

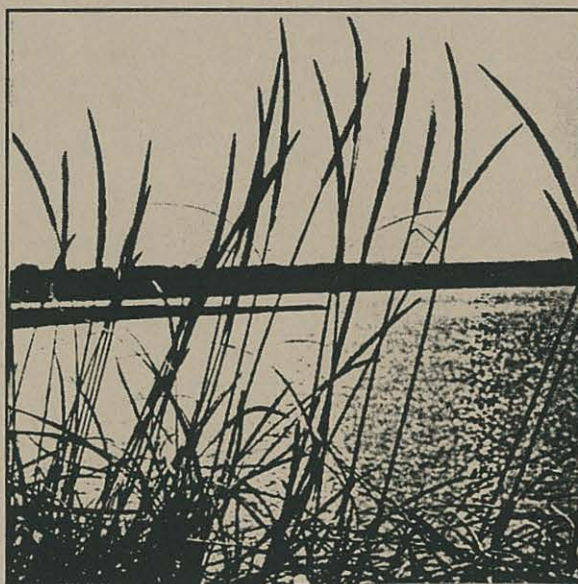
GC  
1080  
.N634  
no. 91-2  
c.2

NOAA TECHNICAL MEMORANDUM CS/NOPPO 91-2



**THE FEDERAL EFFORT  
TO EVALUATE  
COASTAL WETLAND  
MITIGATION**

Washington, D.C.  
April 1991



**NOAA** National Oceanic and Atmospheric Administration  
Office of the Chief Scientist  
National Ocean Pollution Program Office

**THE FEDERAL EFFORT TO EVALUATE COASTAL  
WETLAND MITIGATION**

**A Report by the National Ocean Pollution Policy Board's  
Habitat Loss and Modification Working Group**

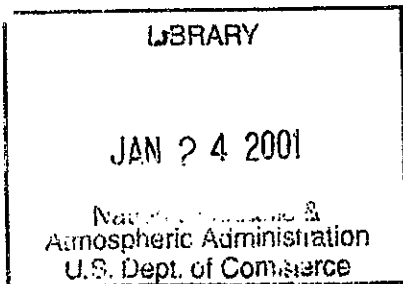
Sari J. Kiraly  
National Oceanic and Atmospheric Administration  
Office of the Chief Scientist  
National Ocean Pollution Program Office

Ford A Cross  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Southeast Fisheries Science Center  
Beaufort Laboratory

John D. Buffington  
U.S. Fish and Wildlife Service  
Region 8, Research and Development

**DUPLICATE  
WITHDRAWN**

GC  
1080  
.N634  
no.91-2  
CZ



April 1991

**U.S. DEPARTMENT OF COMMERCE**  
Robert A. Mosbacher, Secretary

**National Oceanic and Atmospheric**  
John A. Knauss, Administrator

**OFFICE OF THE CHIEF SCIENTIST**  
Sylvia A. Earle, Chief Scientist



## CONTENTS

	Page
Preface	iii
Abstract	1
Introduction	2
Overview of Wetland Restoration and Creation Research	2
Overview of Wetland Mitigation Project Follow-up Studies	6
Conclusions and Recommendations	9
Appendix A: Workshop Topics and Presenters	
Appendix B: Habitat Loss and Modification Working Group	

NOTE: An Appendix volume containing workshop presentation summaries is available upon request from the National Ocean Pollution Program Office.

## PREFACE

This report was prepared by the National Ocean Pollution Policy Board's Habitat Loss and Modification Working Group (Working Group), which is an interagency technical committee established by the National Ocean Pollution Policy Board pursuant to recommendations contained in the current National Marine Pollution Program Federal Plan for Ocean Pollution Research, Development, and Monitoring: Fiscal Years 1988-1992 (Federal Plan). The Working Group is jointly chaired by the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS). The activities of the Working Group are coordinated through NOAA's National Ocean Pollution Program Office, which also directed preparation of the Federal Plan.

Understanding the effects of losing or modifying marine habitats as a result of human activities is one of six goals identified in the Federal Plan. The Working Group was charged with conducting projects which would address recommendations outlined in the Federal Plan for achieving this goal at the Federal level and to arrive at products which would be useful for Federal agencies planning and conducting habitat programs. Three study areas were selected: coastal wetland mapping, coastal habitat loss, and coastal wetland mitigation. This report concerns wetland mitigation. The initial two topics are addressed in other Working Group reports.

The Working Group addressed the topic by assessing the Federal effort to evaluate coastal wetland mitigation as a means to compensate for loss of natural wetlands. Two aspects of mitigation are addressed: wetland restoration and creation research and follow-up studies for Federally-permitted mitigation projects. In order to gather the necessary information, a workshop which included representatives from pertinent Federal agency programs was held in January 1991 at San Diego State University, San Diego, California. This report is based on a series of presentations by the Federal program representatives and on subsequent workshop discussions. The report presents an overview of what currently is being done by the Federal agencies, identifies deficiencies, and offers the Working Group's recommendations on what could be done to improve the Federal effort to understand how coastal wetlands function and evaluate the relative value of restored and created wetlands.

# THE FEDERAL EFFORT TO EVALUATE COASTAL WETLAND MITIGATION

Sari J. Kiraly  
National Oceanic and Atmospheric Administration  
Office of the Chief Scientist  
National Ocean Pollution Program Office

Ford A Cross  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Southeast Fisheries Science Center  
Beaufort Laboratory

John D. Buffington  
U.S. Fish and Wildlife Service  
Region 8, Research and Development

**ABSTRACT.** The practice of mitigation whereby modification or destruction of natural wetlands is permitted providing the loss is compensated for by restoration or creation of another wetland site is increasingly becoming a subject of concern. The Habitat Loss and Modification Working Group examined the Federal effort to evaluate coastal wetland mitigation through wetland restoration and creation research and through follow-up studies which evaluate the success of Federally-permitted mitigation projects. The Working Group recommends that the Federal effort, particularly that of monitoring and evaluating the outcome of Federally-permitted projects which affect coastal wetlands, could be improved substantially. In addressing this recommendation, a committee to promote coordination of habitat restoration and creation research should be established. In addition, more research should focus on understanding how coastal wetland ecosystems function, and a system for evaluating the functional success of mitigation projects should be established as part of a national permit-tracking system.

## INTRODUCTION

Under authority of Section 404 of the Clean Water Act (Federal Water Pollution Control Act, as amended, Pub.L. 92-500) and Section 10 of the Rivers and Harbors Act of 1899 (30 Stat. 1151), the U.S. Army Corps of Engineers (COE) may issue permits for construction projects which modify or destroy natural wetlands, providing the wetland loss is compensated for, or mitigated, by the restoration or creation of another wetland site. However, the relative value of a restored or created site compared to the natural one is virtually unknown. Although the new habitat may appear structurally similar to a natural one, it may not be functionally equivalent in terms of supporting living marine resources or in nutrient cycling.

Increasingly, mitigation is becoming an important issue, particularly as concern has arisen that it may be used as a means to attain the national goal of no-net-loss of wetlands. It is essential, therefore, that we gain a better understanding of the effectiveness of habitat restoration and creation. Additionally, under Superfund legislation and the Oil Pollution Act, Federal agencies are mandated to participate in damage assessment and restoration of trust resources. For these restoration projects the best methodologies must be employed, and this also requires that we improve our understanding of the effectiveness of available approaches.

Two important aspects of the mitigation issue are wetland restoration and creation research; and follow-up studies to evaluate the success of mitigation projects, such as those required by permits issued under Section 404 of the Clean Water Act. In this report, with the focus on coastal wetlands, we summarize information presented to the National Ocean Pollution Policy Board's Habitat Loss and Modification Working Group (Working Group) on a series of Federal programs conducting work in these areas. In addition, based on this information, we present the Working Group's conclusions as to the perceived status and effectiveness of the overall Federal effort and provide recommendations on what could be done to improve our understanding of how natural coastal wetland ecosystems function and the relative value of created and restored wetlands.

### OVERVIEW OF WETLAND RESTORATION AND CREATION RESEARCH

Several Federal agencies are presently conducting habitat restoration and creation research. These include the National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS), Minerals Management Service (MMS), U.S. Army Corps of Engineers (COE), and U.S. Environmental Protection Agency (EPA). Although the work conducted by the EPA primarily has involved freshwater wetland habitats, it is included in this report because of its applicability to work which needs to be addressed in coastal areas.

## National Oceanic and Atmospheric Administration

NOAA supports coastal wetland restoration and creation research through the National Sea Grant College Program (NSGCP), the Coastal Ocean Program (COP), and at the National Marine Fisheries Service's (NMFS) regional fisheries research centers. Some of this work is cooperatively funded by two or more of these program areas.

The NSGCP funds habitat utilization and dynamics research at coastal colleges and universities. These investigations focus on ecological processes that regulate ecosystem structure, production, and response to human-induced stresses. High priority areas of study include: studies on processes controlling habitat variability, prediction of habitat alteration associated with changes in physical environmental factors, implications of habitat change on living marine resources, and evaluating the success of efforts to restore and create habitats.

An example of the work funded through the NSGCP is the wetland mitigation research conducted at San Diego State University (SDSU). SDSU has conducted a substantial amount of research on the restoration, creation, and enhancement of coastal wetlands. As part of this effort, guidelines and methodologies for wetland restoration and assessment have been developed and published (Pacific Estuarine Research Laboratory, 1990). Currently, SDSU is cooperating with state and local agencies to study the restoration of wetlands in San Diego Bay, which were degraded as a result of highway construction. One goal of the project is to determine if three endangered species, two bird and one plant, can successfully re-establish at the restored site.

NOAA's COP Estuarine Habitat Studies (COP/EHS), initiated in 1990, has three basic objectives: (1) determine how coastal and estuarine habitats function to support living marine resources, including research on causes of degradation and methods for restoration; (2) determine the location and extent of critical habitats and their rates of change or loss; and (3) synthesize new and existing information in the form of mechanistic models of habitat function and Geographic Information Systems (GIS) which would be of use to managers in protecting, conserving, and restoring critical habitats.

NOAA has recently established a Restoration Center within NMFS. The Center is designed to: (1) develop, implement, and monitor restoration plans associated with Superfund and oil spill claims cases; and (2) further develop the research expertise in NMFS to address its restoration information needs.

The NMFS laboratories in Beaufort, North Carolina, and Galveston, Texas are conducting research on the value of created and restored coastal wetland habitats for living marine resources. Studies have included the development and evaluation of methodologies for creating seagrass habitat, and evaluation of the functional value of created and natural seagrass and saltmarsh habitats in North Carolina,



Florida, and Texas. Because of the general paucity of information on the faunal component, both laboratories are characterizing created habitat in terms of faunal composition and habitat use relative to natural habitats. Some of the studies include predator-prey relations, feeding habitats, and sediment development processes.

Both laboratories conducted research on mitigation/restoration approaches under the aegis of a NMFS-COE Memorandum of Agreement between 1985 and 1988. Pilot projects designed to demonstrate the feasibility of enhancing, creating, or restoring fishery habitat within the scope of COE projects were initiated. Subsequently, the two agencies have signed an agreement to continue the effort to enhance and create fishery habitats within the COE Civil Works Program on a national scale.

Both laboratories have also joined forces with the academic community through funding from NOAA's COP. The NMFS Beaufort Laboratory, North Carolina State University, and the University of North Carolina at Chapel Hill are conducting a study to evaluate measures of enhancing rates of habitat development through augmentation of sediments with organic matter. A similar experimental study is being carried out at San Diego State University. Additionally, the NMFS Beaufort Laboratory is conducting joint research with the University of North Carolina at Chapel Hill, East Carolina University, the University of South Florida, and the Florida Department of Natural Resources to evaluate the value of created seagrass meadows for fish and shellfish. The Galveston Laboratory, in cooperation with Texas A&M University, is conducting work designed to develop criteria for evaluating the success or failure of created salt marsh habitats in terms of sediment development, infaunal invertebrate populations, and processes important to the well-being of fish and shellfish utilizing this habitat type.

#### U.S. Fish and Wildlife Service

The USFWS National Wetlands Research Center has been conducting studies which focus on marsh management practices and the use of dredged materials for marsh creation in coastal Louisiana, and on the use of restored versus natural tidal wetlands by birds and fish in south San Francisco Bay. For the marsh management study, in each of two coastal Louisiana hydrologic basins a site enclosed by levees and fitted with a water-control structure is being compared to an unmanipulated control site. This four-year study is in its second year. Additionally, the Center is monitoring the use of dredged material for marsh creation in the active Mississippi River Delta. The study includes the use of GIS's and field investigations to determine the value of these wetlands to fish and wildlife resources, with emphasis on wintering waterfowl. Lastly, the south San Francisco Bay study concentrates on determining the functional habitat differences between a natural tidal wetland versus a man-made or restored tidal wetland and the use of each site by shorebirds, wading birds, and fish.



## Minerals Management Service

MMS has funded research on habitat functional values and mitigation in Alaska and Louisiana that relate to coastal facilities which support oil and gas development. In Alaska, MMS-supported research concerns oilfields on the arctic coastal plain, which contains the majority of the State's wetlands affected by development. Much of the coastal plain is wetland; in oilfields these wetlands have been altered locally by the mining of gravel and the placement of gravel on the tundra surface to support facilities and roads. Gravel fill conversions have affected an average of 2-3 percent of the wetlands within oilfields. Water impounded upslope from gravel fill and surface disruptions caused by vehicular traffic have affected additional acreage. Responses of fish and wildlife populations to these wetland alterations have been studied. In some cases, mitigation efforts to compensate for effects judged to be adverse have been initiated. However, much mitigation planning and effort await the outcome of ongoing studies. These studies are examining how populations respond to the landscape's physical configuration and plant community composition, and how nearness of the landscape to its original, or pristine, condition and its aesthetic appeal to humans correlates with its value as fish and wildlife habitat.

In Louisiana, MMS has supported wetland research with the goal of preparing a factual array of data and data analysis in order to determine the suitability of marsh management techniques as mitigative tools for combatting wetland loss. The study was organized into six major components: (1) a review of marsh management literature; (2) an analysis of administrative, legal, and policy issues; (3) a description of structural management techniques; (4) a description of the environmental characteristics of the coast; (5) an evaluation of marsh management effectiveness based on review of existing and newly collected field monitoring data; and (6) an ecological evaluation (i.e., synthesis) of marsh management effectiveness based on its biological effects and suitability for use in coastal Louisiana.

## U.S. Environmental Protection Agency

The EPA, in January 1986, adopted a Wetlands Research Plan (Zedler and Kentula, 1986), primarily focusing on freshwater wetlands, to assist the Agency in implementing its responsibilities to protect the Nation's wetland resources. One of three research areas, the Mitigation Component, has three goals: (1) provide a framework for making permit decisions based on the information needs of the Section 404 permitting program; (2) provide guidance for the design of projects through improved methods of creating, restoring, and enhancing wetlands and wetland functions; and (3) develop methods for describing and evaluating natural and created wetlands. In addressing these goals, trends and patterns in Section 404 permitting were analyzed to determine how the permitting process influences the extent and rate of wetland loss and to locate mitigation projects

for evaluation in the field. Databases were compiled for portions of the Section 404 permit record in Oregon, Washington, Texas, Arkansas, Missouri, Alabama, Mississippi, Louisiana, and California. Reports have been completed on all the data bases. A synthesis of information on wetland creation and restoration was developed as a provisional guidance document for personnel involved in Section 404 permitting (Kusler and Kentula, 1990).

Field studies were also conducted in freshwater areas to evaluate project design, compare created and natural wetlands, describe the development of projects over time, and develop methods for describing and evaluating wetlands. Pilot studies comparing created and natural wetlands have been conducted in Oregon, Washington, Florida, and Connecticut. Additionally, an evaluation of the success of a marsh enhancement, more than 25 years after its initiation, is being conducted in Iowa. Here, Texas A&M University is re-sampling the Elk Creek Marsh enhancement project, repeating a pre-impoundment study. The next 5-year phase of the EPA Wetlands Research Program includes wetland restoration as one of the major areas for research.

#### OVERVIEW OF WETLAND MITIGATION PROJECT FOLLOW-UP STUDIES

Although several agencies are involved in the Federal permit process, there are few efforts at the Federal level to monitor the progress and outcome of coastal wetland mitigation projects performed under Federal permit requirements. Agencies involved in the Federal permit process include the U.S. Army Corps of Engineers (COE), NOAA's National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), and the Environmental Protection Agency (EPA).

#### The U.S. Army Corps of Engineers

The COE Regulatory Program makes decisions on mitigation requirements on a permit-by-permit basis for all types of activities it regulates. The COE mitigation policy states that impacts on wetland projects for which it issues permits must be avoided to the extent practicable, applying a sequenced approach of first avoiding impacts without compensatory mitigation and then minimizing, rectifying, and reducing impacts, and finally compensating for unavoidable impacts based on the functions and values of the resources at issue. In assessing these values, the COE employs its Wetlands Evaluation Techniques (WET), and the USFWS's Habitat Evaluation Procedures (HEP) (both are methodologies for applying selected criteria in evaluating the relative ecological value of a habitat), or other generally recognized aquatic site assessment techniques, and the best professional judgement of Federal and state agency representatives. In applying mitigation practices, there is a preferential approach of on-site rather than off-site mitigation, with restoration of degraded wetlands having priority over creation of new wetlands.

Replacement is done on a 1:1 basis, based on functions and values or acre for acre.

In coastal areas, the COE's Civil Works Program includes navigation improvements, beach erosion control, shore protection, and storm damage protection. These projects often adversely impact the environment, requiring some type of mitigation to offset these damages. The COE generally uses the USFWS HEP to develop mitigation measures for its projects. The COE also conducts an incremental cost-effectiveness analysis on its mitigation measures. COE policy on monitoring mitigation measures is that monitoring will be limited to that oversight activity necessary to ensure that required mitigation is implemented. The COE does not periodically evaluate whether or not mitigation measures are producing the desired results.

#### U.S. Army Corps of Engineers/National Oceanic and Atmospheric Administration

NOAA's NMFS Southwest Regional Office recommended to the COE that a compensatory mitigation project be required for issuance of a Section 404 permit to the Port of Long Beach, California for a dredge and fill project. Subsequently, NMFS has worked closely with the COE and the Port of Long Beach in developing the mitigation project. The objectives of this project have been to restore and improve the nursery of juvenile fish, provide a new least-tern feeding area, provide additional habitat for migratory birds within a regional complex of wetlands, and provide nesting habitat for light footed clapper rails.

To evaluate the performance of the mitigation project, a 2.5-year monitoring program was begun in April 1990. Performance will be evaluated in three ways: (1) an assessment of fish utilization and food web support which will be done using the Biological Evaluation Standardized Technique (BEST), a 3-D computer model which compares quantitative bimonthly estimates of standing stock, nursery function, spawning, and food availability for a number of target species of fish to values found at a reference area in the Anaheim Bay wetlands; (2) weekly or biweekly standardized bird counts which will be used to compare abundances and diversity at the mitigation sites to those in the reference area; and (3) annual vegetation surveys which will determine the degree of establishment of marsh grasses. Results to-date suggest the beginnings of a successful mitigation project.

#### National Oceanic and Atmospheric Administration

NOAA's NMFS regional offices review and comment on COE Section 404 and Section 10 permit actions, Federal Energy Regulatory Commission permits, and Environmental Impact Statements and Reports. To varying degrees, depending on the region, NMFS offices track and document individual permit actions, including the acreage potentially affected within the habitat of concern, amount of habitat modification or loss deemed acceptable by NMFS, amount of habitat modification or loss

authorized under the permit, and the amount of mitigation required. However, on both the part of the permitting and the resource agencies involved in the permit review process, in most cases there is no follow-up for permit compliance once a permit is issued.

One component of NMFS, the Northern Area Office of the NMFS Southwest Regional Office, is currently developing a program to better track permits after they have been reviewed by the Office. This involves a number of measures to address goals that include better planning, monitoring, and enforcement of mitigation projects. First, to improve the overall assessment of permitted impacts and the potential for successful mitigation, the Office is working to obtain access to a number of available resource planning data bases, including those of the EPA, California Department of Fish and Game, and the University of California. Second, the Office is developing a new data base system to better track permits after they have been reviewed. Every project that includes mitigation will be entered into the NMFS database, and will include such information as: required acreage and habitat types to be created; applicant name, address, and phone number; exact locations of the project site and the mitigation site; and dates by which various project milestones are to be met. A system design is envisioned that will include daily notification of projects to be reviewed. When a project is found to be out of compliance with the original permit application, the COE will be advised.

#### U.S. Fish and Wildlife Service

Mitigation projects involving loss of forested wetlands (bottomland hardwood and cypress-tupelo) have been surveyed by the USFWS National Wetlands Research Center for the Gulf of Mexico region, where these habitats are among the most important and extensive in that coastal zone. The Center found that, although data on losses of forested wetlands appear to be available from a variety of sources, there does not appear to be any effort to compile this information and provide an analysis of overall trends for the coastal zone. Three types of forested wetland mitigation projects were surveyed by the Center: (1) small scale projects such as dredged material planting and mitigation for small scale development projects; (2) agricultural field reforestation; and (3) large scale attempts to restore hydrology. Based on the survey results, the Center identified research needs related to forested wetland mitigation in the Gulf of Mexico coastal zone to include data on the extent of losses and future threats to the resources (e.g., sea level rise), development of improved seeding and planting technologies, and technologies for restoring hydrology.

## CONCLUSIONS AND RECOMMENDATIONS

The Federal effort in coastal habitat restoration and creation research, and particularly the effort to monitor and evaluate the outcome or value of Federally-permitted coastal habitat mitigation projects, should be improved substantially. The following specific recommendations offered by the Working Group may assist in achieving this goal.

**A committee should be established to promote coordination of habitat restoration and creation research carried out by the Federal agencies.** Presently, there is no comprehensive mechanism for coordinating habitat restoration and creation research at the interagency level. Those cooperative efforts which exist are the result of cooperation between individual investigators or programs and do not appear to be adequate. It is recommended that an interagency committee be established to act as a forum for pulling together information on the mitigation research activities of each Federal agency and to identify opportunities for interagency cooperation or new program development. Better coordination among Federal agencies could assure that funding is being applied to the highest priority issues, programs are focusing on appropriate goals and objectives, duplication of effort is minimized, and the information generated is reaching the appropriate users. It is further recommended that the National Ocean Pollution Policy Board investigate the necessary steps to implement this interagency forum.

**Habitat restoration and creation research should focus on the function of coastal wetland ecosystems.** Understanding function is a necessary prerequisite for determining ecosystem value, a critical datum for resource managers when making decisions regarding mitigation projects. Presently, several Federal agencies are supporting research to better understand the structure and function of natural, created, and restored coastal wetland habitats. However, more intensive and better coordinated efforts are needed to understand how natural coastal ecosystems function in order to evaluate the relative success of created or restored habitats. Of particular importance is the need for additional information on the characteristics of natural wetland function and the degree to which created wetlands function like natural ones. Based on sound scientific data, indicators should be identified which signal the overall condition or health of the system, guidelines should be drawn for acceptable levels of created wetland ecosystem function, and criteria should be developed to evaluate the success of mitigation projects. It is recommended that the National Ocean Pollution Policy Board investigate the potential for assembling a formal mechanism to address these issues. This mechanism should focus on encouraging the development of more comprehensive and coordinated Federal research to better understand coastal wetland ecosystem function.

A system for evaluating the outcome of coastal habitat mitigation projects performed under Clean Water Act Section 404 permits should be established as part of a national permit-tracking system. Although the COE and NMFS have developed systems to track permit actions, and NMFS has initiated a regional effort to follow-up on permit-related mitigation projects, Federal agencies generally lack sufficient resources to routinely monitor the outcome of the mitigation projects which are required. It is not clear how much monitoring is taking place and who is doing it. In an effort to correct this situation, a cross-cutting analysis of expenditure by the agencies should be performed to determine the relationship between the cost of mitigation to permittees and the cost of the permitting program in evaluating success or failure. Finally, degree of success or failure of mitigation projects should be used by resource managers in permit decisions and in evaluating the requirements of mitigation projects on a case-by-case basis.

#### Literature Cited

- Kusler, J.A. and M.E. Kentula (eds.) 1990. Wetland Creation and Restoration: The Status of the Science. Island Press, Washington, D.C.
- Pacific Estuarine Research Laboratory. 1990. A Manual for Assessing Restored and Natural Coastal Wetlands with Examples from Southern California. California Sea Grant Report No. T-CSGCP-021. University of California, La Jolla, California.
- Zedler, J.B. and M.E. Kentula. 1986. Wetlands Research Plan. EPA/600/3-86/009. U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, Oregon. National Technical Information Service Accession Number PB86 158 656/AS.

**APPENDIX A: WORKSHOP TOPICS AND PRESENTERS**



**HABITAT LOSS AND MODIFICATION WORKING GROUP**

**WORKSHOP ON FEDERAL EFFORTS TO EVALUATE COASTAL WETLAND MITIGATION**

San Diego State University  
North Life Sciences Building, Room 101  
San Diego, California

January 16-18, 1991

**PRESENTATIONS**

**Research**

**National Oceanic and Atmospheric Administration**

**Mitigation Research in the Office of Oceanic and Atmospheric  
Research and in the Coastal Ocean Program Office**

Dr. John Sutherland  
Office of Oceanic and Atmospheric Research  
National Oceanic & Atmospheric Administration  
1335 East West Highway, Room 5226  
Silver Spring, MD 20910

**Assessing Restored and Natural Coastal Marshes:**

Dr. Joy Zedler  
San Diego State University  
College of Sciences  
Department of Biology  
San Diego, CA 92182

**Mitigation and Restoration Research at the National Marine  
Fisheries Service Beaufort Laboratory**

Dr. Gordon Thayer  
National Marine Fisheries Service  
Southeast Fisheries Science Center  
Beaufort Laboratory  
Beaufort, North Carolina 28516

**Mitigation and Restoration Research at the National Marine  
Fisheries Service Galveston Laboratory**

Dr. Thomas Minello  
National Marine Fisheries Service  
Southeast Fisheries Science Center  
Galveston Laboratory  
4700 Avenue U  
Galveston, TX 77550

**U.S. Fish and Wildlife Service**

**Status, Mitigation Efforts, and Research Needs for Forested  
Wetlands Along the Gulf of Mexico Coastal Zone**

Mr. James Allen  
National Wetlands Research Center  
1010 Gause Boulevard  
Slidell, Louisiana 70458

**Minerals Management Service**

**Arctic Alaska Wetlands: Habitat Functional Values and Mitigation**

Dr. Joseph Truett  
LGL Alaska Research Associates, Inc.  
450 South Ash Street  
Flagstaff, Arizona 86004

**A Study of Marsh Management Practice in Coastal Louisiana**

Dr. Donald Cahoon  
Louisiana Geological Survey  
P.O. Box G  
Baton Rouge, LA 70893

**U.S. Environmental Protection Agency**

**Mitigation Research in the U.S. Environmental Protection Agency  
Wetland Research Program**

Dr. Mary Kentula  
U.S. Environmental Protection Agency  
Environmental Research Laboratory  
200 Southwest 35th Street  
Corvallis, OR 97333

Follow-up Studies

U.S. Army Corps of Engineers

**Mitigation in the U.S. Army Corps of Engineers Regulatory Program**

Mr. Kirk Stark  
Operations, Construction and Readiness Division  
CECW-OR  
20 Massachusetts Avenue, NW  
Washington, DC 20314-1000

**Mitigation and the U.S. Army Corps of Engineers Federal Projects**

Mr. John Bellinger  
Office of Environmental Policy, CECW-RE  
20 Massachusetts Avenue, NW  
Washington, DC 20314

U.S. Army Corps of Engineers/National Oceanic and Atmospheric Administration

**Monitoring Ecological Responses to a Large-scale Wetlands Project**

Dr. Arthur Barnett  
MEC Analytical Systems  
2433 Impala Drive  
Carlsbad, VA 92008

National Oceanic and Atmospheric Administration

**Efforts to Improve Mitigation tracking in Northern California**

Mr. Christopher Mobley  
National Marine Fisheries Service  
Southwest Region, Northern Area Office  
777 Somona Avenue, Room 325  
Santa Rosa, CA 95404

U.S. Environmental Protection Agency

**An Approach to Setting Performance Criteria and Design Guidelines  
for Mitigation Projects**

Dr. Mary Kentula  
U.S. Environmental Protection Agency  
Environmental Research Laboratory  
200 Southwest 35th Street  
Corvallis, OR 97333

**APPENDIX B: HABITAT LOSS AND  
MODIFICATION WORKING GROUP**

**HABITAT LOSS AND MODIFICATION WORKING GROUP**

**CO-CHAIRS:**

Dr. John D. Buffington  
Regional Director for Research and Development  
U.S. Fish and Wildlife Service  
U.S. Department of the Interior  
18th and C Streets, NW, Room 3245  
Washington, DC 20240  
202/208-6394 (FAX: 202/208-4674)

Dr. Ford A Cross  
Laboratory Director  
Beaufort Laboratory, Southeast Fisheries Science Center  
National Marine Fisheries Service  
National Oceanic and Atmospheric Administration  
Beaufort, North Carolina 28516-9722  
919/728-8724 (FAX: 919/728-8784)

**COORDINATOR:**

Ms. Sari J. Kiraly  
Ecologist  
National Ocean Pollution Program Office, CS/OP  
National Oceanic and Atmospheric Administration  
Universal Building, Room 625  
1825 Connecticut Avenue, NW  
Washington, DC 20235  
202/606-4243 (FAX: 202/387-8945)

Mr. Frank Baxter  
Chief, Office of External Coordination  
National Mapping Division  
U.S. Geological Survey  
590 National Center  
Reston, VA 22097  
703/648-5112 (FAX: 703/648-5585)

Mr. John W. Bellinger  
Environmental Planner  
Office of Environmental Policy, CECW-RE  
U.S. Army Corps of Engineers  
20 Massachusetts Avenue, NW  
Washington, DC 20314-1000  
202/272-0130 (FAX: 202/272-1163)

Dr. Virginia Carter  
Biologist  
Water Resources Division  
U.S. Geological Survey  
430 National Center  
Reston, VA 22092  
703/648-5897 (FAX: 703/648-5274)

Mr. Don Field  
Marine Resource Specialist  
Ocean Assessments Division  
National Ocean Service, N/OMA31  
National Oceanic and Atmospheric Administration  
6001 Executive Boulevard, Room 305  
Rockville, MD 20852  
301/443-0453 (FAX: 301/984-9356)

Dr. Robert Middleton  
Marine Biologist  
Branch of Environmental Operations  
Minerals Management Service  
U.S. Department of the Interior  
Mail Stop 644  
381 Elden Street  
Herndon, VA 22070  
703/787-1737 (FAX: 703/787-1010)

Ms. Dorene Robb  
Environmental Protection Specialist  
Office of Wetlands Protection  
U.S. Environmental Protection Agency  
A-104F  
401 M Street, SW  
Washington, DC 20460  
202/245-3906 (FAX: 202/475-8000)

Mr. Michael Slimak, Deputy Director  
Office of Environmental Processes and  
Effects Research  
and  
Mr. Steve Cordle, Team Leader  
Office of Environmental Processes and  
Effects Research  
U.S. Environmental Protection Agency  
RD-682  
West Tower, Room 609  
401 M Street, SW  
Washington, DC 20460  
202/382-5950 (FAX: 202/382-6370)

Dr. John Sutherland  
Ecological Specialist  
Office of Oceanic Research Programs  
National Sea Grant College Program  
Oceanic and Atmospheric Research  
National Oceanic and Atmospheric Administration  
1335 East West Highway, Room 5226  
Silver Spring, MD 20910  
301/427-2435 (FAX: 301/427-2799)

Dr. Billy M. Teels  
National Biologist  
Soil Conservation Service  
U.S. Department of Agriculture  
South Agriculture Building, Room 6144  
P.O. Box 2890  
Washington, DC 20013  
202/447-5991 (FAX: 202/447-2646)

Dr. Bill Wilen  
Fish and Wildlife Biologist  
National Wetlands Inventory  
U.S. Fish and Wildlife Service  
400-ARLSQ  
U.S. Department of the Interior  
18th and C Street, NW  
Washington, DC 20240  
703/358-2201 (FAX: 703/358-2232)