUSED SIGNIFICANTLY MORE MAJOR RAPID VALVE CLOSURES (RVC'S) AT CONCENTRATIONS OF 400 PPM AND HIGHER, AND A SIGNIFICANTLY GREATER CUMULATIVE MAGNITUDE OF ALL RVC'S AT 200 PPM AND HIGHER. BARITE, LIGNOSULPHONATE AND CALCIUM CARBONATE REVEALED NO CLEAR DOSE-RESPONSE RELATIONSHIP FOR THESE TWO SHELL MOVEMENT PARAMETERS, BUT ALL THREE OF THESE PARTICULATES PRODUCED SIMILAR PATTERNS OF EFFECT. THE SMU IS COMPLETELY SELF-CONTAINED; A BATTERY POWERED CIRCUIT AND TAPE RECORDER PERMIT RECORDING SHELL MOVEMENT DATA ON A MAGNETIC TAPE, WHICH IS LATER RETRIEVED FOR ANALYSIS.

HAMILTON, P.V., M.A. WINTER, AND R.K. PEGG. 1981. EFFECTS OF WHOLE DRILLING MUD AND SELECTED COMPONENTS ON THE SHELL MOVEMENTS OF THE BAY SCALLOP, ARGOPECTEN IRRADIANS. NORTHEAST GULF SCI. 5(1):13-20. (ERL,GB X348*). AVAIL. FROM NTIS, SPRINGFIELD, VA: PB82-238999.

THE SHELL MOVEMENTS OF BAY SCALLOPS (ARGOPECTEN IRRADIANS) WERE ELECTRONICALLY MONITORED BEFORE AND AFTER DIFFERENT AMOUNTS OF WHOLE DRILLING MUD, BARITE, LIGNOSULFONATE, AND CALCIUM CARBONATE WERE ADDED TO THEIR TANKS. MOVEMENTS WERE COMPARED WITH THOSE MADE BY SCALLOPS EXPOSED TO SEAWATER FOR THE SAME DURATION USING SIX RESPONSE MEASURES. FOR WHOLE DRILLING MUD, A GRADED DOSE-RESPONSE RELATIONSHIP EXISTED FOR TWO RESPONSE MEASURES: CHANGE IN THE NUMBER OF MAJOR RAPID VALVE CLOSURES (RVCS) AND CHANGE IN THE CUMULATIVE MAGNITUDE OF ALL RVCS. EJECTION OF PSEUDOFECES IS FREQUENTLY ASSOCIATED WITH RVCS. SCALLOPS TESTED SIMULTANEOUSLY WITH BARITE, LIGNOSULFONATE, AND CALCIUM CARBONATE SHOWED IRREGULAR BUT SIMILAR DOSE-RESPONSE RELATIONSHIPS FOR THESE TWO RESPONSE MEASURES. THREE OTHER MEASURES (CHANGES IN GAPE WIDTH, RVC MAGNITUDE, AND NUMBER OF ALL RVCS) WERE NOT RELIABLE INDICATORS OF RESPONSIVENESS FOR ANY MATERIALS. NONE OF THE MATERIALS CAUSED SIGNIFICANT CHANGES IN THE NUMBER OF SWIMMING ATTEMPTS, BUT ONLY ONE-THIRD OF THE ANIMALS EVER ATTEMPTED TO SWIM. SCALLOPS EXPOSED TO SEAWATER SHOWED NO SIGNIFICANT CHANGE FOR ANY RESPONSE MEASURE.

KENDALL, J.J., E.N. POWELL, S.J. CONNOR, AND T.J. BRIGHT. 1983. EFFECTS OF DRILLING FLUIDS (MUDS) AND TURBIDITY ON THE GROWTH AND METABOLIC STATE OF THE CORAL ACROPORA CERVICORNIS, WITH COMMENTS ON METHODS OF NORMALIZATION FOR CORAL DATA. BULL. MAR. SCI. 33(2):336-352. (ERL,GB X396*).

THE EFFECTS OF A USED DRILLING MUD ON CORAL HEALTH HAVE BEEN EXAMINED BY MONITORING CHANGES IN CALCIFICATION RATE, SOLUBLE TISSUE PROTEIN CONCENTRATION AND TOTAL NINHYDRIN POSITIVE SUBSTANCE (NPS) CONCENTRATION IN THE CORAL ACROPORA CERVICORNIS. EXPOSURE TO A USED DRILLING MUD REDUCED CALCIFICATION RATE IN GROWING TIPS BY 62%, 83% AND 88% AT 25 PPM, 50 PPM AND 100 PPM (V/V), RESPECTIVELY AFTER A 24-H EXPOSURE PERIOD. SOLUBLE TISSUE PROTEIN CONCENTRATION DROPPED SIGNIFICANTLY IN THE GROWING TIP AFTER 24 H EXPOSURE TO A SOLUTION OF 25-, 50-, 100- AND 500-PPM DRILLING MUD FOR 24 H. EQUIVALENT CONCENTRATIONS OF KAOLIN (TO PRODUCE TURBIDITY) CAUSED NO DROP IN BPS OR PROTEIN CONCENTRATION AND A MUCH LOWER DROP IN CALCIFICATION RATE SUGGESTING THAT THE TOXIC EFFECTS OBSERVED FOR THE DRILLING MUD USED WERE NOT CAUSED BY AN INCREASE IN TURBIDITY ALONE. THE SIGNIFICANT DROP IN PROTEIN CONCENTRATION SUGGESTS THAT THE USE OF PROTEIN OR OTHER TISSUE COMPONENTS FOR NORMALIZATION IN CORALS MAY NOT BE JUSTIFIED IN SOME CASES AND SHOULD BE VIEWED WITH CAUTION.

KENDALL, JAMES JOSEPH. 1983. EFFECTS OF DRILLING FLUIDS (MUDS) AND TURBIDITY ON THE METABOLIC STATE OF THE CORAL ACROPORA CERVICORNIS: CALCIFICATION RATE AND PROTEIN CONCENTRATION. PH.D. DISSERTATION. TEXAS A&M UNIVERSITY, COLLEGE STATION, TX. 110P. (ERL,GB X430*).

THE EFFECTS OF TEN USED DRILLING MUDS ON CORAL HEALTH HAVE BEEN EXAMINED BY MONITORING CHANGES IN CALCIFICATION RATE AND SOLUBLE TISSUE PROTEIN IN THE CORAL ACROPORA CERVICORNIS. EXPOSURE TO 25-PPM (V/V) OF ONE MUD FOR 24 H REDUCED CALCIFICATION RATE IN THE GROWING TIPS BY AS MUCH AS 63%. SOLUBLE TISSUE PROTEIN CONCENTRATION DROPPED SIGNIFICANTLY IN THE GROWING TIP AFTER 24 H EXPOSURE TO A SOLUTION OF 25-, 50-, 100-, AND 500-PPM OF THE SAME MUD. EXTENSIVE ZOOXANTHELLAE LOSS WAS VISIBLY OBSERVED AFTER EXPOSURE TO THE 500-PPM SOLUTION. EQUIVALENT CONCENTRATIONS OF KAOLIN (TO PRODUCE TURBIDITY) CAUSED A MUCH LOWER DROP IN CALCIFICATION RATE SUGGESTING THAT THE TOXIC EFFECTS OF THE DRILLING MUD USED WERE NOT CAUSED BY AN INCREASE IN TURBIDITY ALONE. THE SIGNIFICANT DROP IN PROTEIN CONCENTRATION SUGGESTS THAT THE USE OF PROTEIN OR OTHER TISSUE COMPONENTS FOR NORMALIZATION IN CORALS MAY NOT BE JUSTIFIED IN SOME CASES AND SHOULD BE VIEWED WITH CAUTION. IN RECOVERY EXPERIMENTS, CORALS WERE EXPOSED TO DRILLING MUDS (AND KAOLIN) FOR 24 H; SOME WERE ALLOWED TO RECOVER IN CLEAN SEAWATER FOR 48 H. AFTER THE 24 H EXPOSURE, CALCIFICATION RATES WERE SIGNIFICANTLY LESS THAN THOSE OF CONTROLS. AFTER A 48-H RECOVERY PERIOD, CALCIFICATION RATES RETURNED TO CONTROL LEVELS FOR CORALS EXPOSED TO KAOLIN AND SOME OF THE DRILLING MUDS BUT WERE STILL SIGNIFICATLY BELOW CONTROLS FOR OTHER MUDS. THE RESULTS INDICATE THAT THE CAPACITY FOR RECOVERY AFTER EXPOSURE CANNOT BE PREDICTED FROM THE RESULTS OF EXPERIMENTS ON EXPOSURE ONLY. RECOVERY CAPACITY MUST BE INDEPENDENTLY VERIFIED FOR ALL STUDIES ON THE EFFECTS OF SHORT-TERM EXPOSURE TO DRILLING MUDS.

KENDALL, J.J., JR., E.N. POWELL, S.J. CONNOR, T.J. BRIGHT, AND C.E. ZASTROW. 1984. IMPORTANCE OF MONITORING METABOLIC RECOVERY IN THE CORAL ACROPORA CERVICORNIS AFTER SHORT-TERM EXPOSURE TO DRILLING MUDS: CALCIFICATION RATE AND PROTEIN CONCENTRATION. CORAL REEFS. 2:215-225. (ERL,GB X008*).

THE EFFECT OF USED DRILLING MUDS ON CORAL HEALTH WAS EXAMINED BY MONITORING CHANGES IN CALCIFICATION RATE AND SOLUBLE TISSUE PROTEIN CONCENTRATION IN THE CORAL ACROPORA CERVICORNIS. EXPOSURE TO 25 PPM (V/V) OF ONE MUD FOR 24 H REDUCED CALCIFICATION RATE IN THE GROWING TIPS BY AS MUCH AS 62%. IN RECOVERY EXPERIMENTS, CORALS WERE EXPOSED TO DRILLING MUDS FOR 24 H; SOME OF THERE WERE ALLOWED TO RECOVER IN CLEAN SEAWATER FOR 48 H. AFTER THE 24-HOUR EXPOSURE, CALCIFICATION RATES WERE SIGNIFICANTLY LESS THAN THOSE OF THE CONTROLS. AFTER A 48-HOUR RECOVERY PERIOD, CALCIFICATION RATES RETURNED TO CONTROL LEVELS FOR ONE MUD BUT WERE STILL SIGNIFICANTLY BELOW CONTROL LEVELS FOR ANOTHER. THE RESULTS INDICATE THAT THE CAPACITY FOR RECOVERY AFTER EXPOSURE CANNOT BE PREDICTED FROM THE RESULTS OF EXPERIMENTS ON EXPOSURE ONLY. RECOVERY CAPACITY MUST BE INDEPENDENTLY VERIFIED FOR ALL STUDIES ON THE EFFECTS OF SHORT-TERM EXPOSURE TO DRILLING MUDS.

KOENIG, MICHAEL L., ERIC N. POWELL, AND MARGARET R. KASSCHAU. 1981. EFFECTS OF SALINITY CHANGE ON THE FREE AMINO ACID POOLS OF TWO NEREID POLYCHAETES, NEANTHES SUCCINEA AND LEONEREIS CULVERI. COMP. BIOCHEM. PHYSIOL. A COMP. PHYSIOL. 70A(4):631-637. (ERL,GB X413*).
AVAIL. FROM NTIS, SPRINGFIELD, VA: PB82-207721.

1. THE RESPONSE OF THE FREE AMINO ACID POOLS OF TWO NEREID POLYCHAETES, NEANTHES SUCCINEA AND LAEONEREIS CULVERI TO BOTH INCREASED AND DECREASED SALINITIES WAS EXAMINED. IN BOTH SPECIES, GLYCINE AND ALANINE ACCOUNTED FOR MOST OF THE OBSERVED CHANGE IN THE TOTAL FREE AMINO ACID (FAA) POOL SIZE. 2. GLUTAMINE VALUES INCREASED UNDER HYPO-OSMOTIC CONDITIONS SUGGESTING THAT THIS AMINO ACID PLAYS A ROLE IN NITROGEN STORAGE DURING THE REDUCTION IN FAAS WHICH OCCURS WITH REDUCED SALINITY. 3. THE SALINITY REPSONSE WAS SUPERIMPOSED ON A "LABORATORY STRESS" RESPONSE CHARACTERIZED BY A GENERALIZED INCREASE IN THE FAA POOL SIZE. THE TWO RESPONSES APPEARED TO BE ADDITIVE IN NATURE. 4. SIGNIFICANT DIFFERENCES IN THE RESPONSES TO SALINITY CHANGE IN NEREID POLYCHAETES.

KRONE, M.A., AND D.C. BIGGS. 1980. SUBLETHAL METABOLIC RESPONSES OF THE HERMATYPIC CORAL MADRACIS DECACTIS EXPOSED TO DRILLING MUD ENRICHED WITH FERROCHROME LIGNOSULFONATE. IN: SYMPOSIUM: RESEARCH ON ENVIRONMENTAL FATE AND EFFECTS OF DRILLING FLUIDS AND CUTTINGS, JANUARY 21-24, 1980, LAKE BUENA VISTA, FL., VOL. 2. AMERICAN PETROLEUM INSTITUTE, WASHINGTON, DC. PP. 1097-1100. (ERL,GB X167*).

MADRACIS DECACTIS CORALS WERE EXPOSED FOR 17 DAYS IN LABORATORY AQUARIA TO SUSPENSIONS OF 100 PPM DRILLING MUD OBTAINED APRIL 1979 FROM A WORKING DRILL RIG IN MOBILE BAY, ALABAMA, AND SPIKED IN THE LABORATORY WITH 0, 3, AND 10 PPM FERROCHROME LIGNOSULFONATE (FCLS). DURING THE FIRST WEEK OF EXPOSURE TO DRILL MUD + FCLS, CORALS INCREASED THEIR OXYGEN CONSUMPTION AND AMMONIUM EXCRETION, RELATIVE TO UNCONTAMINATED CONTROLS. THOSE CORALS EXPOSED TO THE HIGHEST ENRICHMENTS OF FCLS DEMONSTRATED THE GREATEST INCREASES IN RESPIRATION AND EXCRETION AND ALSO THE LARGEST VARIATIONS IN RESPIRATION AND EXCRETION BETWEEN INDIVIDUAL CORALS. CORALS REACHED THEIR HIGHEST AVERAGE RATES OF RESPIRATION AND EXCRETION BY THE END OF THE FIRST WEEK AND, AFTER A SECONDARY INCREASE IN EXCRETION AND RESPIRATION BETWEEN DAYS 10-13 WHICH WAS MOST PRONOUNCED IN THOSE CORALS EXPOSED TO FCLS ENRICHMENT, LEVELED OFF AT NEAR-INITIAL RATES BY THE END OF THE SECOND WEEK. ANALYSIS OF VARIANCE DEMONSTRATED THAT OXYGEN CONSUMPTION OF FCLS-STRESSED CORALS WAS NOT STATISTICALLY DIFFERENT ($P = 0.24$) FROM UNCONTAMINATED CONTROL CORALS. BY CONTRAST, AMMONIUM EXCRETION WAS SIGNIFICANTLY GREATER ($P = 0.10$) IN FCLS-STRESSED CORALS THAN IN UNCONTAMINATED CONTROL ANIMALS. ALL CORALS EXPOSED TO FCLS REACTED BY REDUCING THEIR DEGREE OF POLYP EXPANSION. TWO OF THESE, ONE EXPOSED TO 100 PPM DRILL MUD + 3 PPM FCLS AND THE OTHER TO 100 PPM DRILL MUD + 10 PPM FCLS BECAUSE BACTERIALLY INFECTED AND SHOWED LOCAL AREAS OF POLYP MORTALITY AS THE EXPERIMENT ENTERED ITS SECOND WEEK. THESE WERE THE TWO CORALS WHICH HAD SHOWN THE MOST RAPID AND MOST CONSISTENT INCREASES IN EXCRETION AND RESPIRATION DURING THE FIRST WEEK OF EXPOSURE TO FCLS. WHEN EXPOSURE TO DRILL MUD + FCLS WAS DISCONTINUED, RESPIRATION AND EXCRETION OF SURVIVING CORALS REMAINED LOW AND STABLE WHILE THEIR POLYP ACTIVITY RETURNED TO NORMAL LEVELS WITHIN 48 HOURS.

KRONE, MICHAEL A. 1981. SUBLETHAL METABOLIC RESPONSES OF THE HERMATYPIC CORAL MADRACIS DECACTIS EXPOSED TO DRILLING MUD ENRICHED WITH FERROCHROME LIGNOSULFONATE: FINAL REPORT. EPA-600/4-81-049, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 67P.

MADRACIS DECATIS CORALS WERE EXPOSED FOR 17 DAYS IN LABORATORY AQUARIA TO SUSPENSIONS OF 100 PPM DRILLING MUD SPIKED WITH 0, 3, AND 10 PPM FERROCHROME LINGOSULFONATE (FCLS). DURING THE FIRST WEEK OF EXPOSURE, THESE CORALS INCREASED THEIR OXYGEN CONSUMPTION AND AMMONIUM EXCRETION, RELATIVE TO UNCONTAMINATED CONTROLS. THOSE CORALS EXPOSED TO THE HIGHEST ENRICHMENTS OF FCLS DEMONSTRATED THE GREATEST INCREASES IN RESPIRATION AND EXCRETION AND ALSO THE LARGEST VARIATIONS IN RESPIRATION AND EXCRETION BETWEEN INDIVIDUAL EXPERIMENTAL ANIMALS. CORALS REACHED THEIR HIGHEST AVERAGE RATES OF RESPIRATION AND EXCRETION BY THE END OF THE FIRST WEEK OF CONTINUOUS EXPOSURE. RATES THEN DECREASED DURING THE NEXT WEEK AND, AFTER A SECONDARY INCREASED IN EXCRETION AND RESPIRATION BETWEEN DAYS 10-13 WHICH WAS MOST PRONOUNCED IN THOSE CORALS EXPOSED TO FCLS ENRICHMENT, LEVELED OFF AT NEAR-INITIAL RATES BY THE END OF THE SECOND WEEK. TWO CORALS, ONE EXPOSED TO 100 PPM DRILL MUD PLUS 3 PPM FCLS AND THE OTHER TO 100 PPM DRILL MUD PLUS 10 PPM FCLS, BECAME NOTICEABLY MORIBUND AS THE EXPERIMENT ENTERED ITS SECOND WEEK. THESE WERE THE TWO CORALS WHICH SHOWED THE MOST RAPID AND MOST CONSISTENT INCREASED IN EXCRETION AND RESPIRATION DURING THE FIRST WEEK OF EXPOSURE TO FCLS. BY WEEK TWO, POLYP EXPANSION IN BOTH OF THESE CORALS WAS DRAMATICALLY REDUCED, AND EACH WAS REMOVED FROM THE EXPERIMENT WHEN AREAS OF BARE CORALLUM SUGGESTED THE ONSET OF POLYP DEATH. ALL CORALS EXPOSED TO FCLS REACTED BY REDUCING THEIR POLYP EXPANSION BEHAVIOR, ALTHOUGH ONLY THE TWO CITED ABOVE SHOWED MASS POLYP MORTALITY. WHEN EXPOSURE TO DRILL MUD PLUS FCLS WAS DISCONTINUED, RESPIRATION AND EXCRETION OF SURVIVING CORALS REMAINED LOW AND STABLE WHILE THEIR POLYP ACTIVITY RETURNED TO NORMAL LEVELS WITHIN 48 HOURS.

LEHMAN, H.K., AND P.V. HAMILTON. 1980. SOME FACTORS INFLUENCING THE DISTRIBUTION OF THE SNAIL NERITINA RECLIVATA. NORTHEAST GULF SCI. 4(1):67-72. (ERL,GB X269*).

THE GASTROPOD FAMILY NERITIDAE CONTAINS OVER 200 LIVING SPECIES, MOST OF WHICH INHABIT INTERTIDAL ZONES IN TROPICAL AND TEMPERATE CLIMATES. THE OLIVE NERITE, NERITINA RECLIVATA SAY, IS IRREGULARLY DISTRIBUTED ALONG COASTAL REGIONS OF THE GULF OF MEXICO AND THE CARIBBEAN SEA FROM 10 TO 30 DEGREES N LATITUDE. ITS DISTRIBUTION ENDS IN THE NORTH AT JACKSONVILLE, FLORIDA ON THE ATLANTIC OCEAN AND IN THE SOUTH AT TRINIDAD (RUSSELL, 1941). MOST RECORDS OF N. RECLIVATA ARE FROM COASTAL REGIONS OF THE GULF OF MEXICO, BUT THIS MAY BE DUE TO THE PAUCITY OF FAUNAL SURVEYS ELSEWHERE IN ITS RANGE. DESPITE THE COMMON OCCURRENCE OF N. RECLIVATA, IT REMAINS VIRTUALLY UNSTUDIED. RUSSELL (1941) REPORTED THAT N. RECLIVATA INHABITS BRACKISH AND FRESHWATER, AND IS ABSENT FROM MANY SMALL ISLANDS IN THE ANTILLES THAT DO NOT SUPPORT PERMANENT FRESHWATER RIVERS. ACCORDING TO THIS AUTHOR, N. RECLIVATA IS FOUND ON SOLID SUBSTRATES IN THE WATER, BUT NOT ON THE MUD. N. RECLIVATA CRAWLS USING MONOTAXIC RETROGRADE WAVES, A TYPE OF LOCOMOTION OFTEN FOUND IN SPECIES LIVING ON SOLID SUBSTRATE (GAINEY, 1976). PILSBRY (1931) NOTED THE SNAIL'S PRESENCE ON REEDS AND OTHER AQUATIC PLANTS NEAR DRAINAGE CANALS AND SUGGESTED THAT ALGAE MAY COMPRISE THE FOOD OF THE SNAIL. WE HAVE COLLECTED N. RELIVATA FROM HARD SUBSTRATES (E.G., PLANTS, STUMPS, ROCKS) AT LOCATIONS BETWEEN 5 KM UP THE ESCAMBIA RIVER AND THE WESTERN TIP OF THE GULF BREEZE PENINSULA, SANTA ROSA COUNTY, FLORIDA. THESE LOCATIONS CORRESPOND TO A SALINITY RANGE OF 1 TO 19 PPT (U.S. ENVIRONMENTAL PROTECTION AGENCY, 1975). BECAUSE OUR PRELIMINARY OBSERVATIONS SUGGESTED AN AFFINITY OF NERITINA FOR SOLID SUBSTRATES, WE INVESTIGATED THIS RELATIONSHIP TO DETERMINE ITS ECOLOGICAL BASIS.

MORRISON, S.J., AND D.C. WHITE. 1980. EFFECTS OF GRAZING BY ESTUARINE GAMMARIDEAN AMPHIPODS ON THE MICROBIOTA OF ALLOCHTHONOUS DETRITUS. APPL. ENVIRON. MICROBIOL. 40(3):659-671. (ERL,GB X187*).

ESTUARINE GAMMARIDEAN AMPHIPODS GRAZING AT NATURAL POPULATION DENSITY ON DETRITAL MICROBIOTA AFFECTED THE MICROBIAL COMMUNITY COMPOSITION, BIOMASS, AND METABOLIC ACTIVITY WITHOUT AFFECTING THE PHYSICAL STRUCTURE OF THE LEAVES. TOTAL MICROBIAL BIOMASS ESTIMATED BY ADENOSINE TRIPHOSPHATE AND LIPID PHOSPHATE OR OBSERVED BY SCANNING ELECTRON MICROSCOPY WAS GREATER ON GRAZED THAN ON UNGRAZED DETRITUS. THE RATES OF OXYGEN CONSUMPTION, POLY-B-HYDROXYBUTYRATE SYNTHESIS, TOTAL LIPID BIOSYNTHESIS, AND RELEASE OF CO2-14 FROM RADIOACTIVELY PRELABELED MICROBIOTA WERE HIGHER ON GRAZED THAN ON UNGRAZED LEAVES, INDICATING STIMULATION OF THE METABOLIC ACTIVITY OF GRAZED DETRITAL MICROBES. THIS WAS TRUE WITH RATES BASED EITHER ON THE DRY LEAF WEIGHT OR MICROBIAL BIOMASS. THERE WAS A FASTER INCREASE IN THE C-14-GYCLOLIPID THAN IN THE C-14-NEUTRAL LIPID OR C-14-PHOSPHOLIPID FRACTIONS. ANALYSIS OF SPECIFIC PHOSPHOLIPIDS SHOWED LOSSES OF THE METABOLICALLY STABLE [C-14]GLYCERDLPHOSPHORYLGLYCEROL WITH AMPHIPOD GRAZING. THE BIOCHEMICAL DATA SUPPORTED SCANNING ELECTRON MICR-OSCOPY OBSERVATIONS OF A SHIFT AS THE GRAZING PROCEEDED FROM A BACTERIAL/FUNGAL COMMUNITY TO ONE DOMINATED BY BACTERIA.

NEFF, JERRY M. 1981. FATE AND BIOLOGICAL EFFECTS OF OIL WELL DRILLING FLUIDS IN THE MARINE ENVIRONMENT: A LITERATURE REVIEW. EPA-600/3-82-064, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 150P.

THE MAJOR ENVIRONMENTAL CONCERNS ABOUT DISCHARGE OF USED DRILLING MUDS TO THE OCEAN ARE THAT THEY MAY BE ACUTELY TOXIC OR CAUSE DELETERIOUS SUBLETHAL EFFECTS IN SENSITIVE ORGANISMS AND ECOSYSTEMS AND THAT HEAVY METALS ASSOCIATED WITH DRILLING MUDS MAY BE ACCUMULATED BY MARINE ORGANISMS TO DANGEROUS CONCENTRATIONS. A MAJORITY OF MAJOR DRILLING MUD INGREDIENTS ARE BIOLOGICALLY INERT OR HAVE A VERY LOW ORDER OF ACUTE TOXICITY. OF THE MAJOR DRILLING MUD INGREDIENTS, ONLY CHROME- AND FERROCHROME-LIGNOSULFONATES CAN BE CONSIDERED AT ALL TOXIC. THEIR TOXICITY IS QUITE LOW TO ALL BUT A FEW SENSITIVE SPECIES (E.G., SOME CORALS). MINOR INGREDIENTS OF SOME ENVIRONMENTAL CONCERN INCLUDE SODIUM PHOSPHATE SALTS, DETERGENTS, BIOCIDES (CHLORINATED PHENOLS NO LONGER ARE PERMITTED FOR OFFSHORE DISPOSAL), CHROMATE SALTS AND ASPHALT/OIL-BASED INGREDIENTS. ORDINARILY, THESE MATERIALS ARE NOT USED IN LARGE ENOUGH QUANTITIES TO CAUSE CONCERN. THEIR CONCENTRATIONS SHOULD BE KEPT LOW IN DRILLING MUDS DESTINED FOR OCEAN DISPOSAL. WHERE POSSIBLE, LESS TOXIC SUBSTITUTES SHOULD BE USED. TO DATE, THE ACUTE TOXICITY AND SUBLETHAL BIOLOGICAL EFFECTS OF MORE THAN 20 USED OFFSHORE-TYPE DRILLING MUDS HAVE BEEN EVALUATED WITH MORE THAN 60 SPECIES OF MARINE ANIMALS FROM THE ATLANTIC, PACIFIC, GULF OF MEXICO AND BEAUFORT SEA. REPRESENTATIVES OF FIVE MAJOR ANIMAL PHYLA HAVE BEEN TESTED, INCLUDING CHORDATA, ARTHROPODA, MOLLUSCA, ANNELIDA AND ECHINODERMATA. LARVAE AND OTHER EARLY LIFE STAGES, AND OCEANIC SPECIES (CONSIDERED TO BE MORE SENSITIVE TAN ADULTS AND ESTUARINE SPECIES TO POLLUTANT STRESS) WERE INCLUDED. IN ALL BUT A FEW CASES, ACUTE TOXICITY, USUALLY MEASURED AS 96-HR. LC50, WAS 10,000 PPM OR HIGHER DRILLING MUD ADDED. THE LOWEST ACUTE LC50 VALUE WAS 500 PPM FOR STAGE I LARVAE OF DOCK SHRIMP PANDALUS DANAE EXPOSED TO A HIGH DENSITY FERROCHROME LIGNOSULFONATE DRILLING MUD FROM COOK INLET, ALASKA. CHRONIC OR SUBLETHAL RESPONSES WERE OBSERVED IN A FEW CASES AT CONCENTRATIONS AS LOW AS 50 PPM.

NEW ENGLAND AQUARIUM, BOSTON, MA. 1984. SURVEY OF THE TOXICITY AND CHEMICAL COMPOSITION OF USED DRILLING MUDS. EPA-600/3-84-071, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 125P.

CHEMICAL CHARACTERIZATION AND TOXICITY OF OIL DRILLING FLUIDS WERE INVESTIGATED BY EDGERTON RESEARCH LABORATORY FROM OCT. 1, 1979 TO AUG., 1983 AS PART OF A COMPREHENSIVE RESEARCH PROGRAM SPONSORED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY TO DETERMINE FATE AND EFFECTS OF SUCH FLUIDS IN THE MARINE ENVIRONMENT. DRILLING MUDS USED WERE SUPPLIED BY EPA, THE PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION, AND THE AMERICAN PETROLEUM INSTITUTE. THE DRILLING MUDS WERE DESIGNATED "MAY 15," "MAY 29," "SEPT. 4," "EXXON," "GILSON," "MOBILE BAY," "JAY FIELD," AND "PESA." INVESTIGATIONS DURING THE FIRST YEAR CENTERED ON THE CHEMICAL COMPOSITION AND ACUTE TOXICITY OF DRILLING MUDS, AND THE EFFECTS OF DRILLING MUDS ON RECRUITMENT OF BENTHIC ORGANISMS. IN THE SECOND YEAR, STUDIES FOCUSED ON TOXICITY TESTING WITH PLANKTONIC COPEPODS, CHEMICAL CHARACTIERIZATION OF TOXICITY TEST PHASES, BIOACCUMULATION STUDIES, AND EFFECTS OF MUDS ON LARVAL AND ADULT BENTHIC ORGANISMS. INVESTIGATIONS DURING THE THIRD AND FOURTH YEAR EXAMINED SUBLETHAL EFFECTS OF DRILLING FLUIDS ON CLAM LARVAE, TRACE METAL AND ORGANIC CONSTITUENTS IN BOTH DRILLING FLUIDS AND TOXICITY TEST-PHASES, AND PRELIMINARY DEVELOPMENT OF A DRILLING FLUID SOLID PHASE TOXICITY TEST. TOXIC COMPONENTS OF USED DRILLING MUDS TESTED WERE PRESENT AS DISSOLVED COMPONENTS OR ASSOCIATED WITH VERY SLOWLY SETTLING PARTICLES. SOME USED DRILLING MUDS CONTAINED LIPOPHILIC FRACTIONS THAT WERE SIMILAR TO HYDROCARBONS FOUND IN #2 FUEL OIL IN THE LIQUID FRACTION AND SUSPENDED PARTICULATES FRACTION AND CONTAINED #2 FUEL OIL IN WHOLE MUDS. MUDS THAT CONTAINED THOSE COMPONENTS WERE MORE TOXIC THAN THOSE THAT DID NOT. JUVENILE COPEPODS (ACARTIA TONSA) WERE NOT MORE SENSITIVE TO TOXIC DRILLING MUD SOLUTIONS THAN ADULTS OF THIS SPECIES. IN GENERAL, CANCER IRRORATUS LARVAE APPEARED TO EXHIBIT TOXICITY RESPONSES TO DRILLING MUDS THAT WERE SIMILAR TO COPEPODS TESTED. ARRESTED SHELL DEVELOPMENT INDUCED BY EXPOSURE TO DRILLING MUDS APPEARED TO BE A SENSITIVE INDICATOR OF STRESS IN BIVALVE LARVAE. TOTAL CHROMIUM CONCENTRATION SHOWED NO CORRELATION TO TOXICITY IN DRILLING MUDS THAT WERE TESTED; HOWEVER, THE HIGHEST CONCENTRATIONS OF CR(VI), THE MOST BIOLOGICALLY TOXIC FORM OF CHROMIUM, OCCURRED IN TEST PHASES THAT EXHIBITED THE GREATEST TOXICITY TO MERCENARIA MERCENARIA LARVAE. THE MUDS DESIGNATED "MAY 15" AND "SEPT. 4" APPEARED TO BE RELATIVELY NON-TOXIC TO PSEUDOPLEURONECTES AMERICANUS AND TO MENIDIA MENIDIA, ALTHOUGH THE "MAY 15" MUD WAS TOXIC TO NEOMYSIS AMERICANA AND TO ACARTIA TONSA. A STUDY OF EFFECTS OF DRILLING MUD ON INVERTEBRATE RECOLONIZATION OF DEFAUNATED SEDIMENT SHOWED THAT RECOLONIZATION DECREASED IN DRILLING MUD LAYERED ON TOP OF SEDIMENT WHEN MUDS WERE MIXED WITH SEDIMENTS. CAPITELLA CAPITATA WAS MUCH MORE NUMEROUS IN RECOLONIZATION SEDIMENTS THAT CONTAINED DRILLING MUD. TEST RESULTS SHOWED THAT METHODS USED TO PREPARE DRILLING MUD TEST MEDIA AFFECT THE APPARENT TOXICITY OF THE MUDS.

NICKELS, J.S., R.J. BOBBIE, R.F. MARTZ, G.A. SMITH, D.C. WHITE, AND N.L. RICHARDS. 1981. EFFECT OF SILICATE GRAIN SHAPE, STRUCTURE, AND LOCATION ON THE BIOMASS AND COMMUNITY STRUCTURE OF COLONIZING MARINE MICROBIOTA. APPL. ENVIRON. MICROBIOL. 41(5):1262-1268. (ERL,GB X190#).

MICROBIOTA COLONIZING SILICA GRAINS OF THE SAME SIZE AND WATER PORE SPACE, BUT WITH A DIFFERENT MICROTOPOGRAPHY, SHOWED DIFFERENCES IN BIOMASS AND COMMUNITY STRUCTURE AFTER 8 WEEKS OF EXPOSURE TO RUNNING SEAWATER. THE ABSENCE OF SURFACE CRACKS AND CREVICES RESULTED IN A MARKED DIMINUTION OF THE TOTAL MICROBIAL BIOMASS MEASURED AS LIPID PHOSPHATE AND TOTAL EXTRACTABLE PALMITIC ACID. WITH INCREASING SMOOTHNESS OF THE SAND GRAIN SURFACE, EXAMINATION OF THE COMMUNITY STRUCTURE SHOWED A MARKED DECREASE IN PROCARYOTES AND ALGAL MICROEUCARYOTES, WITH A RELATIVE INCREASE IN MICROEUCARYOTIC GRAZERS. A COMPARISON OF THE COLONIZING SEDIMENT INCUBATED IN RUNNING SEAWATER OR AT 32 M ON THE SEA FLOOR WITH A SEDIMENT CORE SHOWED A DECREASED BACTERIAL BIOMASS WITH A DIFFERENT COMMUNITY STRUCTURE AND A DECREASED TOTAL MICROEUCARYOTIC POPULATION OF BOTH GRAZERS AND ALGAE. THE QUANTITATIVE DIFFERENCES IN MICROBIAL BIOMASS AND COMMUNITY STRUCTURE BETWEEN THE MICROCOSMS AND THE ACTUAL BENTHIC POPULATION IN THE CORE WERE DETERMINED.

OLLA, BORI L., WILLIAM W. STEINER, AND JOSEPH J. LUCZKOVICH. 1980. EFFECTS OF DRILLING MUDS ON THE BEHAVIOR OF JUVENILE RED HAKE, UROPHYCIS CHUSS (WALBAUM) I. ESTABLISHMENT OF BEHAVIORAL BASELINES: PROGRESS REPORT (1980). 77P. (ERL,GB X363#).

A CRITICAL STAGE IN ANY FISH'S LIFE IS THE JUVENILE PERIOD. DURING THIS TIME THE INDIVIDUAL MUST FIND ENOUGH FOOD TO SUSTAIN ACTIVE AND HEALTHY GROWTH, AVOID PREDATION, AND OFTENTIMES DEVELOP BEHAVORIAL TRAITS AND RELATIONS THAT WILL BE IMPORTANT IN REPRODUCTIVELY ACTIVE ADULTHOOD. IN THE SEARCH FOR BETTER UNDERSTANDING OF MARINE FISH LIFE HISTORY, AND SUBSEQUENT MANAGEMENT OF FISHERY RESOURCES, IT IS ESSENTIAL THAT WE UNDERSTAND THE HABITAT REQUIREMENTS, RESOURCE UTILIZATION PATTERNS, AND RECRUITMENT STRATEGIES OF JUVENILE FISHES, PARTICULARLY THOSE BENTHIC SPECIES THAT ARE LINKED TO SPECIFIC ENVIRONMENTAL CONDITIONS. THE AIM OF THE PRESENT WORK IS TO EXAMINE UNDER LABORATORY CONDITIONS SELECTED BEHAVIORAL PATTERNS OF JUVENILE RED HAKE, UROPHYCIS CHUSS (WALBAUM), AS THESE PATTERNS RELATE TO THE HAKE'S ENVIRONMENTAL REQUIREMENTS. THIS WORK IS THE INITIAL PHASE OF ANY INQUIRY INTO THE BIOLOGY OF JUVENILE RED HAKE. SPECIFICALLY, OUR STUDIES WERE CONFINED TO THE BENTHIC LIFE STAGE IN WHICH THE FISH ARE COMMONLY FOUND IN ASSOCIATION WITH SEA SCALLOPS, PLACOPECTEN MAGELLANICUS (GMELIN). IN THE WORK PRESENTED HEREIN, WE HAVE QUANTIFIED SEVERAL BEHAVIORAL MEASURES OF THE JUVENILE RED HAKE NORMALLY ASSOCIATED WITH SEA SCALLOPS. SPECIFICALLY, WE STUDIED IN THE LABORATORY: 1) ACTIVITY RHYTHMS; 2) AGONISTIC ENCOUNTERS; 3) RELATION OF COMPETITION TO LEVEL OF FOOD RESOURCES; 4) SHELTER PREFERENCE AND UTILIZATION; 5) GROWTH RATES UNDER SIMULATED FIELD CONDITIONS.

OLLA, BORI L., WILLIAM W. STEINER, AND JOSEPH J. LUCZKOVICH. 1981. EFFECTS OF DRILLING FLUIDS ON THE BEHAVIOR OF THE JUVENILE RED HAKE, UROPHYCIS CHUSS (WILBAUM) II. EFFECTS ON ESTABLISHMENT BEHAVIORAL BASELINES: PROGRESS REPORT (1981) (UNPUBLISHED REPORT). 153P. (ERL,GB X364*).

IN ANY CONTROLLED EXPERIMENT DESIGNED TO TEST THE EFFECTS OF A POTENTIALLY HARMFUL POLLUTANT ON ANY MARINE ORGANISM OR COMMUNITY, IT IS ESSENTIAL THAT THE TEST ORGANISM/COMMUNITY BE EXPOSED TO THE TEST AGENT IN A REALISTIC MANNER. THE CONDITIONS OF EXPOSURE SHOULD SIMULATE, AS CLOSELY AS POSSIBLE, CONDITIONS UNDER WHICH THE TEST ORGANISM/COMMUNITY MIGHT ENCOUNTER THE POLLUTANT IN THE NATURAL ENVIRONMENT, GIVEN THE CONSTRAINTS IMPOSED BY THE LABORATORY. IF SUCH CRITERIA ARE NOT MET, THE ENTIRE PROCEDURE MAY BE OF ACADEMIC INTEREST, BUT THE RESULTS ARE OF LIMITED PRACTICAL VALUE, ESPECIALLY IF REGULATORY CRITERIA OR GUIDELINE ARE TO BE BASED ON LABORATORY RESULTS. OUR TESTING CONCERNED BENTHIC ORGANISMS AND COMMUNITIES. TO BE ECOLOGICALLY PERTINENT, THIS REQUIRED THAT DRILLING FLUIDS HAD TO BE INTRODUCED INTO EXPERIMENTAL AQUARIA IN A PROCEDURE THAT SIMULATED THE PROCESS WHEREBY DRILLING FLUIDS FROM ACTIVE OIL RIGS EVENTUALLY REACH BENTHIC COMMUNITIES. ON THE MAJORITY OF DRILLING PLATFORMS CURRENTLY, OR PREVIOUSLY, IN USE, THAT MEANS THE DRILLING FLUIDS ARE RELEASED PERIODICALLY INTO THE WATER COLUMN UNDERNEATH THE RIG, AT VARIOUS DEPTHS, AND SUBSEQUENTLY DRIFT THROUGH THE WATER COLUMN TO THE BENTHOS. IT IS OBVIOUS THAT SUCH A PATH WILL EFFECT BOTH THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE DRILLING FLUIDS, A MIXTURE OF LIQUID, VARIOUS SIZED CLAY PARTICLES, SALTS, ORGANIC COMPOUNDS AND OTHER CHEMICAL ADDITIVES, MANY OF WHICH ARE WATER-SOLUBLE. THE LAYERING OF WHOLE DRILLING MUDS ON THE TEST BENTHIC COMMUNITY SUBSTRATE IS, QUITE SIMPLY, UNREALISTIC. LIKEWISE, EXPOSING BENTHIC ORGANISMS TO ONLY WATER SOLUBLE FRACTIONS, PARTICULARLY THOSE COMPONENTS THAT WOULD BE QUICKLY ABSORBED INTO THE WATER COLUMN DURING THE DESCENT TO THE BOTTOM, IS ALSO UNREALISTIC. STATIC SYSTEMS OF ANY SORT ARE ALSO UNREALISTIC FOR DETERMINING THE RESPONSES OF NATURAL DYNAMIC COMMUNITIES TO POLLUTANTS.

PARKER, JEFFREY H., GLEN A. SMITH, HERBERT L. FREDRICKSON, J. ROBIE VESTAL, AND DAVID C. WHITE. 1982. SENSITIVE ASSAY, BASED ON HYDROXY- FATTY ACIDS FROM LIPOPOLYSACCHARIDE LIPID A, FOR GRAM-NEGATIVE BACTERIA IN SEDIMENTS. APPL. ENVIRON. MICROBIOL. 44(5):1170-1177. (ERL,GB X338*).
AVAIL. FROM NTIS, SPRINGFIELD, VA: P83-223693.

BIOCHEMICAL MEASURES HAVE PROVIDED INSIGHT INTO THE BIOMASS AND COMMUNITY STRUCTURE OF SEDIMENTARY MICROBIOTA WITHOUT THE REQUIREMENT OF SELECTION BY GROWTH OR QUANTITATIVE REMOVAL FROM THE SEDIMENT GRAINS. THIS STUDY USED THE ASSAY OF THE HYDROXY FATTY ACIDS RELEASED FROM THE LIPID A OF THE LIPOPOLYSACCHARIDE IN SEDIMENTS TO PROVIDE AN ESTIMATE OF THE GRAM-NEGATIVE BACTERIA. THE METHOD WAS SENSITIVE TO PICOMOLAR AMOUNTS OF HYDROXY FATTY ACIDS. THE RECOVERY OF LIPOPOLYSACCHARIDE HYDROXY FATTY ACIDS FROM ORGANISMS ADDED TO SEDIMENTS WAS QUANTITATIVE. THE LIPIDS WERE EXTRACTED FROM THE SEDIMENTS WITH A SINGLE-PHASE CHLOROFORM-METHANOL EXTRACTION. THE LIPID-EXTRACTED RESIDUE WAS HYDROLYZED IN 1 N HCL, AND THE HYDROXY FATTY ACIDS OF THE LIPOPOLYSACCHARIDE WERE RECOVERED IN ABOUT FIVEFOLD MORE SENSITIVE THAN THE CLASSICAL PHENOL-WATER OF TRICHLOROACETIC ACID METHODS WHEN APPLIED TO MARINE SEDIMENTS. BY EXAMINATION OF THE PATTERNS OF HYDROXY FATTY ACIDS, IT WAS ALSO POSSIBLE TO HELP DEFINE THE COMMUNITY STRUCTURE OF THE SEDIMENTARY GRAM-NEGATIVE BACTERIA.

PARKER, JEFFREY H., JANET S. NICKELS, ROBERT F. MARTZ, MICHAEL J. GEHRON, NORMAN L. RICHARDS, AND DAVID C. WHITE. 1984. EFFECT OF WELL-DRILLING FLUIDS ON THE PHYSIOLOGICAL STATUS AND MICROBIAL INFECTION OF THE REEF BUILDING CORAL MONTASTREA ANNULARIS. ARCH. ENVIRON. CONTAM. TOXICOL. 13(1):113-118. (ERL,GB X382*).

THE REEF BUILDING CORAL MONTASTREA ANNULARUS WAS EXPOSED CONTINUOUSLY TO SUSPENSIONS OF OIL AND GAS-WELL DRILLING FLUIDS AT CONCENTRATIONS OF 0.1 ML LITER(-1), 0.01 ML LITER(-1), AND 0.0001 ML LITER(-1) IN FLOWING SEAWATER AT THE U.S. NAVAL STAGE I PLATFORM (30 DEGREES 7.5' N, 85 DEGREES 46.3' W). AFTER 6 WEEKS EXPOSURE, CORAL FRAGMENTS OF 12 TO 65 CM(2) SURFACE AREA WERE BROKEN OFF, RINSED IN SEAWATER, AND EXTRACTED IN A ONE-PHASE CHLOROFORM-METHANOL-BUFFER AND RETURNED TO THE LABORATORY. IN THE LABORATORY, THE EXTRACTION WAS COMPLETED AND THE PHASES SEPARATED. THE LIPIDS WERE FRACTIONATED USING SILICIC ACID AND THIN LAYER CHROMATOGRAPHY. TOTAL PHOSPHOLIPID, TRIGLYCERIDE GLYCEROL, TOTAL EXTRACTABLE FATTY ACIDS, TRIGLYCERIDE FATTY ACIDS AS WELL AS THE ESTER FATTY ALCOHOLS SHOWED NO CONSISTENT CHANGES WITH EXPOSURE TO THE DRILLING FLUIDS. CHANGES IN FREE AMINO ACID CONCENTRATIONS WERE EXTRACTED AS WELL AS SIGNIFICANT DECREASES IN THE RECOVERABLE DIACYL PHOSPHOLIPID. SIGNIFICANT INCREASES IN PLASMALOGEN PHOSPHOLIPIDS APPEARED WITH EXPOSURE. INCREASES IN PLASMALOGEN PHOSPHOLIPIDS ARE CONSISTENT WITH INFECTION BY ANAEROBIC FERMENTING BACTERIA WHICH CAN INDICATE DISEASE. THIS EVIDENCE SUGGESTS THAT BIOCHEMICAL INDICATORS OF INFECTION WITH ANAEROBIC BACTERIA MAY BE USEFUL AS SENSITIVE MARKERS FOR POLLUTION-INDUCED CHANGES IN REEF BUILDING CORALS AND THUS FOR MONITORING THE HEALTH OF CORAL REEFS.

PARSONS, DEAN, TOM BURKE, TERRY HIGHT, NORMAN RICHARDS, AND SUZANNE BOLTON. 1980. DRILLING MUD RESEARCH--OVERSIGHT. IN: OCEANOGRAPHY MISCELLANEOUS--PART 1, HEARINGS BEFORE THE SUBCOMMITTEE ON OCEANOGRAPHY OF THE COMMITTEE ON MERCHANT MARINE AND FISHERIES, HOUSE OF REPRESENTATIVES, NINETY-SIXTH CONGRESS, MARCH 3, 1980. U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, DC. SERIAL NO. 96-28. PP. 1-37. (ERL,GB X165*).

THE SUBCOMMITTEE ON OCEANOGRAPHY MEETS TODAY TO RECEIVE SCIENTIFIC AND TECHNICAL TESTIMONY CONCERNING AVAILABLE RESEARCH ON THE NATURE AND COMPOSITION OF DRILL MUDS, DRILL CUTTINGS, AND FORMATION WATERS, AND THEIR SHORT- AND LONG -TERM EFFECTS ON THE ENVIRONMENT. THESE ARE MATERIALS EITHER USED IN, OR INCIDENTAL TO, OFFSHORE OIL AND GAS DRILLING. DRILLING MUDS ARE MIXTURES OF CLAYS, DIVERSE CHEMICALS, AND WATER WHICH ARE USED AS A LUBRICANT DURING OIL AND GAS OPERATIONS. THESE MUDS, WHICH VARY GREATLY IN COMPOSITION DEPENDING UPON THE SPECIFIC REQUIREMENTS OF AN INDIVIDUAL WELL, ARE ALSO PUMPED INTO THE OIL ELLS TO REINFORCE THE WALLS OF THE DRILLED HOLE, TO WEIGH THE DRILLING COLUMN WHICH HELPS PREVENT BLOW-OUTS, AND TO TRANSPORT CUTTINGS TO THE SURFACE. DRILL CUTTINGS ARE THOSE PIECES OF THE SEABED AND SUBSURFACE ROCK WHICH ARE DISPLACED OR IMPACTED BY THE DRILLING PROCESS. FORMATION WATERS ARE THE WATERS FOUND IN OFF-SHORE OIL AND GAS RESERVOIRS WHICH CONTAIN PETROLEUM, DISSOLVED MINERAL SALTS, AND TRACES OF HEAVY METALS. THESE WATERS ARE GENERALLY SEPARATED FROM THE OIL AND GAS AT THE SURFACE AND SIMPLY RETURNED TO THE WATER COLUMN FROM THE OIL RIG. ALL OF THESE MATERIALS CONTAIN POTENTIALLY HAZARDOUS SUBSTANCES WHICH COULD ADVERSELY AFFECT BIOLOGICAL POPULATIONS. THE EXTENT OF THAT HAZARD IS THE SUBJECT OF CONSIDERABLE DEBATE WITHIN THE SCIENTIFIC COMMUNITY WHICH INCLUDES GOVERNMENT, INDUSTRY, AND PRIVATE RESEARCHERS. IN ORDER TO MAKE INTELLIGENT ASSESSMENTS OF THE EFFECTS OF CERTAIN ACTIVITIES ON THE OCS, THE CONGRESS AND RELEVANT AGENCIES MUST HAVE ACCESS TO CONCLUSIVE SCIENTIFIC RESEARCH UPON WHICH TO BASE THESE ASSESSMENTS. IT IS FOR THIS REASON THAT THE SUBCOMMITTEE HAS REQUESTED WITNESSES FROM THE DEPARTMENT OF THE INTERIOR, THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, AND THE ENVIRONMENTAL PROTECTION AGENCY TO APPEAR BEFORE IT TO OFFER AN ASESSMENT OF CURRENT SCIENTIFIC KNOWLEDGE. REPRESENTATIVES OF THE DEPARTMENT OF THE INTERIOR HAVE STATED IN PAST TESTIMONY THAT THEY POSSESS A "SHELF FULL" OF STUDIES ON THESE MATERIALS, NONE OF WHICH INDICATES ANY ADVERSE LONG- OR SHORT-TERM ENVIRONMENTAL EFFECTS. HOWEVER, IN JULY OF LAST YEAR NOAA STATED THAT THE EVIDENCE ON THESE MATERIALS WAS "CONTRADICTORY AND CONTROVERSIAL" AND, IN FACT, RECOMMENDED BARGING OF THESE MATERIALS OFF GEORGES BANK TO AVOID UNREASONABLE RISK TO THE FISHERIES. THIS MEMBER HAS SEEN STUDIES WHICH INDICATE "NO EFFECT" AND OTHERS WHICH INDICATE "SIGNIFICANT EFFECTS." AT LEAST ONE INDUSTRY PUBLICATION WOULD INDICATE THAT WE DO NOT KNOW THE COMPOSITION OF THESE MATERIALS, LET ALONE THEIR EFFECTS. THUS, IN AN EFFORT TO ELIMINATE OUR CONFUSION--TO RESOLVE SOME OF THESE INCONGRUITIES--TODAY'S HEARING HAS BEEN CALLED.

POTOMAC RESEARCH INCORPORATED. 1978. MARINE OIL POLLUTION RESEARCH STUDY FINAL REPORT 1 JUNE 1978. POTOMAC RESEARCH INCORPORATED, PANAMA CITY, FL. 52P. (ERL,GB X063*).

THIS REPORT DOCUMENTS THE BIOLOGICAL BIOASSAY WORK DONE ON STAGE I, A STATIONARY NAVY RESEARCH PLATFORM LOCATED 12 MILES OFF THE COAST OF PANAMA CITY, FLORIDA, FOR THE NAVAL COASTAL SYSTEMS CENTER (NCSC) IN CONJUNCTION WITH AN INTERAGENCY AGREEMENT BETWEEN NCSC AND THE ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY (ERL), GULF BREEZE, FLORIDA. THE REPORT SUMMARIZES THE RESULTS OF THE COMMUNITY STUDIES, SHORT TERM BIOASSAYS AND POLYCHAETE IDENTIFICATION. CONCLUSIONS ARE BASED UPON THE COMPILED INFORMATION.

POWELL, E.N., J.J. KENDALL, S.J. CONNER, C.E. ZASTROW, AND T.J. BRIGHT. IN PRESS. EFFECT OF EIGHT OUTER CONTINENTAL SHELF DRILLING MUDS ON THE CALCIFICATION RATE AND FREE AMINO ACID POOL OF THE CORAL ACROPORA CERVICORNIS. BULL. ENVIRON. CONTAM. TOXICOL. (ERL,GB X477).

POWELL, ERIC N., MARGARET KASSCHAU, EDWARD CHEN, MICHAEL KOENIG, AND JILL PECON. 1982. CHANGES IN THE FREE AMINO ACID POOL DURING ENVIRONMENTAL STRESS IN THE GILL TISSUE OF THE OYSTER, CRASSOSTREA VIRGINICA. COMP. BIOCHEM. PHYSIOL. A COMP. BIOCHEM. 71A(4):591-598. (ERL,GB X203*). AVAIL. FROM NTIS, SPRINGFIELD, VA: PB82-239039.

1. OYSTERS WERE EXPOSED FOR 2- AND 5-DAY PERIODS TO INCREASED SALINITY (26%-38%), ANOXIA TURBIDITY AND DRILLING EFFLUENTS. 2. AFTER TWO DAYS, THE FAA POOL IN THE GILL TISSUE OF OYSTERS EXPOSED TO 38% SALINITY HAD ELEVATED GLYCINE, ALANINE AND B-ALANINE LEVELS: OYSTERS EXPOSED TO ANOXIA SHOWED ELEVATED GLYCINE AND ALANINE AND DECREASED ASPARTIC ACID LEVELS. 3. AFTER 2 DAYS, BOTH OYSTERS EXPOSED TO TURBIDITY AND TO DRILLING EFFLUENTS HAD INCREASED CYSTEIC ACID LEVELS. GLUTAMIC ACID AND ALANINE LEVELS WERE ALSO ELEVATED IN OYSTERS EXPOSED TO DRILLING EFFLUENTS. 4. AFTER 5 DAYS, GLYCINE, ALANINE AND B-ALANINE REMAINED ABOVE CONTROL LEVELS IN OYSTERS EXPOSED TO INCREASED SALINITY WHEREAS IN THOSE EXPOSED TO ANOXIA, TURBIDITY AND DRILLING EFFLUENTS, A SIGNIFICANT DECREASE IN MOST AMINO ACIDS OCCURRED WITH THE TOTAL FAA POOL DECREASING BY 50%. 5. THE FAA POOL'S RESPONSE WAS UNIQUE FOR EACH STRESS STUDIED SUGGESTING THAT THE FAA POOL MAY PROVE TO BE A USEFUL DIAGNOSTIC TOOL FOR DETERMINING A POSTERIORI THE CAUSATIVE AGENT RESPONSIBLE FOR A GIVEN STRESS RESPONSE.

POWELL, E.N., S.J. CONNOR, J.J. KENDALL, C.E. ZASTROW, AND T.J. BRIGHT. 1984. RECOVERY BY THE CORAL ACROPORA CERVICORNIS AFTER DRILLING MUD EXPOSURE. THE FREE AMINO ACID POOL. ARCH. ENVIRON. CONTAM. TOXICOL. 13(2):243-258. (ERL,GB X462*).

CORALS WERE EXPOSED TO DRILLING MUD FOR 24 HR AND THEN ALLOWED TO RECOVER FOR 48 HR IN CLEAN SEAWATER. DEPENDING ON THE CONCENTRATION AND THE MUD USED, EXPOSURE PRODUCED EITHER AN INCREASE OR DECREASE IN FREE AMINO ACID (FAA) POOL SIZE. ASPARTATE WAS AFFECTED TO A GREATER DEGREE THAN OTHER AMINO ACIDS. NO CLEAR INSTANCE OF RECOVERY COULD BE ASCERTAINED AFTER 48 HR IN CLEAN SEAWATER. IN SEVERAL CASES, CORALS, APPARENTLY UNAFFECTED BY A 24 HR EXPOSURE, NEVERTHELESS SUFFERED SIGNIFICANT CHANGES IN THE FAA POOL DURING THE 48 HR RECOVERY PERIOD. THUS, THE DEGREE OF TOXICITY OF THE DRILLING MUD COULD NOT BE ACCURATELY PREDICTED FROM THE 24 HR EXPOSURE DATA. IN MANY CASES, THE CHOICE OF NORMALIZING PARAMETER DETERMINED WHETHER TWO SETS OF DATA WERE SIGNIFICANTLY DIFFERENT OR NOT ACCURATE EFFECTS ASSESSMENT DEPENDS ON A COMPARISON OF NORMALIZATION TO CONFIRM STATISTICAL RESULTS.

PRONI, JOHN R. 1983. FINAL REPORT ON THE FLOWER GARDENS BANK DRILLING FLUIDS PROJECT (UNPUBLISHED). 13P. (ERL,GB X175*).

THE FLOWER GARDNES BANK PROJECT, A JOINT ENDEAVOR OF THE ENVIRONMENTAL PROTECTION AGENCY (EPA) AND THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) WAS UNDERTAKEN WITH THE PRINCIPAL OBJECTIVE OF DETERMINING WHETHER OR NOT DRILLING FLUIDS RELEASED TO THE OCEAN IN DRILLING OIL WELLS COULD OR COULD NOT REACH A PORTION OF THE FLOWER GARDEN BANKS UPON WHICH GROW CORALS OF A SPECIFIC TYPE OR TYPES. A SECOND PRINCIPAL OBJECTIVE WAS TO DETERMINE IF DRILLING FLUIDS OR COMPONENTS OF DRILLING FLUIDS COULD REACH THE CORALS WHAT EXPECTED CONCENTRATIONS MIGHT BE ATTAINED. THE PROJECT WAS ENVISIONED TO BE FIVE YEARS IN DURATION AND POSSIBLY LONGER. HOWEVER, AFTER TWO YEARS OF OPERATION FUNDS WERE ABRUPTLY CUT-OFF. A RELATIVELY MODEST AMOUNT OF FUNDING WAS THEN PROVIDED FOR SALVAGING THAT WORK WHICH HAD BEEN DONE AND FOR WINDING THE PROJECT DOWN. ONE KEY ELEMENT IN THIS PROJECT WAS THE PROVISION OF DISCHARGES OF DRILLING FLUIDS INTO THE OCEAN. PROVISION OF THESE DISCHARGES WHICH WAS NOT UNDER THE CONTROL OF EITHER THE EPA OR NOAA PROVED TO BE QUITE DIFFICULT. THERE WERE SEVERAL REASONS FOR THE DIFFICULTIES. OIL COMPANIES WERE NOT CERTAIN WHEN A PARTICULAR WELL WAS TO DISCHARGE; ADVANCE NOTICE FOR A DISCHARGE FOR A GIVEN WELL WAS AT BEST TENS OF HOURS. THIS ADVANCE DISCHARGE NOTICE TIME IS INCOMPATIBLE WITH SHIP SCHEDULING WHICH MUST BE DONE WEEKS IF NOT MONTHS OR EVEN YEARS IN ADVANCE. THIS PROBLEM OF WELL DISCHARGE WAS HIGHLIGHTED WHEN ON ONE OCCASION A NOAA SHIP, THE RESEARCHER, SPENT FOUR WEEKS IN GULF OF MEXICO, AT A COST TO NOAA OF $15,000 A DAY, WITHOUT OBTAINING AN OPPORTUNITY TO STUDY A SINGLE DISCHARGE. THREE COOPERATIVE DISCHARGES WERE OBTAINED DURING THE LIMITED EXTENT OF THE PROJECT. IN ORDER TO SATISFY THE OBJECTIVES OF THIS PROJECT STATED IN THE INTRODUCTORY PARAGRAPH A RELIABLE MEANS OF DETECTING AND TRACKING DRILLING FLUIDS DISCHARGED INTO THE OCEAN NEEDED TO BE DEVELOPED. CHEMICAL, PARTICULATE ANALYSIS AND ACOUSTICAL TECHNIQUES WERE DEVELOPED AND EMPLOYED. ALSO TO SATISFY THE OBJECTIVES AN UNDERSTANDING OF THE PATHWAYS BY WHICH DRILLING FLUIDS COULD REACH THE BANKS WAS REQUIRED; THIS IMPLIED THE NEED FOR HYDROGRAPHIC AND ACOUSTICAL MEASUREMENTS. THE CHEMICAL PROGRAM WAS HEADED BY DR. JOHN H. TREFRY OF THE FLORIDA INSTITUTE OF TECHNOLOGY WHILE THE ACOUSTICS, HYDROGRAPHY AND OVERALL ANALYSIS OF THE DATA WAS DONE BY DR. JOHN R. PRONI OF NOAA. MANY ADDITIONAL SUB-GOALS AND QUESTIONS APPEARED DURING THE COURSE OF THIS PROJECT AS IT WAS REALIZED HOW LITTLE WAS UNDERSTOOD ABOUT DRILLING FLUID DISPERSAL. ONE OF THESE SUB-GOALS WAS DETERMINING WHETHER OR NOT WATER COLUMN STRUCTURE COULD INFLUENCE THE TRANSPORT OF DRILLING FLUIDS AND IN PARTICULAR DID HORIZONTAL DENSITY STRATA EXIST WHICH MIGHT SERVE AS CONDUITS FOR PORTION OF THE DISCHARGE PLUME TO THE CORALS? WE SHALL SEE PRESENTLY THAT SIGNIFICANT RESULTS WERE OBTAINED DESPITE THE SEVERE CURTAILMENT OF THE PROJECT.

RAO, K. RANGA, AND DANIEL G. DOUGHTIE. IN PRESS. HISTOPATHOLOGICAL CHANGES IN GRASS SHRIMP EXPOSED TO CHROMIUM, PENTACHLOROPHENOL, AND DITHIOCARBAMATES. IN: RESPONSES OF MARINE ANIMALS TO POLLUTANTS. J. HEATH AND J. STEGEMAN, EDITORS, ELSEVIER/APPLIED SCIENCE PUBLISHERS. (ERL,GB X435).

THIS REPORT DEALS WITH THE HISTOPATHOLOGICAL/ULTRASTRUCTURAL CHANGES IN VARIOUS TISSUES OF GRASS SHRIMP PALAEMONETES PUGIO) EXPOSED TO HEXAVALENT AQUATREAT DNM-30 (15% SODIUM DIMETHYL DITHIOCARBAMATE PLUS 15% DISODIUM ETHYLENE BISDITHIOCARBAMATE) AND BUSAN-85 (50% POTASSIUM DIMETHYL DITHIOCARBAMATE). THE PATHOLOGICAL ALTERATIONS INDUCED BY DITHIOCARBAMATES AND PCP WERE MOST SEVERE AND FIRST EVIDENT IN THE GILLS OF THE BIOCIDES TESTED, THE DITHIOCARBAMATES CAUSED THE MOST EXTENSIVE BRANCHIAL DAMAGE--THE SO CALLED BLACK GILL SYNDROME, INVOLVING EARLY MELANIZATION AND EVENTUAL LAMELLAR TRUNCATION. HEXAVALENT CHROMIUM, ON THE OTHER HAND, DID NOT INDUCE MARKED CHANGES IN THE GILLS, BUT IT CAUSED INVASIVE MELANIZED CUTICULAR LESIONS (PARTICULARLY AT THE ARTICULATIONS OF THE PEREIOPODS, PLEOPODS, AND ABDOMINAL SEGMENTS). ADDITIONALLY CHROMIUM CAUSED APPARENT LABYRINTH HYPOACTIVITY IN THE ANTENNAL GLANDS, WHEREAS THE DITHIOCARBAMATES SEEMED TO INDUCE LABYRINTH HYPERACTIVITY. HEPATOPANCREATIC HISTOPATHOLOGY WAS MORE SEVERE IN SHRIMP EXPOSED TO CHROMIUM AND PCP THAN IN DITHIOCARBAMATE-EXPOSED SHRIMP. THE APPARENT MITOTIC ACTIVITY IN THE HEPATOPANCREAS WAS INCREASED IN AQUATREAT-EXPOSED SHRIMP AND SUPPRESSED IN CHROMIUM-EXPOSED SHRIMP; MANY MITOTIC FIGURES IN THE LATTER CASE WERE ABNORMAL. ALL FOUR COMPOUNDS CAUSED VARYING DEGREES OF MIDGUT EPITHELIAL HYPERTROPHY, CYTOPLASMIC VACUOLIZATION, AND DIMINUTION OF BASAL TUBULAR ENDOPLASMIC RETICULUM, BUT ONLY PCP CAUSED WIDESPREAD RUPTURE OF MIDGUT EPTITHELIAL CELL APICES. ADDITIONAL NOTABLE ULTRASTRUCTURAL ANOMALIES INCLUDED: MITOCHONDRIAL COMPARTMENTALIZATION IN PCP-EXPOSED SHRIMP; MITOCHONDRIAL FUSION IN DITHIOCARBAMATE-EXPOSED SHRIMP. THESE PATHOLOGICAL CHANGES POINT TO DIFFERENCES IN THE MECHANISMS OF POLLUTANT TOXICITY AND INDICATE THEIR POTENTIAL USE IN THE BIOLOGICAL MONITORING OF AQUATIC POLLUTANTS.

RAO, K. R., AND P. J. CONKLIN. IN PRESS. MOLT-RELATED SUSCEPTIBILITY AND REGENERATIVE LIMB GROWTH AS SENSITIVE INDICATORS OF AQUATIC POLLUTANT TOXICITY TO CRUSTACEANS. IN: PROCEEDINGS INDO-U.S. CONFERENCE ON LIFE HISTORIES OF BENTHIC MARINE INVERTEBRATES. (ERL,GB X472).

RAO, K. R., P. J. CONKLIN, AND D. G. DOUGHTIE. IN PRESS. PHYSIOLOGICAL AND HISTOPATHOLOGICAL EVALUATION OF THE TOXICITY OF HEXAVALENT CHROMIUM TO THE GRASS SHRIMP PALAEMONETES PUGIO. IN: POLLUTION AND PHYSIOLOGY OF MARINE ANIMALS. F.J.VERNBERG, A. CALABRESE, F.P. THURBER, AND W.B. VERNBERG, EDITORS, UNIVERSITY OF SOUTH CAROLINA PRESS. (ERL,GB X473).

RAO, K. RANGA, PHILIP J. CONKLIN, AND ANITA C. BRANNON. 1978. INHIBITION OF LIMB REGENERATION IN THE GRASS SHRIMP, PALAEMONETES PUGIO, BY SODIUM PENTACHLOROPHENATE. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NEW YORK, NY. PP. 193-203. (ERL,GB X116*).

THE INITIATION AND PROGRESS OF REGENERATION FOLLOWING THE REMOVAL OF THE LEFT FIFTH PEREIOPOD WERE STUDIED USING THE GRASS SHRIMP, PALAEMONETES PUGIO. THE REGENERATION PATTERNS OF 400 SHRIMP SUBJECTED TO VARIOUS TREATMENTS REVEALED THAT SODIUM PENTACHLOROPHENATE (NA-PCP) AFFECTS THE INITIATION AND PROGRESS OF LIMB REGENERATION. DEPENDING ON THE CONCENTRATION USED, NA-PCP CAUSED EITHER A COMPLETE INHIBITION OF REGENERATION, A DELAY OF INITIATION OF LIMB BUD DEVELOPMENT, OR A REDUCTION OF LIMB BUD GROWTH WITHOUT ALTERING THE INTERMOLT DURATION. BY COMPARING THE REGENERATION INDICES (R VALUES) OF CONTROL AND EXPERIMENTAL SHRIMP NOTED ON SPECIFIED DAYS PRECEDING ECDYSIS AND ON THE DAY FOLLOWING ECDYSIS IT WAS POSSIBLE TO DETERMINE THE EXTENT (%) OF INHIBITION OF REGENERATION IN SHRIMP EXPOSED TO NA-PCP. EC50 VALUES WERE COMPUTED USING PROBIT ANALYSIS. FOR EXAMPLE, THE R VALUES OF SHRIMP NINE DAYS AFTER LIMB REMOVAL YIELDED THE FOLLOWING EC50 VALUES WITH 95% CONFIDENCE INTERVALS SHOWN IN PARENTHESIS: UNFED SHRIMP, 0.473 PPM NA-PCP (0.306-0.670); FED SHRIMP, 0.565 PPM (0.452-0.706). THE EC50 VALUES BASED ON POSTECDYSIAL R VALUES WERE: UNFED SHRIMP, 0.615 PPM NA-PCP (0.451-0.852); FED SHRIMP, 0.637 PPM (0.485-0.850). THE INHIBITORY EFFECTS OF NA-PCP WERE MORE PRONOUNCED ON THE INITIAL PHASES OF LIMB REGENERATION (INVOLVING WOUND HEALING, CELL DIVISION AND DEDIFFERENTIATION) THAN ON THE LATER PHASES OF REGENERATION (INVOLVING FURTHER DIFFERENTIATION AND CELLULAR ENLARGEMENT). CRUSTACEAN LIMB REGENERATION CAN BE USED AS A SENSITIVE BIOASSAY FOR STUDYING THE EFFECTS OF CHEMICAL POLLUTANTS.

RAO, K. RANGA, FERRIS R. FOX, PHILIP J. CONKLIN, ANGELA C. CANTELMO, AND ANITA C. BRANNON.. 1979. PHYSIOLOGICAL AND BIOCHEMICAL INVESTIGATIONS OF THE TOXICITY OF PENTACHLOROPHENOL TO CRUSTACEANS. IN: MARINE POLLUTION: FUNCTIONAL RESPONSES. W.B. VERNBERG, A. CALABRESE, F. THURBERG, AND F.J. VERNBERG, EDITORS, ACADEMIC PRESS, NEW YORK, NY. PP. 307-339. (ERL,GB X117*).

A SERIES OF PHYSIOLOGICAL AND BIOCHEMICAL INVESTIGATIONS TO DETERMINE THE TOXICITY OF PENTACHLOROPHENOL TO CRUSTACEANS ARE DESCRIBED. THE STUDIES FOCUS ON: (1) THE TOXICITY OF NA-PCP TO GRASS SHRIMP AT DIFFERENT STAGES OF THE MOLT CYCLE; (2) THE EFFECTS OF NA-PCP ON LIMB REGENERATION IN GRASS SHRIMP, (3) THE EFFECTS OF NA-PCP AND 2,4-DINITROPHENOL (DNP) ON OXYGEN CONSUMPTION BY GRASS SHRIMP AND TISSUES FROM BLUE CRABS, AND (4) THE EFFECTS OF NA-PCP AND DNP ON BLUE CRAB HEPATOPANCREATIC ENZYMES. TESTS WITH DNP, ALSO A KNOWN UNCOUPLER, PERMITTED A COMPARISON OF THE EFFECTS OF BOTH PHENOLS.

RAO, K. RANGA, FERRIS R. FOX, PHILIP J. CONKLIN, AND ANGELA C. CANTELMO. 1981. COMPARATIVE TOXICOLOGY AND PHARMACOLOGY OF CHLOROPHENOLS: STUDIES ON THE GRASS SHRIMP, PALAEMONETES PUGIO. IN: BIOLOGICAL MONITORING OF MARINE POLLUTION. J. VERNBERG, F. THURBERG, A. CALABRESE, AND W. VERNBERG, EDITORS, ACADEMIC PRESS, INC., NEW YORK. PP. 37-72. (ERL,GB X235*).

EXPERIMENTS WITH THE GRASS SHRIMP, PALAEMONETES PUGIO, TO ASSESS THE TOXICITY OF SEVERAL CHLOROPHENOLS: 2,4-DICHLOROPHENOL, 2,4,5-TRICHLORODPHENOL, 2,4,6-TRICHLOROPHENOL, 2,3,4,5-TETRACHLORDPHENOL, 2,3,4,6-TETRACHLORDPHENOL, 2,3,5,6-TETRACHLORDPHENOL, AND PENTACHLOROPHENOL ARE DESCRIBED. AUTHORS REPORT A CYCLIC VARIATION IN GRASS SHRIMP SUSCEPTIBILITY TO VARIOUS CHLOROPHENOLS IN RELATION TO THE MOLT CYCLE. WITH THE EXCEPTION OF 2,4-DICHLOROPHENOL, THE VARIOUS CHLOROPHENOLS WERE MORE TOXIC TO MOLTING SHRIMP THAN TO NON-MOLTING SHRIMP IS DUE TO AN INCREASED BIOACCUMULATION OF THESE DURING THE PERIOD SHORTLY AFTER MOLTING.

RAO, K. RANGA, DANIEL G. DOUGHTIE, AND PHILIP J. CONKLIN. 1982. PHYSIOLOGICAL AND HISTOPATHOLOGICAL EVALUATION OF DITHIOCARBAMATE TOXICITY TO THE GRASS SHRIMP, PALAEMONETES PUGIO. IN: PHYSIOLOGICAL MECHANISMS OF MARINE POLLUTANT TOXICITY. W.B. VERNBERG, A. CALABRESE, AND F.P. THURBERG, EDITORS, ACADEMIC PRESS, NEW YORK. PP. 413-445. (ERL,GB X369*). AVAIL. FROM NTIS, SPRINGFIELD, VA: PB83-247205.

TOXICITY TESTS ON AQUATREAT DNM-30 (96 H LC50: 127 PPB) AND BUSAN 85 (96 H LC50: 49 PPB) REVEALED THAT DITHIOCARBAMATES ARE HIGHLY TOXIC TO MOLTING GRASS SHRIMP (PALAEMONETES PUGIO). THE RESULTS OF THESE TESTS, WHEN COUPLED WITH OTHER REPORTS ON DITHIOCARBAMATE TOXICITY, SUGGEST THAT CRUSTACEANS ARE MORE SENSITIVE TO DITHIOCARBAMATES THAN ARE FISH. IN LIMB REGENERATION STUDIES, BOTH OF THE DITHIOCARBAMATE FORMULATIONS CAUSED A DOSE-RELATED INHIBITION OF REGENERATIVE LIMB GROWTH IN GRASS SHRIMP; THE D 4 (96 H) EC50S FOR INHIBITION OF REGENERATIVE LIMB GROWTH WERE LOWER THAN THE 96 H LC50 VALUES. SINCE THE NUMBER OF DAYS TO MOLTING WAS NOT SIGNIFICANTLY ALTERED BY AQUATREAT OR BUSAN-EXPOSURE, DITHIOCARBAMATES APPEAR TO PRIMARILY EXERT THEIR EFFECT DIRECTLY ON THE DEVELOPING LIMB BUD TISSUE RATHER THAN THROUGH THE NEUROENDOCRINE SYSTEM. DURING THE COURSE OF EXPOSURE TO THE DITHIOCARBAMATES, SOME OF THE SHRIMP DEVELOPED GROSS ABNORMALITIES IN GILL MORPHOLOGY. RESPIRATION STUDIES REVEALED THAT AQUATREAT AND BUSAN-EXPOSED GRASS SHRIMP EXHIBITED LOWER RATES OF OXYGEN CONSUMPTION THAN DID CONTROL SHRIMP. HISTOLOGICAL AND ULTRASTRUCTURAL EXAMINATIONS REVEALED A GRADATION OF PATHOLOGICAL RESPONSES IN THE CARBAMATE-EXPOSED GILLS--INCLUDING A MASSIVE INFLUX OF HEMOXYTES INTO DEGENERATING GILL LAMELLAE, THE FORMATION OF PRESUMABLY MELANIZED PLUGS INTO LAMELLAR APICES, AND THE SLOUGHING OF THESE PLUGS AND SURROUNDING CUTICLE AT THE ECDYSIS--LEADING TO LAMELLAR TRUNCATION AND TO DEGENERATION OF ENTIRE PLEUROBRANCHIAL GILL PROCESSES. THE OBSERVED DEFENSIVE RESPONSE OF GRANULAR HEMOCYTES TO DITHIOCARBAMATES IS COMPARABLE TO SOME OF THE PREVIOUSLY DESCRIBED WOUND HEALING RESPONSES IN OTHER CRUSTACEANS.

RHOADS, DONALD C., AND LARRY F. BOYER. 1982. EFFECTS OF MARINE BENTHOS ON PHYSICAL PROPERTIES OF SEDIMENTS: A SUCCESSIONAL PERSPECTIVE. IN: ANIMAL-SEDIMENT RELATIONS. P.L. MCCALL AND M.J.S. TEVESZ, EDITORS, PLENUM PUBLISHING CORPORATION, NEW YORK. PP. 3-52. (ERL,GB 479*).

THIS CHAPTER FOCUSES ON PHYSICAL ORGANISM-SEDIMENT RELATIONS THAT ARE OF POTENTIAL VALUE IN PREDICTING THE PHYSICAL PROPERTIES OF SEDIMENTS AND THE TRANSPORT FATES OF FINE-GRAINED SEDIMENTS AND THEIR ASSOCIATED CONTAMINANTS. GENERALIZATIONS ARE MADE ABOUT HOW EARLY AND LATE SUCCESSIONAL STAGES INFLUENCE THE PHYSICAL PROPERTIES OF SEDIMENTS--SOME OF THE CAUSE-AND-EFFECT RELATIONSHIPS ARE WELL KNOWN, WHILE OTHERS REMAIN SPECULATIVE. A FEW PROMISING TECHNIQUES AND APPROACHES FOR FUTURE WORK ARE DISCUSSED.

RICHARDS, NORMAN L. 1981. AQUATIC TOXICITY OF DRILLING FLUIDS: RECENT FINDINGS (ABSTRACT). PRESENTED AT THE 3RD INTERNATIONAL OCEAN DUMPING SYMPOSIUM, WOODS HOLE OCEANOGRAPHIC INSTITUTION, WOODS HOLE, MASS., OCT. 12-18, 1. (ERL,GB X328*).

THIS PAPER SUMMARIZES PRELIMINARY RESULTS OF BOTH LABORATORY AND FIELD RESEARCH INTO THE FATE AND EFFECTS OF DRILLING FLUIDS. DIFFERENCES IN SPECIES-TO-SPECIES TOXICITY IN ESTUARINE VS OFFSHORE AND COLD-WATER VS WARM-WATER LOCALITIES ARE REVIEWED. A STEPPED-SEQUENCE SCHEME FOR TOXICITY TESTING IS PRESENTED: IT EMPHASIZES PREDICTION OF THE POTENTIAL FOR EFFECTS ON BENTHIC COMMUNITIES, REEF-BUILDING CORALS, AND COMMERCIAL FISHERIES ON GEORGES BANK. THE SCHEME INCLUDED LABORATORY AND FIELD EXPERIMENTS TO INVESTIGATE MORTALITY, ACCUMULATION OF SELECTED DRILLING FLUID COMPONENTS, BEHAVIORAL AND OTHER FUNCTIONAL EFFECTS, INCLUDING REPRODUCTION, AND PATHOBIOLOGY. REVIEW OF RECENT STUDIES SUGGEST THE FOLLOWING: (1) WITH GIVEN WELLS, DRILLING FLUID SAMPLES TAKEN FROM DIFFERENT DEPTHS HAD A BROAD RANGE OF TOXICITY; (2) TOXICITY OF DRILLING FLUID SAMPLES TO MARINE LIFE VARIED HIGHLY FROM WELL TO WELL; (3) SOME DRILLING FLUIDS WERE TOXIC TO ONE SPECIES-USUALLY AT HIGH CONCENTRATIONS-BUT NOT TO OTHER SPECIES; (4) FOR A GIVEN SPECIES, TOXICITY OF A DRILLING FLUID VARIED WITH THE LIFE STAGE TESTED; (5) THE ESTABLISHMENT OF BENTHIC COMMUNITIES IN DEFAUNATED SAND SUBSTRATE BY SETTLING OF PELAGIC LARVAE FROM UNFILTERED FLOWING SEAWATER WAS ALTERED BY EXPOSURE TO DRILLING FLUIDS: DEVELOPMENT OF ESTUARINE AND OFFSHORE COMMUNITIES DIFFERED; (6) THE BEHAVIOR OF CERTAIN CRUSTACEANS, MOLLUSKS, AND COELENTERATES WAS ALTERED BY EXPOSURE TO DRILLING FLUIDS, AND (7) DRILLING FLUIDS APPARENTLY AFFECTED CERTAIN FUNCTIONAL PROCESSES, SUCH AS RESPIRATION, PHOTOSYNTHESIS, AND CALCIFICATION IN CERTAIN TEST ANIMALS.

RUBINSTEIN, NORMAN I., REBECCA RIGBY, AND CHARLES N. D'ASARO. 1980. ACUTE AND SUBLETHAL EFFECTS OF WHOLE USED DRILLING FLUIDS ON REPRESENTATIVE ESTUARINE ORGANISMS. IN: SYMPOSIUM: RESEARCH ON ENVIRONMENTAL FATE AND EFFECTS OF DRILLING FLUIDS AND CUTTINGS, JAN. 21-24, 1980, LAKE BUENA VISTA, FL., VOL. 2. AMERICAN PETROLEUM INSTITUTE, WASHINGTON, DC. PP. 828-846. (ERL,GB 160*).

A LONG-TERM (100 DAYS) MULTISPECIES TOXICITY TEST WAS CONDUCTED TO ELUCIDATE BIOLOGICAL EFFECTS OF DRILLING FLUIDS ON REPRESENTATIVE ESTUARINE ORGANISMS AND DEVELOPING BENTHIC COMMUNITIES. ORGANISMS SELECTED FOR STUDY WERE: THE MYSID SHRIMP, MYSIDOPSIS BAHIA, A WATER COLUMN CRUSTACEAN, THE OYSTER, CRASSOSTREA VIRGINICA, AN EPIBENTHIC MOLLUSK, AND A DEPOSIT FEEDING POLYCHAETE, ARENICOLA CRISTATA. RESULTS INDICATE THAT THE DRILLING FLUIDS TESTED WERE MODERATELY TOXIC TO MYSIDS AT 30 TO 100 PPM. OYSTER GROWTH WAS ALSO SIGNIFICANTLY INHIBITED AT THESE CONCENTRATIONS. LUGWORM SURVIVAL IN ALL THREE CONCENTRATIONS WAS SIGNIFICANTLY REDUCED. FINALLY, EXCLUSION OF EARLY COLONIZING MOLLUSKS WAS OBSERVED IN AQUARIA CONTAINING 100 PPM DRILLING FLUIDS.

SCHATTEN, GERALD, CALVIN SIMERLY, AND HEIDE SCHATTEN. IN PRESS. EFFECTS OF BARIUM SULFATE ON SEA URCHIN FERTILIZATION AND EARLY DEVELOPMENT. IN: WASTES IN THE OCEAN, VOLUME 3. JOHN WILEY & SONS, INC., NEW YORK, NY. (ERL,GB X427).

FERTILIZATION AND DEVELOPMENT OF SEA URCHINS OFFER AN UNRIVALED SYSTEM TO STUDY THE CELLULAR CONSEQUENCES OF EXOGENOUS IONS. AT FERTILIZATION, A VARIETY OF EVENTS OCCUR, INCLUDING THE ACROSOME REACTION OF THE SPERM, THE CORTICAL REACTION OF THE EGG, SPERM INCORPORATION, THE UNION OF THE SPERM AND EGG NUCLEI WITHIN THE EGG CYTOPLASM, BIOELECTRIC CHANGES, THE ESTABLISHMENT OF THE BLOCK TO POLYSPERMY AND THE ACTIVATION OF THE METABOLISM OF THE FERTILIZED EGG. THESE EVENTS REQUIRE A COMPLEX REPERTOIRE OF ENZYMATIC AND STRUCTURAL CHANGES IN CELLULAR BEHAVIOR AND ARE REGULATED BY IONIC FLUXES, PARTICULARLY BY CHANGES IN INTRACELLULAR CALCIUM CONCENTRATION. BARIUM, A DIVALENT CATION, MIGHT BE EXPECTED TO MIMIC CALCIUM IN THIS MARINE SYSTEM AND TO INTERFERE WITH THE CELLULAR AND DEVELOPMENTAL EVENTS NORMALLY REGULATED BY CALCIUM FLUXES. GAMETES FROM THE GULF COAST SEA URCHINS LYTECHINUS VARIEGATUS AND ARBACIA PUNCTULATA WERE STUDIED BY LIGHT, ELECTRON AND TIME-LASPE VIDEO MICROSCOPY TO EVALUATE THE INTERFERENCE BY BARIUM SULFATE WITH NORMAL FERTILIZATION AND DEVELOPMENT. IN BARIUM SULFATE CONCENTRATIONS ABOVE 1 MILLIMOLAR, ALL THE NORMAL EVENTS AT FERTILIZATION WERE DRASTICALLY REDUCED; AT 10 MILLIMOLAR BARIUM SULFATE, ZERO PERCENT FERTILIZATION AND DEVELOPMENT WERE NOTED. THESE RESULTS INDICATE THAT HIGH CONCENTRATIONS (GREATER THAN 1 MMOL) OF BARIUM SULFATE CAN INTERFERE WITH NORMAL FERTILIZATION AND DEVELOPMENT OF SEA URCHINS AT SITES THAT ARE USUALLY REGULATED BY CALCIUM IONS.

SCHATTEN, GERALD, CALVIN SIMBERLY, AND HEIDE SCHATTEN. 1982. PROJECT REPORT: EFFECTS OF BARIUM SULFATE ON SEA URCHIN FERTILIZATION AND DEVELOPMENT (UNPUBLISHED REPORT). (ERL,GB X433*).

FERTILIZATION AND DEVELOPMENT OF SEA URCHINS OFFER AN UNRIVALED SYSTEM TO STUDY THE CELLULAR CONSEQUENCES OF EXOGENOUS IONS. AT FERTILIZATION, A VARIETY OF EVENTS OCCUR, INCLUDING THE ACROSOME REACTION OF THE SPERM, THE CORTICAL REACTION OF THE EGG, SPERM INCORPORATION, THE UNION OF THE SPERM AND EGG NUCLEI WITHIN THE EGG CYTOPLASM, BIOELECTRIC CHANGES, THE ESTABLISHMENT OF THE BLOCK TO POLYSPERMY AND THE ACTIVATION OF THE METABOLISM OF THE FERTILIZED EGG. THESE EVENTS REQUIRE A COMPLEX REPERTOIRE OF ENZYMATIC AND STRUCTURAL CHANGES IN CELLULAR BEHAVIOR AND ARE REGULATED BY IONIC FLUXES, PARTICULARLY BY CHANGES IN INTRACELLULAR CALCIUM CONCENTRATION. BARIUM, A DIVALENT CATION, MIGHT BE EXPECTED TO MIMIC CALCIUM IN THIS MARINE SYSTEM AND TO INTERFERE WITH THE CELLULAR AND DEVELOPMENTAL EVENTS NORMALLY REGULATED BY CALCIUM FLUXES. GAMETES FROM THE GULF COAST SEA URCHINS LYTECHINUS VARIEGATUS AND ARBACIA PUNCTULATA WERE STUDIED BY LIGHT, ELECTRON AND TIME-LAPSE VIDEO MICROSCOPY TO EVALUATE THE INTERFERENCE BY BARIUM SULFATE WITH NORMAL FERTILIZATION AND DEVELOPMENT. IN BARIUM SULFATE CONCENTRATIONS ABOVE 1 MILLIMOLAR, ALL THE NORMAL EVENTS AT FERTILIZATION WERE DRASTICALLY REDUCED; AT 10 MILLIMOLAR BARIUM SULFATE, ZERO PERCENT FERTILIZATION AND DEVELOPMENT WERE NOTED. THESE RESULTS INDICATE THAT HIGH CONCENTRATIONS (LESS THAN 1 MILLIMOLAR) OF BARIUM SULFATE CAN INTERFERE WITH NORMAL FERTILIZATION AND DEVELOPMENT OF SEA URCHINS AT SITES THAT ARE USUALLY REGULATED BY CALCIUM IONS.

SCIENCE APPLICATIONS, INC., LA JOLLA, CA. 1984. DRILL MUD ASSESSMENT CHEMICAL ANALYSIS REFERENCE VOLUME. EPA-600/3-84-048, U.S. ENVIRONMENTAL PROTECTION AGENCY. ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 265P. AVAIL. FROM NTIS, SPRINGFIELD, VA: PB84-170000.

THIS REPORT PRESENTS CONCENTRATIONS OF SPECIFIC METALS AND HYDROCARBONS IN ELEVEN DRILLING FLUIDS (MUDS) TAKEN FROM OPERATING GAS AND OIL RIGS IN THE GULF OF MEXICO. EACH DRILLING FLUID WAS ANALYZED CHEMICALLY FOR HEAVY METAL AND HYDROCARBON CONTENT IN THREE DISTINCT PHASES: (1) THE BULK OR WHOLE MUD, (2) A SUSPENDED PHASE DERIVED FROM THE BULK MUD SAMPLE, AND (3) A "DISSOLVED" OR LIQUID PHASE. ALIQUOTS OF BULK MUDS WERE REMOVED FOR BARIUM ANALYSES BY INSTRUMENTAL NEUTRON ACTIVATION AND FOR ANALYSIS FOR IRON, ALUMINUM, LEAD, ZINC, CADMIUM, COPPER, STRONTIUM, AND CALCIUM BY ATOMIC ABSORPTION ANALYSIS. ANALYSIS OF THE SUSPENDED PARTICULATE AND LIQUID PHASES WAS SIMILAR. THE AROMATIC AND ALIPHATIC CONTENT OF THE THREE PHASES WERE DETERMINED BY EXTRACTION AND THE FRACTIONATION BY COLUMN CHROMATOGRAPHY. THE ANALYSIS FOR EACH OF THE 11 DRILLING FLUIDS IS PRESENTED IN FOUR PARTS: A. DRILLING FLUID CONCENTRATIONS, B. WHOLE DRILLING FLUID ORGANIC CONCENTRATIONS, C. PARTICULATE PHASE ORGANIC CONCENTRATIONS, D. "DISSOLVED" PHASE ORGANIC CONCENTRATIONS.

SCIENCE APPLICATIONS, INC., LA JOLLA, CA. 1984. DRILL MUD ASSESSMENT CHEMICAL ANALYSIS REFERENCE VOLUME (PROJECT SUMMARY). EPA-600/S3-84-048, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 2P.

SMITH, GLEN A., JANET S. NICKELS, RONALD J. BOBBIE, NORMAN L. RICHARDS, AND DAVID C. WHITE. 1982. EFFECTS OF OIL AND GAS WELL-DRILLING FLUIDS ON THE BIOMASS AND COMMUNITY STRUCTURE OF MICROBIOTA THAT COLONIZE SANDS IN RUNNING SEAWATER. ARCH. ENVIRON. CONTAM. TOXICOL. 11(1):17-23. (ERL,GB X303*).

WELL-DRILLING FLUID AND A NUMBER OF THE KNOWN COMPONENTS (BARITE, CLAY, ALDACIDE, SURFLO, AND DOWICIDE, WERE TESTED FOR EFFECTS ON THE BIOMASS AND COMMUNITY STRUCTURE OF THE MICROBIOTA THAT COLONIZE MARINE SANDS EXPOSED FOR EIGHT WEEKS TO RUNNING AMBIENT SEAWATER. SHADING THE MICROBIOTA FROM LIGHT DEPRESSED THE MICROFLORA WITHOUT A SIGNIFICANT EFFECT ON THE BIOMASS, WHILE WELL-DRILLING FLUIDS LAYERED ON THE SURFACE OR MIXED WITH THE SAND SIGNIFICANTLY INCREASED A COMPONENT OF THE BACTERIA AND THE MICROFAUNA AS REFLECTED IN CHANGES IN THE FATTY ACID COMPOSITION. THERE WERE SOME SHADING EFFECTS FROM THE SURFACE LAYERING OF WELL-DRILLING FLUIDS AS REFLECTED IN THE FATTY ACIDS FROM THE MICROFLORA WHEN COMPARED TO THE SANDS MIXED WITH WELL-DRILLING FLUIDS. BARITE HAD ESSENTIALLY NO EFFECT ON THE BIOMASS OR COMMUNITY STRUCTURE WHILE CLAYS INCREASED NEARLY ALL OF THE BIOMASS INDICATORS FOR THE BACTERIA AS WELL AS THE MICROFAUNA; THE CLAY OVERLAY MIRRORS THE EFFECT OF THE DRILLING FLUIDS. ALDACIDE SHIFTED THE BACTERIAL COMPOSITION, DEPRESSING THE PROPORTIONS OF MICROBES CONTAINING THE CYCLOPROPANE FATTY ACIDS AND THE ANAEROBIC PATHWAYS OF DESATURATION. CONCENTRATIONS OF 1 AND 15 UG/L INCREASED THE BACTERIAL BIOMASS AS REFLECTED IN THE TOTAL LIPID (16:0) AND EXTRACTABLE LIPID PHOSPHATE COUPLED WITH A DECREASE IN THE TOTAL MICROEUKARYOTES. SURFLO INCREASED IN THE BIOMASS AND SHIFTED THE BACTERIAL COMMUNITY STRUCTURE AT CONCENTRATIONS BETWEEN 4 AND 800 UG/L. THE LOWEST LEVEL ALSO STIMULATED THE MICROFAUNA. DOWICIDE AT 100 UG/L INCREASED THE BACTERIA FORMING CISVACCENIC ACID AND THE MICROFAUNA SIMILAR TO LOW CONCENTRATIONS OF SURFLO.

SZMANT-FROELICH, A., V. JOHNSON, T. HOEHN, J. BATTEY, G.J. SMITH, E. FLEISCHMANN, J. PORTER, AND D. DALLMEYER. 1982. PHYSIOLOGICAL EFFECTS OF OIL-DRILLING MUDS ON THE CARIBBEAN CORAL MONTASTREA ANNULARIS. IN: REEF AND MAN: PROCEEDINGS OF THE FOURTH INTERNATIONAL CORAL REEF SYMPOSIUM, MANILA, PHILIPPINES, 18-22, MAY, 1981. EDGARDO D. GOMEZ, ET AL., EDITOR, MARINE SCIENCES CENTER, UNIVERSITY OF THE PHILIPPINES, QUEZON CITY, PHILIPPINES. PP. 163-168. (ERL,GB X307*).

THE EFFECT OF CHRONIC EXPOSURE TO DRILLING MUDS ON THE REEF CORAL MONTASTREA ANNULARIS WAS INVESTIGATED. COLONIES WERE EXPOSED FOR 6 WEEKS TO CONCENTRATIONS OF 0, 1, 10 AND 100 PPM DRILLLING MUD IN A FLOW-THRU SEAWATER SYSTEM. WEEKLY MEASUREMENTS WERE MADE OF CORAL RESPIRATION, PHOTOSYNTHESIS, CALCIFICATION AND NH4 AND NO3 UPTAKE RATES. CALCIFICATION AND RESPIRATION RATES OF CORALS EXPOSED TO 100 PPM DRILLING MUD DECREASED BY 53% AND 25% RESPECTIVELY AFTER 4 WEEKS OF EXPOSURE AND BY 84% AND 40% AFTER 6 WEEKS. GROSS PHOTOSYNTHESIS WAS REDUCED BY 26% AFTER 5 WEEKS. NO3 UPTAKE RATES DECREASED BY 42% AND 48% AFTER 4 AND 6 WEEKS WHILE NH4 UPTAKE DECREASED BY 32% AND 49% AFTER 5 AND 6 WEEKS OF EXPOSURE. SEVERAL OF THE 100 PPM CORALS DIED BEFORE THE END OF THE EXPERIMENT, WHILE NONE OF THE OTHER CORALS DIED. CALCIFICATION AND RESPIRATION RATES OF 10 PPM CORALS WERE LOWER BUT NOT SIGNIFICANTLY DIFFERENT FROM THOSE OF CONTROLS. BRINE SHRIMP EXTRACT ELICITED NORMAL FEEDING RESPONSES FROM CONTROL, 1 PPM AND 10 PPM CORALS BUT NOT FROM THE 100 PPM CORALS AFTER 6 WEEKS OF EXPOSURE TO DRILLING MUD. THE LATTER GROUP STILL DID NOT RESPOND TO THE EXTRACT AFTER A 1-WEEK RECOVERY PERIOD IN CLEAN SEAWATER.

SZMANT-FROELICH, ALINA. 1983. PHYSIOLOGICAL EFFECTS OF DRILLING MUDS ON REEF CORALS. EPA-600/3-83-013, U.S. ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FL. 54P.

PIECES OF CORAL FROM TWO SPECIES, MONTASTREA ANNULARIS AND ACROPORA CERVICORNIS, WERE EXPOSED IN THE LABORATORY TO CONCENTRATIONS OF 0, 1, 10, AND 100 PPM DRILLING MUD FOR PERIODS TWO DAYS TO SEVEN WEEKS. SEVERAL PHYSIOLOGICAL FUNCTIONS OF THE CORAL ANIMAL (CALCIFICATION RATE, RESPIRATION RATE) AND OF THEIR ZOOXANTHELLAE (PHOTOSYNTHESIS RATE, NUTRIENT UPTAKE RATE) WERE MONITORED AT REGULAR INTERVALS DURING THE EXPOSURE PERIODS. IN ADDITION, BIOMASS PARAMETERS (TISSUE NITROGEN, ZOOXANTHELLAE CELL DENSITY, CHLOROPHYLL CONTENT) WERE MEASURED AT TWO-WEEK INTERVALS FOR THE LONGER EXPOSURE EXPERIMENT, AND AT THE END OF EACH EXPERIMENT FOR THE SHORTER EXPOSURES. INITIAL LONG-TERM EXPOSURES OF PIECES OF MONTASTREA ANNULARIS TO A SERIES OF DRILL MUDS (DESIGNATED JX-2 THROUGH JX-7) COLLECTED FROM A JAY OIL-FIELD WELL SHOWED A SIGNIFICANT DETRIMENTAL EFFECT ON CALCIFICATION, RESPIRATION, AND NO(3) UPTAKE RATES DURING THE FOURTH WEEK OF EXPOSURE TO 100 PPM DRILL MUD. PHOTOSYNTHESIS AND NH(4) UPTAKE RATES WERE AFFECTED ALSO DURING THE FIFTH WEEK OF EXPOSURE. NORMAL FEEDING BEHAVIOR WAS ABSENT FROM THESE CORALS WHEN TESTED DURING THE SIXTH AND SEVENTH WEEKS OF EXPOSURE. SEVERAL 100 PPM CORALS DIED DURING THE FIFTH AND SIXTH WEEKS.

TAGATZ, MARLIN E., GAYLE R. PLAIA, AND CHRISTINE H. DEANS. IN PREP. RESPONSES OF MACROBENTHOS COLONIZING ESTUARINE SEDIMENTS CONTAMINATED WITH DRILLING MUD CONTAINING DIESEL OIL. MAR. BIOL. (BERL.). (ERL,GB 505).

BOXES FILLED WITH CLEAN SAND OR CLEAN SAND WITH A 2-CM OVERLAY OF MIXTURES OF SAND WITH BARITE OR DRILLING MUD WERE PLACED IN SANTA ROSA SOUND, FLORIDA, TO DETERMINE THE EFFECTS OF A USED LIME DRILLING-MUD ON FIELD-COLONIZED MACROBENTHIC COMMUNITIES. EFFECT OF THE DRILLING MUD ON COMMUNITY STRUCTURE WAS GREATER THAN THAT OF ITS BARITE COMPONENT AFTER COLONIZATION FOR 8 WEEKS. BARITE CAUSES CHANGES IN TEXTURE OF THE SEDIMENT AND THEREBY RECRUITMENT. THE AVERAGE NUMBERS OF ANIMALS AND SPECIES IN BOXES CONTAINING 1:10 AND 1:3 MIXTURES OF MUD TO SAND WERE SIGNIFICANTLY LESS THAN THOSE IN CONTROL BOXES AND MOST OF THE BARITE/SAND MIXTURES. THE SHANNON-WEAVER INDEX OF DIVERSITY, SIMPSON'S INDEX OF DOMINANCE, AND THE BRAY-CURTIS DISSIMILARITY INDEX DIFFERED ONLY FOR 1:3 MUD/SAND COMMUNITIES. TOXIC EFFECTS OF THE LIME DRILLING MUD WERE ATTRIBUTED TO A DIESEL FUEL OIL COMPONENT (3.98 MG/G OF MUD).

TAGATZ, MARLIN E., JOEL M. IVEY, JAMES C. MOORE, AND MICHAEL TOBIA. 1977. EFFECTS OF PENTACHLOROPHENOL ON THE DEVELOPMENT OF ESTUARINE COMMUNITIES. J. TOXICOL. ENVIRON. HEALTH. 3(3):501-506. (ERL,GB 310*).

PENTACHLOROPHENOL AFFECTED THE COMPOSITION OF COMMUNITIES OF ESTUARINE ORGANISMS DEVELOPED IN SAND FROM PLANKTONIC LARVAE IN ESTUARINE WATER THAT FLOWED THROUGH TEN CONTROL AQUARIA AND TEN AQUARIA PER EXPOSURE CONCENTRATION AVERAGING 7, 76, OR 622 MG/LITER. ANNELIDS, ARTHROPODS, AND MOLLUSKS WERE THE NUMERICALLY DOMINANT PHYLA WHEN ANIMALS WERE COLLECTED IN A 1-MM-MESH SIEVE AFTER 9 WK OF EXPOSURE. MOLLUSKS WERE MARKEDLY FEWER AT 7 MG/LITER; ANNELIDS AND ARTHROPODS AT 76 MG/LITER. ALMOST NO ANIMALS OCCURRED AT 622 MG/LITER. THE TOTAL NUMBERS OF INDIVIDUALS AND SPECIES WERE SIGNIFICANTLY LESS (A=0.01) IN AQUARIA EXPOSED TO 76 MG/LITER THAN IN THOSE UNEXPOSED OR EXPOSED TO 7 MG/LITER.

TAGATZ, MARLIN E., AND MICHAEL TOBIA. 1978. EFFECT OF BARITE (BASO4) ON DEVELOPMENT OF ESTUARINE COMMUNITIES. ESTUARINE COASTAL MAR. SCI. 7(4):401-407. (ERL,GB 340).

BARITE (BASO4), THE PRIMARY COMPONENT OF OIL DRILLING MUDS, AFFECTED THE COMPOSITION OF ESTUARINE COMMUNITIES DEVELOPED FROM PLANKTONIC LARVAE IN AQUARIA CONTAINING SAND AND FLOWING ESTUARINE WATER. AQUARIA CONTAINED: SAND ONLY; A MIXTURE (BY VOLUME) OF 1 PART BARITE AND 10 PARTS SAND; 1 PART BARITE, AND 3 PARTS SAND; OR SAND COVERED BY 0.5 CM BARITE. FOR ALL ENVIRONMENTS, ANNELIDS AND MOLLUSKS WERE THE NUMERICALLY DOMINANT PHYLA COLLECTED IN A 1-MM-MESH SIEVE AFTER 10 WEEKS EXPOSURE; A TOTAL OF 3020 ANIMALS, REPRESENTING 59 SPECIES, WAS COLLECTED. SIGNIFICANTLY FEWER ANIMALS AND SPECIES (A=0.01) DEVELOPED IN AQUARIA SAND COVERED BY BARITE THAN IN AQUARIA UNEXPOSED OR EXPOSED TO 1 BARITE:10 SAND. NUMBER OF ANIMALS IN AQUARIA CONTAINING 1 BARITE:3 SAND ALSO DIFFERED (A=0.05) FROM THAT IN CONTROL AQUARIA. ANNELIDS WERE PARTICULARLY AFFECTED AND SIGNIFICANTLY FEWER (A=0.01) WERE FOUND IN ALL TREATMENTS THAN IN THE CONTROL. MOLLUSKS DECREASED MARKEDLY IN NUMBER ONLY IN BARITE-COVERED AQUARIA. BARITE, HOWEVER, DID NOT IMPEDE GROWTH (AS HEIGHT) OF THE ABUNDANT CLAM, LAEVICARDIUM MORTONI, OR DECREASE ABUNDANCE OF SIX OTHER PHYLA. OUR DATA INDICATE THAT LARGE QUANTITIES OF THIS COMPOUND, AS DISCHARGED IN OFFSHORE OIL DRILLING, POSSIBLY COULD ADVERSELY AFFECT THE COLONIZATION OF BENTHIC ANIMALS.

TAGATZ, M.E., J.M. IVEY, H.K. LEHMAN, AND J.L. OGLESBY. 1978. EFFECTS OF A LIGNOSULFONATE-TYPE DRILLING MUD ON DEVELOPMENT OF EXPERIMENTAL ESTUARINE MACROBENTHIC COMMUNITIES. NORTHEAST GULF SCI. 2(1):35-42. (ERL,GB 370).

DRILLING MUD, AS USED IN EXPLORATORY DRILLING FOR OIL OFFSHORE, AFFECTED THE COMPOSITION OF ESTUARINE COMMUNITIES THAT DEVELOPED FROM PLANKTONIC LARVAE IN AQUARIA CONTAINING SAND AND FLOWING ESTUARINE WATER. AQUARIA CONTAINED: SAND ONLY; A MIXTURE (BY VOLUME) OF 1 PART MUD AND 10 PARTS SAND; 1 PART MUD AND 5 PARTS SAND; OR SAND COVERED BY 0.2 CM MUD. FOR ALL ENVIRONMENTS, ANNELIDS, MOLLUSKS, ARTHROPODS, AND COELENTERATES WERE THE NUMERICALLY DOMINANT PHYLA COLLECTED IN A 1 MM MESH SIEVE AFTER EIGHT WEEKS EXPOSURE; A TOTAL OF 1,025 ANIMALS, REPRESENTING 45 SPECIES, WAS COLLECTED. ANNELIDS AND COELENTERATES WERE SIGNIFICANTLY FEWER (A=0.05) IN AQUARIA CONTAINING DRILLING MUD THAN IN THE CONTROL AQUARIA. ARTHROPODS WERE SIGNIFICANTLY AFFECTED ONLY BY MUD COVER OVER SAND; MOLLUSKS ALSO WERE DIMINISHED IN THIS ENVIRONMENT, BUT NOT SIGNIFICANTLY. EXPOSURE TO CONCENTRATIONS OF DRILLING MUD REDUCED NOT ONLY THE NUMBER OF INDIVIDUALS, BUT ALSO THE FREQUENCY OF OCCURENCE OF MACROBENTHIC SPECIES. THUS, THE AVERAGE NUMBER OF ANNELID SPECIES IN 1 PART MUD: 5 PARTS SAND AQUARIA OR IN MUD-COVERED AQUARIA WAS SIGNIFICANTLY LESS THAN IN CONTROL AQUARIA. THE AVERAGE NUMBER OF ARTHROPOD SPECIES PER AQUARIUM WAS ALSO SIGNIFICANTLY LESS IN MUD-COVER EXPOSURE THAN IN THE CONTROL. DISCHARGE OF LARGE QUANTITIES OF DRILLING MUD AT LEVELS TESTED IN THE LABORATORY COULD ADVERSELY AFFECT THE COLONIZATION OF VARIOUS SUBSTRATA BY BENTHIC ANIMALS IN NATURE.

TAGATZ, M.E., J.M. IVEY, AND M. TOBIA. 1978. EFFECTS OF DOWICIDE G-ST ON DEVELOPMENT OF EXPERIMENTAL ESTUARINE MACROBENTHIC COMMUNITIES. IN: PENTACHLOROPHENOL: CHEMISTRY, PHARMACOLOGY, AND ENVIRONMENTAL TOXICOLOGY. K. RANGA RAO, EDITOR, PLENUM PRESS, NY. PP. 157-163. (ERL,GB 352).

AQUARIA CONTAINING CLEAN SAND RECEIVED A CONTINUOUS SUPPLY OF FLOWING SEAWATER FROM SANTA ROSA SOUND, FLORIDA, MIXED WITH KNOWN QUANTITIES OF DOWICIDE G-ST (79% SODIUM PENTACHLOROPHENATE) FOR THIRTEEN WEEKS. THE MEASURED CONCENTRATIONS OF PENTACHLOROPHENOL (PCP) IN AQUARIA WERE 1.8, 15.8 AND 151 MG/L. AT THE END OF THE EXPERIMENT, MACROFAUNA ESTABLISHED IN CONTROL AND EXPERIMENTAL AQUARIA WAS EXAMINED. MOLLUSKS, ARTHROPODS AND ANNELIDS WERE NUMERICALLY DOMINANT AMONG THE MACROFAUNA. ALTHOUGH EXPOSURE TO 1.8 MG PCP/L HAD NO EFFECT, THE HIGHER CONCENTRATIONS OF PCP CAUSED MARKED REDUCTION IN THE NUMBERS OF INDIVIDUALS AND SPECIES. MOLLUSKS WERE THE MOST SENSITIVE TAXONOMIC GROUP TO PCP. THESE RESULTS AND OUR PREVIOUS STUDIES ON THE EFFECTS OF A NINE-WEEK EXPOSURE TO PCP IN THE ESTABLISHMENT OF MACROBENTHIC COMMUNITIES INDICATE THAT DISCHARGE OF PCP INTO NATURAL WATERS COULD ALTER THE NORMAL COLONIZATION BY BENTHIC ANIMALS AND COULD IMPACT VARIOUS ECOLOGICAL RELATIONSHIPS AMONG LOCALIZED POPULATIONS.

TAGATZ, M.E., J.M. IVEY, AND J.L. OGLESBY. 1979. TOXICITY OF DRILLING-MUD BIOCIDES TO DEVELOPING ESTUARINE MACROBENTHIC COMMUNITIES. NORTHEAST GULF SCI. 3(2):88-95. (ERL,GB 391).

THE EFFECTS OF VARIOUS BIOCIDES, AS USED IN DRILLING MUDS FOR EXPLORATORY DRILLING FOR OIL OFFSHORE, WERE DETERMINED BY COMPARING MACROBENTHIC COMMUNITIES THAT DEVELOPED FROM PLANKTONIC LARVAE IN TREATED AND UNTREATED AQUARIA. SURFLO-833 AND ALDACIDE WERE TESTED SIMULTANEOUSLY. HARVEST AT SEVEN WEEKS YIELDED 1,941 ANIMALS, REPRESENTING 37 SPECIES OF 6 PHYLA. THE EFFECTS OF SURFLO-833 (25% DICHLOROPHENOL AND OTHER CHLOROPHENALS) ON THESE COMMUNITIES WERE SIMILAR TO THOSE OF PENTACHLOROPHENOL (TAGATZ ET AL., 1977; 1978), A BIOCIDE KNOWN TO BE TOXIC TO MANY AQUATIC ORGANISMS (RAO, 1978). SIGNIFICANTLY FEWER (A=0.05) CHORDATES, MOLLUSKS, AND ANNELIDS OCCURRED IN 819 MG SURFLO-833/1 (MEASURED) THAN IN THE CONTROL; MOLLUSKS WERE MOST SENSITIVE AND ALSO SIGNIFICANTLY FEWER IN AQUARIA RECEIVING 41 MG/1. AVERAGE NUMBERS OF ANIMALS AND SPECIES PER AQUARIUM DID NOT SIGNIFICANTLY DECREASE IN ALDACIDE (91% PARAFORMALDEHYDE) AT NOMINAL CONCENTRATIONS OF 15 AND 300 MG/1. THE HIGH TOXICITY OF THE CHLOROPHENOLS TESTED INDICATES THAT THE USE OF ALTERNATIVE BIOCIDES, POSSIBLY PARAFORMALDEHYDE, SHOULD BE CONSIDERED FOR NATURAL WATERS.

TAGATZ, M.E., J.M. IVEY, H.K. LEHMAN, M. TOBIA, AND J.L. OGLESBY. 1980. EFFECTS OF DRILLING MUD ON DEVELOPMENT OF EXPERIMENTAL ESTUARINE MACROBENTHIC COMMUNITIES. IN: SYMPOSIUM: RESEARCH ON ENVIRONMENTAL FATE AND EFFECTS OF DRILLING FLUIDS AND CUTTINGS, JANUARY 21-24, 1980, LAKE BUENA VISTA, FL., VOL. 2. AMERICAN PETROLEUM INSTITUTE, WASHINGTON, DC. PP. 847-865. (ERL,GB 401*).

THE EFFECTS OF DRILLING MUD ON DEVELOPMENT OF ESTUARINE MACROBENTHIC COMMUNITIES, WHICH RESULT FROM SETTLING PLANKTONIC LARVAE, WERE ASSESSED BY COMPARING NUMBER AND SPECIES OF ANIMALS THAT GREW IN UNCONTAMINATED AND CONTAMINATED AQUARIA FOR AT LEAST 7 WEEKS. AQUARIA CONTAINED SAND AND WERE CONTINUOUSLY SUPPLIED WITH UNFILTERED SEAWATER. WE TESTED WHOLE DRILLING MUD, BARITE (MUD-WEIGHTING AGENT), A PARAFORMALDEHYDE-TYPE BIOCIDE (ALDACIDE), AND THREE CHLOROPHENOL-TYPE BIOCIDES (PENTACHLOROPHENOL, DOWICIDE G-ST, AND SURFLO B-33). TESTS WITH WHOLE DRILLING MUD AND BARITE WERE DESIGNED TO DETERMINE THEIR IMPACT AS A COVER (2 OR 5 MM) OVER THE SUBSTRATUM AND WHEN MIXED WITH CLEAN SAND (RATIOS OF 1:10 SAND AND HIGHER). ANNELIDS WERE MOST SENSITIVE TO DRILLING MUD AND BARITE AND SIGNIFICANTLY FEWER (P=0.05) IN ALL CONTAMINATED AQUARIA THAN IN CONTROL AQUARIA. FOR ALL PHYLA, THE AVERAGE NUMBER OF SPECIES PER AQUARIUM WAS SIGNIFICANTLY LESS IN TREATMENTS WITH A COVER OF MUD OR BARITE THAN IN THE CONTROLS. MOLLUSKS WERE PARTICULARLY AFFECTED BY THE CHLOROPHENOL-TYPE BIOCIDES AND SIGNIFICANTLY FEWER (P=0.05) AT CONCENTRATIONS (ACTIVE INGREDIENT IN WATER) OF 7 MICROGRAMS PENTACHLOROPHENOL/1, 18 MICROGRAMS DOWICIDE G/1, AND 10 MICROGRAMS SURFLO B-33/1. NUMBERS OF INDIVIDUALS AND SPECIES OF ANNELIDE PER EXPERIMENTAL AQUARIUM WERE ALSO SIGNIFICANTLY LESS THAN IN CONTROL AQUARIA AT 76 MICROGRAMS PENTACHLOROPHENOL/1, 183 MICROGRAMS DOWICIDE G/1, AND 205 MICROGRAMS SURFLO B-33/1. NUMBERS OF ANIMALS AND SPECIES DID NOT SIGNIFICANTLY DECREASE IN THE PRESENCE OF ALDACIDE AT NOMINAL CONCENTRATIONS (ACTIVE INGREDIENT) AS HIGH AS 273 MICROGRAMS/1. ADVERSE EFFECTS OF DRILLING MUD ON MARINE BENTHOS COULD RESULT FROM TOXIC CONSTITUENTS OR FROM THOSE THAT PHYSICALLY ALTER THE SUBSTRATE.

TAGATZ, M.E., J.M. IVEY, C.E. DALBO, AND J.L. OGLESBY. 1982. RESPONSES OF DEVELOPING ESTUARINE MACROBENTHIC COMMUNITIES TO DRILLING MUDS. ESTUARIES. 5(2):131-137. (ERL,GB 413).

THE EFFECTS OF DRILLING MUD ON DEVELOPMENT OF ESTUARINE MACROBENTHIC COMMUNITIES, WHICH RESULT FROM SETTLING PLANKTONIC LARVAE, WERE ASSESSED BY COMPARING NUMBER AND SPECIES OF ANIMALS THAT GREW IN UNCONTAMINATED AND CONTAMINATED AQUARIA FOR 8 WEEKS. AQUARIA CONTAINED SAND AND WERE CONTINUOUSLY SUPPLIED WITH UNFILTERED SEAWATER. SEVEN DRILLING MUDS, OBTAINED FROM AN ACTIVE EXPLORATORY PLATFORM IN ESTUARINE WATERS, WERE TESTED CONSECUTIVELY AT NOMINAL CONCENTRATIONS OF 0.5, 5, AND 50 PARTS PER MILLION. NUMBERS OF CHORDATES, MOLLUSKS, AND ANNELIDS PER AQUARIUM WERE SIGNIFICANTLY (A=0.05) DECREASED FROM CONTROL NUMBERS IN 50 PPM. A TOTAL OF 13 SPECIES OCCURRED IN 50 PPM COMPARED TO 23 SPECIES IN EACH OF THE OTHER SITUATIONS. GROWTH IN DIAMETER OF MOLGULA MANHATTENSIS WAS AFFECTED IN ALL CONCENTRATIONS OF MUD, THE PERCENTAGE OF LARGE INDIVIDUALS BEING SIGNIFICANTLY LESS THAN IN THE CONTROL.

THOMPSON, JACK H., AND THOMAS J. BRIGHT. 1980. EFFECTS OF AN OFFSHORE DRILLING FLUID ON SELECTED CORALS. IN: SYMPOSIUM: RESEARCH ON ENVIRONMENTAL FATE AND EFFECTS OF DRILLING FLUIDS AND CUTTINGS, JAN. 21-24, 1980, LAKE BUENA VISTA, FL., VOL. 2. AMERICAN PETROLEUM INSTITUTE, WASHINGTON, DC. PP. 1044-1078. (ERL,GB X227*).

SEVEN SPECIES OF CORAL, DICHOCOENIA STOKESII, MONTASTREA ANNULARIS, AGARCIA AGARICITES, ACROPORA CERVICORNIS, PORITES FURCATA, P. ASTREOIDS, AND P. DIVARICATA, WERE EXPERIMENTALLY EXPOSED TO EACH OF THREE CONCENTRATIONS (100, 316, 100 1/1) OF DRILLING MUD (OBTAINED FROM AN OFFSHORE OIL WELLIN THE GULF OF MEXICO), AND CONTROL SEA WATER FOR 96 HOURS TO OBSERVE BEHAVIORAL RESPONSES. EXPERIMENTS WERE CONDUCTED AT CARYSFORT REEF, FLORIDA KEYS, USING CLOSED AQUARIA LOCATED IN THREE METERS OF WATER. POLYP BEHAVIOR WAS DETERMINED WITH SERIAL CLOSEUP PHOTOGRAPHY WHICH ALLOWED COUNTING OF RETRACTED, PARTIALLY RETRACTED, AND NON-RETRACTED POLYPS IN EACH COLONY. RESPONSE TO DRILLING MUD CONCENTRATIONS WAS MEASURED AS PERCENT OF POLYPS RETRACTED. MONTASTREA ANNULARIS, AGARICIA AGARICITES, AND ACROPORA CERVICORNIS WERE KILLED BY EXPOSURE TO 1,000 UL/L MUD. A. CERVICORNIS COLONIES SURVIVED THIS CONCENTRATION IN A REPLICATE EXPERIMENT. ALL CORALS EXCEPT DICHOCOENIA STOKESII AND PORITES DIVARICATA SHOWED SIGNIFICANT (LESS THAN .05) POLYP RETRACTION DURING EXPOSURE TO 100 1/1 MUD CONCENTRATION, 316 UL/L MUD WAS THE MINIMUM CONCENTRATION WHICH INDUCED SIGNIFICANT POLYP RETRACTION IN PORITES DIVARICATA. POLYPS OF DICHOCOENIA STOKESII DID NOT DETECTABLY REACT TO ANY OF THE THREE CONCENTRATIONS.

THOMPSON, JACK HARRELL, JR. 1980. RESPONSES OF SELECTED SCLERACTINIAN CORALS TO DRILLING FLUIDS USED IN THE MARINE ENVIRONMENT. PH.D. DISSERTATION. TEXAS A&M UNIVERSITY, COLLEGE STATION, TX. 130P. (ERL,GB X315*).

ELEVEN SPECIES OF SCLERACTINIAN CORALS (AGARICIA AGARICITES, ACROPORA CERVICORNIS, PORITES ASTREOIDES, P. DIVARICATA, P. FURCATA, MADRACIS MIRABILIS, M. DECATIS, MONTASTREA ANNULARIS, M. CAVERNOSA, DIPLORIA STRIGOSA, AND DICHOCOENIA STOKESII) HAVE BEEN EXPOSED TO SEVERAL LAYERED AND SUSPENDED DRILLING FLUIDS COLLECTED FROM EXPLORATORY DRILLING PLATFORMS IN THE GULF OF MEXICO, OR TO INDIVIDUAL DRILLING FLUID COMPONENTS. QUANTIFIED RESPONSE PARAMETERS INCLUDE RATE OF SEDIMENT REMOVAL AND POLYP CONTRACTION. OTHER STRESS RESPONSES HAVE BEEN QUALITATIVELY MEASURED. CLOSE-UP TIME LAPSE MOVIE PHOTOGRAPHY HAS BEEN USED IN THE LABORATORY AND UNDERWATER IN CONJUNCTION WITH STILL PHOTOGRAPHY AND DIRECT OBSERVATION TO RECORD THE APPROPRIATE RESPONSES. TIME LAPSE MOVIES IN PARTICULAR HAVE PROVEN USEFUL IN PROVIDING A LARGE, READILY QUANTIFIABLE DATA BASE WHICH PERMITS SMALL SHIFTS IN CORAL POLYP BEHAVIOR TO BE DISCERNED. A COMBINATION OF FIELD AND LABORATORY EXPERIMENTS HAVE REVEALED THAT 1) VERY HIGH CONCENTRATIONS OF SOME DRILLING FLUIDS CAN IMPAIR THE SEDIMENT REMOVAL ABILITY OF SOME CORALS; 2) AVERAGE DAILY POLYP EXPANSION MAY BE REDUCED BY EXPOSURE TO LOW CONCENTRATIONS OF DRILLING FLUID IN SEAWATER RANGING FROM LESS THAN 1 MICRO L/L TO GREATER THAN 1,000 MICRO L/L, DEPENDING ON THE SPECIES OF CORAL BEING EXPOSED AND THE PARTICULAR DRILLING FLUID USED; 3) DEATH (TO SOME OR ALL INDIVIDUALS OCCURRED WITHIN 96 HOURS WHEN 3 SPECIES (MONTASTREA ANNULARIS, AGARICIA AGARICITES, AND ACROPORA CERVICORNIS) WERE EXPOSED TO 1,000 MICRO L/L OF ONE DRILL MUD. FOUR OTHER SPECIES (PORITES DIVARICATA, P. FURCATA, P. ASTREOIDES, AND DICHOCOENIA STOKESII EXPERIENCED NO MORTALITY AT THIS CONCENTRATION, WHICH WAS THE HIGHEST USED IN ANY OF THE SUSPENDED DRILLING MUD EXPERIMENTS. EFFECTS OF CHRONIC (GREATER THAN 30 DAYS) EXPOSURE TO DRILLING FLUIDS HAVE NOT BEEN INVESTIGATED. SENSITIVITY OF DIFFERENT SPECIES OF CORAL WAS SEEN TO BE AT LEAST PARTIALLY RELATED TO THEIR NORMAL ECOLOGICAL NICHES. THOSE SPECIES NORMALLY FOUND IN AREAS WHICH EXPERIENCE CONSIDERABLE EXPOSURE TO RESUSPENDED SEDIMENTS WERE GENERALLY ALSO FOUND TO BE MORE TOLERANT TO SUSPENDED DRILLING FLUIDS. FOR EXAMPLE, DICHOCOENIA STOKESII WAS NOT SIGNIFICANTLY AFFECTED BY 1,000 MICRO L/L OF DRILLING MUD, WHILE MONTASTREA ANNULARIS WAS AFFECTED BY 100 MICRO L/L OF THE SAME MUD, AND KILLED WITHIN 96 HOURS BY 1,000 MICRO L/L MUD. TOXICITY OF INDIVIDUAL DRILLING FLUIDS APPEARS TO VARY 100 FOLD OR MORE. SOME DRILLING FLUIDS INDUCE BEHAVIORAL RESPONSES AT RATHER HIGH DILUTIONS [10 (4)-10 (6): 1]. A POTENTIAL FOR SUBLETHAL EFFECTS ON CORAL FROM DRILLING FLUID DISCHARGES APPEARS TO EXIST WHEN THESE DISCHARGES OCCUR UPSTREAM OF A NEARBY REEF AND NO AMELIORATING MEASURES ARE EMPLOYED.

WHITE, DAVID C., JANET S. NICKELS, MICHAEL J. GEHRON, JEFFREY H. PARKER, ROBERT F. MARTZ, AND NORMAN L. RICHARDS. IN PREP. BIOCHEMICAL MEASURES OF CORAL METABOLIC ACTIVITY, NUTRITIONAL STATUS AND MICROBIAL INFECTION WITH EXPOSURE TO OIL AND GAS WELL DRILLING FLUIDS. (ERL,GB X394).

THE REEF BUILDING CORAL MONTASTREA ANNULARUS WAS EXPOSED CONTINUOUSLY TO SUSPENSIONS OF OIL AND GAS-WELL DRILLING FLUIDS AT CONCENTRATIONS OF 0.1 ML LITER (-1), 0.01 ML LITER (-1), AND 0.001 ML LITER (-1) IN FLOWING SEAWATER AT THE U.S. NAVAL STAGE I PLATFORM (30 DEGREES 7.5 ' N, 85 DEGREES 46.3' W). AFTER 6 WEEKS EXPOSURE, CORAL FRAGMENTS OF 30 TO 60 CM SQUARED SURFACE AREA WERE BROKEN OFF, RINSED IN SEAWATER, AND EXTRACTED IN A ONE-PHASE CHLOROFORM-METHANOL SEAWATER EXTRACT AND RETURNED TO THE LABORATORY. IN THE LABORATORY, THE EXTRACTION WAS COMPLETED AND THE LIPIDS WERE ANALYZED FOR THEIR PHOSPHOLIPID CONTENT, ALKYL FATTY ACID COMPOSITION, AND NEUTRAL LIPID TRIGLYCERIDE GLYCEROL. THE AQUEOUS PHASE WAS ANALYZED FOR FREE AMINO ACID COMPOSITION. BIOCHEMICAL EVIDENCE OF STRESS WAS REFLECTED IN THE CESSATION OF GROWTH AS MEASURED IN DEPRESSED DIACYL PHOSPHOLIPID. DETAILED ANALYSIS OF THE ACYL FATTY ACID COMPOSITION BY CAPILLARY GAS CHROMATOGRAPHY SHOWED CHANGES IN POLYENOIC FATTY ACIDS SUGGESTING POSSIBLE CHANGES IN THE METABOLISM OF THE FATTY ACIDS INDUCED BY THE EXPOSURE TO THE DRILLING FLUIDS. THERE WAS NO SIGNIFICANT EFFECT ON THE LEVEL OF TRIGLYCERIDE GLYCEROL. THE CORAL ALSO SHOWED INCREASED LEVELS OF THE FREE ASPARTIC ACID AND A DOSE-RESPONSE RELATED DECREASE IN THE FREE GLUTAMIC ACID WITH EXPOSURE. THIS EVIDENCE SUGGESTS THAT BIOCHEMICAL ANALYSIS OF METABOLIC ACTIVITY AND NUTRITIONAL STATUS MAY BE USEFUL AS MARKERS FOR POLLUTION INDUCED CHANGES IN REEF BUILDING CORALS AND THUS FOR MONITORING CORAL REEFS.

WHITE, DAVID C., ROBERT H. FINDLAY, STEVEN D. FAZIO, RONALD J. BOBBIE, JANET S. NICKELS, WILLIAM M. DAVIS, GLEN A. SMITH, AND ROBERT F. MARTZ. 1980. EFFECTS OF BIOTURBATION AND PREDATION BY MELLITA QUINQUIESPERFORATA ON SEDIMENTARY MICROBIAL COMMUNITY STRUCTURE. IN: ESTUARINE PERSPECTIVES. VICTOR S. KENNEDY, EDITOR, ACADEMIC PRESS, NEW YORK, NY. PP. 163-171. (ERL,GB X129*).

PROCESSING OF SAND BY SAND DOLLARS (ECHINODERMATA: MELLITA QUINQUIESPERFORATA) RESULTED IN MODIFICATION OF THE BENTHIC MICROBIAL COMMUNITY WITHOUT A SIGNIFICANT EFFECT ON GROSS NUTRIENT BALANCES. MEASURES OF CELLULAR AND MEMBRANE BIOMASS (TOTAL ADENOSINE NUCLEOTIDES, LIPID PHOSPHATE AND CHLOROPHYLL A) WERE ESSENTIALY UNCHANGED. MURAMIC ACID CONCENTRATION AND THYMIDINE INCORPORATION INTO DNA, WHICH ARE MEASURES OF PROKARYOTIC BIOMASS AND ACTIVITY, REMAINED UNCHANGE. TOTAL METABOLIC ACTIVITY, MEASURED AS ACETATE INCORPORATION INTO LIPID, WAS UNCHANGED. LIPID GLYCEROL AND THE INOSITOL AND GLUCOSAMINE REMAINING IN THE EXTRACTED RESIDUE WERE REDUCED IN THE PROCESSED SEDIMENT, AS WAS SULPHOLIPID BIOSYNTHESIS. FATTY ACIDS CHARACTERISTIC OF PROKARYOTES WERE ENRICHED WHEREAS FATTY ACIDS CHARACTERISTIC OF MICROEUKARYOTES DECREASED IN PROCESSED SANDS. THE SAME WAS TRUE FOR THE LIPID NEUTRAL CARBOHYDRATES. EXAMINATION OF MEIOFAUNA SHOWED SIGNIFICANT REDUCTION IN FORAMINIFERA, SUGGESTING THAT SAND DOLLARS ARE SELECTIVE PREDATORS FOR A PORTION OF THE NONPHOTOSYNTHETIC MICROEUKARYOTES, HAVING LITTLE EFFECT ON THE BIOMASS OR METABOLIC ACTIVITY OF BENTHIC PROKARYOTES.

WHITE, D.C., R.J. BOBBIE, J.S. NICKELS, S.D. FAZIO, AND W.M. DAVIS. 1980. NONSELECTIVE BIOCHEMICAL METHODS FOR THE DETERMINATION OF FUNGAL MASS AND COMMUNITY STRUCTURE IN ESTUARINE DETRITAL MICROFLORA. BOT. MAR. 23(4):239-250. (ERL,GB X128*).

ASSAY OF LIPID AND CELL WALL COMPONENTS CAN READILY PROVIDE DIFFERENTIATION IN RECIPROCAL MIXTURES OF BACTERIA AND FUNGAL MONOCULTURES. TO TEST NATURAL MICROBIAL ASSEMBLIES, SMALL PLASTIC SHEETS WERE EXPOSED IN A SUBTROPICAL ESTUARY. THE SHEETS WERE THEN TRANSFERRED TO A LABORATORY WHERE ESTUARINE ENVIRONMENTS THAT INHIBIT PROKARYOTIC GROWTH AND STIMULATED FUNGAL GROWTH WERE COMPARED WITH AND ENVIRONMENT WHERE EUKARYOTIC GROWTH WAS INHIBITED AND PROKARYOTIC GROWTH WAS STIMULATED. THE MORPHOLOGY DETERMINED BY SCANNING ELECTRON MICROSCOPY SHOWED TYPICAL MYCELIAL NETWORKS WHERE EUKARYOTIC GROWTH WAS STIMULATED AND NONE WHERE INHIBITED. THE STIMULATION OF EUKARYOTIC GROWTH PRODUCED A GREATER BIOMASS MEASURED IN TERMS OF LIPID PHOSPHATE, RESPIRATORY ACTIVITY OR EXTRACTABLE ADENOSINE NUCLEOTIDES, BUT WITH A SLOWER SYNTHESIS OF PHOSPHOLIPIDS AND DNA AND A SMALLER CONCENTRATION ON MURAMAIC ACID (A UNIQUE PROKARYOTE WALL COMPONENT). THE STIMULATION OF EUKARYOTIC GROWTH INCREASED THE RATE OF SULPHOLIPID SYNTHESIS RELATIVE TO DNA OR PHOSPHOLIPID SYNTHESIS.

WHITE, DAVID C. 1982. BIOCHEMICAL DETERMINATION OF BIOMASS AND COMMUNITY STRUCTURE OF ESTUARINE DETRITAL AND SEDIMENTARY MICROBIOTA. IN: IMPACT OF XENOBIOTIC CHEMICALS ON MICROBIAL ECOSYSTEMS, U.S. FISH WILDL. SERV. TECH. PAP. NO. 107. U.S. FISH AND WILDLIFE SERVICE, WASHINGTON, DC. PP. 22-28. (ERL,GB X375*).

SEDIMENTARY MICROBIAL BIOMASS, METABOLIC ACTIVITY, NUTRITIONAL STATUS, AND COMMUNITY STRUCTURE WERE DETERMINED BY THE ANALYSIS OF EXTRACTABLE LIPIDS AND HYDROLYSIS PRODUCTS OF THE LIPID EXTRACTED RESIDUE. THESE METHODS HAVE BEEN VALIDATED BY ANALYSIS OF MIXTURES OF MICROBIAL MONOCULTURES; BY COMPARISONS WITH MONOCULTURES ISOLATED FROM MICROBIAL ASSEMBLIES; BY SCANNING ELECTRON MICROSCOPIC ANALYSIS OF DETRITAL MICROBIAL ASSEMBLIES MANIPULATED WITH ANTIBIOTICS, NUTRIENTS, AND LIGHT; AND BY MEASUREMENTS OF THE EFFECTS OF GRAZING BY SELECTIVE DEPOSIT FEEDING INVERTEBRATES. THESE METHODS HAVE SHOWN THAT MG/L CONCENTRATIONS OF XENOBIOTICS IN FLUIDS USED IN OIL AND GAS WELL DRILLING SIGNIFICANTLY MODIFY THE BIOMASS AND COMMUNITY STRUCTURE OF MICROBIAL ASSEMBLIES COLONIZING MARINE SAND. SUCH METHODS ENABLE ESTIMATION OF VALIDITY OF THE USE OF MICROCOSM TEST SYSTEMS IN PREDICTING THE IMPACTS OF XENOBIOTICS IN THE FIELD. THESE METHODS COULD GREATLY STRENGTHEN THE LEGAL APPLICABLILITY OF THE DATA FOR USE BY REGULATORY AGENCIES IN PROTECTION ESTUARINE ECOSYSTEMS.

WIERNICKI, C. 1984. ASSIMILATION EFFICIENCY BY PROCAMBARUS CLARKII FED ELODEA (EGERA DENSA) AND ITS PRODUCTS OF DECOMPOSITION. AQUACULTURE. 36(3):203-215. (ERL,GB X372*).

ELODEA CUT INTO TWO INITIAL PARTICLE SIZES (2.0 CM SECTIONS AND 3.0 MM(2) FRAGMENTS) UNDERWENT MICROBIAL DECOMPOSITION FOR PERIODS OF 0, 15, 33, AND 45 DAYS, AND THEN WAS FED TO FOUR SIZE CLASSES OF CRAYFISH (2.0, 3.5, 5.0, AND 9.0 CM). ASSIMILATION EFFICIENCY WAS DETERMINED BY CONOVER'S METHOD. ALL FOUR SIZE CLASSES OF CRAYFISH ASSIMILATED 15-DAY DETRITUS MORE EFFICIENTLY THAN 0-DAY DETRITUS. TWO-CM CRAYFISH ASSIMILATED 33-DAY DETRITUS MORE EFFICIENTLY THAN 15- OR 0-DAY DETRITUS. IN ALL OTHER CASES, ASSIMILATION EFFICIENCY WAS REDUCED. RADIOTRACER TECHNIQUES UTILIZING 14C WERE USED TO DETERMINE THE PERCENTAGE OF CARBON ASSIMILATED IN THE FORM OF PLANT FRAGMENTS COMPARED WITH THE PERCENTAGE ASSIMILATED IN THE FORM OF MICROORGANISMS. RESULTS INDICATE AN INVERSE RELATIONSHIP BETWEEN CRAYFISH SIZE AND THE PERCENTAGE OF CARBON ASSIMILATED IN THE FORM OF MICROORGANISMS.

YINGST, J. Y., AND D. C. RHOADS. IN PRESS. STRUCTURE OF SOFT-BOTTOM BENTHIC COMMUNITIES IN THE VICINITY OF THE TEXAS FLOWER GARDEN BANKS GULF OF MEXICO. ESTUARINE COASTAL SHELF SCI. (ERL,GB 503).

BIOLOGICAL AND SEDIMENTOLOGICAL SAMPLES WERE OBTAINED IN JUNE 1980 FROM BOX CORES TAKEN IN 100-200 METERS OF WATER ON SANDY-MUD SEDIMENTS NEAR THE EAST AND WEST FLOWER GARDEN BANK (FGH) REEFS, ON THE TEXAS-LOUISIANA CONTINENTAL SHELF. THE OBJECTIVE WAS TO OBTAIN NEEDED AND UNKNOWN BASELINE INFORMATION ABOUT SEDIMENTARY PARAMETERS AND ORGANISMS OF THE FGB ENVIRONMENT TO ALLOW INFERENCES TO BE MADE ABOUT THE POTENTIAL EFFECTS OF PHYSICAL DISTURBANCES OF THE SEAFLOOR ON THE INDIGENOUS BENTHOS. BOTH MICROBIAL ATP AND BACTERIAL BIOMASS ARE LOWER THAN REPORTED FOR GEORGIA BIGHT SHELF, BRAZIL-AMAZON RIVER SHELF, CAP BLANC, WEST AFRICAN SHELF, WESTERN COAST OF NORWAY, AND LONG ISLAND SOUND. BACTERIAL COUNTS ARE COMPARABLE TO THE AMAZON RIVER SHELF AND LOWER THAN THOSE RECORDED FOR THE EAST CHINA SEA. MODERATE TO LOW STANDING STOCKS OF BENTHOS FURTHER SUGGEST THAT THIS AREA OF THE GULF OF MEXICO IS A RELATIVELY OLIGOTHROPHIC SYSTEM FOR INFAUNAL BENTHIS CONSUMERS. THE GREATEST POTENTIAL DELETERIOUS PHYSICAL DISTURBANCE TO THE FGB SYSTEM IS AN INFLUX OF DRILLING MUDS FROM NEARBY OIL DRILLING OPERATIONS. HIGHER ORDER SUCCESSIONAL STAGES ARE IN GENERAL ADVERSELY AFFECTED TO A GREATER EXTENT THAN PIONEERING STAGES BY PHYSICAL DISTURBANCE. IN THE TEXAS-LOUISIANA SHELF REGION, DILUTION OF AN ALREADY OLIGOTROPHIC SYSTEM BY INERT BARIUM SULPHATE WOULD BE EXPECTED TO RESULT IN EVEN LOWER STANDING STOCKS OF PIONEERING INVERTEBRATES THAN MIGHT OTHERWISE OCCUR.

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