Summary of Proceedings: NOAA Coastal Wetlands Workshop

Rockville, Maryland
April 29, 1986

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Ocean Assessments Division
Office of Oceanography and Marine Assessment
National Ocean Service

Southeast Fisheries Center
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National Marine Fisheries Service

National Oceanic and Atmospheric Administration
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Introduction

This document summarizes the issues, recommendations and conclusions of a workshop sponsored by the National Oceanic and Atmospheric Administration (NOAA) on April 29, 1986 in Rockville, Maryland. The purpose of this workshop was to bring together individuals with experience in wetland mapping and management to discuss NOAA's efforts to date and plans to compile a comprehensive national coastal wetland data base. Sixteen professionals from six different federal organizations participated in the workshop. This effort is being conducted jointly by the Strategic Assessment Branch (SAB) of the Ocean Assessments Division of the Office of Oceanography and Marine Assessment, National Ocean Service, and the Beaufort Laboratory of the Southeast Fisheries Center, National Marine Fisheries Service (NMFS), both components of NOAA. A list of workshop participants, the workshop agenda, a review of the general topics of discussion, and a work plan outlining the next steps in NOAA's coastal wetland data base development are included.

The specific objectives of the workshop were to:

- o Review current information on the distribution and extent of coastal wetlands
- o Outline the requirements for expanding this data base
- o Develop recommendations for proceeding with NOAA's future work on coastal wetlands

Background

Existing data have been compiled on the extent and distribution of coastal wetlands of the conterminous USA and summarized in a publication titled: An Inventory of the Coastal Wetlands of the USA (Alexander *et al.*, 1986). These data indicate the presence of over 11 million acres of wetlands along the Atlantic Coast, Gulf of Mexico, and West Coast of the USA. Approximately 4.4 million acres are designated as salt marsh, 1.5 million acres as fresh marsh, 0.2 million acres as tidal flats, and 5 million acres as swamp. The Gulf of Mexico has the most wetlands (5.2 million acres) followed by the Southeast (4.2 million acres), the Northeast (1.7 million acres), and the West Coast (0.2 million acres). Detailed information on data sources and a complete table of wetland types by coastal county are presented in two appendices in the Inventory.

While the existing data are incomplete and often outdated, the Inventory represents the first attempt to compile a comprehensive data base for this important national resource. The fundamental obstacle to consolidating these data into a national data base is a lack of consistency between the 23 data sources consulted. In response to this problem NOAA has explored the possibility of developing a consistently derived coastal wetland data base from U.S. Fish and Wildlife Service National Wetland Inventory (NWI) wetland maps. Preliminary tests using a grid sampling technique to estimate wetland distribution and areal extent from these maps are promising. Development of a national data base using this technique was a major focus of the workshop.

Development of a comprehensive and consistent national inventory of coastal wetlands is one of several interrelated activities of NOAA's National Estuarine Inventory (NEI). Each is structured to develop information leading to a national estuarine assessment capability. This is part of a larger effort of strategic assessments of the nation's coastal and oceanic resources. When completed, data from the wetlands inventory will eventually be used in conjunction

with other biological, physical, hydrologic, land use, and economic data being developed for the 92 estuaries identified in the NEI. When completed these data will allow federal agencies, congressional committees, and others who must make programmatic and legislative decisions affecting estuarine resources, the opportunity to evaluate them as an entire resource base rather than as isolated resource units.

General Topics of Discussion

Issue 1: Will a comprehensive coastal wetland data base be useful?

Discussion: NMFS hopes to use such wetland data to help evaluate the quality and abundance of coastal fisheries habitat.

The U.S. Fish and Wildlife Service/National Coastal Ecosystems Team (FWS/NCET) felt that such a data base, if modified somewhat to include more wetland types, would be particularly useful at the program planning and budgeting levels of federal agencies responsible for coastal wetlands and their associated resources.

The U.S. Army Corps of Engineers (COE) indicated that the national data base described by NOAA would not be useful for individual permit decisions. However, such data will be useful at a programmatic and planning level for regional and national decision-making.

The U.S. Environmental Protection Agency (EPA) was particularly interested in wetland data for coastal areas included in the EPA Bays program: Chesapeake Bay (MD&VA), Buzzards Bay (MA), Narragansett Bay (RI), Puget Sound (WA), and Long Island Sound (NY&CT). San Francisco Bay (CA), Delaware Bay (NJ, DE&PA), Pamlico Sound (NC), and the state of Florida were also mentioned by participants as high priority areas.

Recommendations: The consensus of workshop participants was that a comprehensive national coastal wetland data base would represent a significant contribution to our current understanding of coastal resources, particularly in areas where digital data are unavailable and resource use conflict issues now exist.

Issue 2: What methods are available for compiling a national coastal wetland data base?

Discussion: Landsat imagery, both multi-spectral scanner (MSS) and thematic mapper (TM) data, were discussed as potential data sources. The FWS/NCET stated that MSS was difficult to work with and generally incapable of accurately identifying wetland areas. TM, which has been used with local success in coastal Florida and elsewhere, has, in the opinion of the U.S. Fish and Wildlife Service/ National Wetlands Inventory (FWS/NWI) and SAB, yet to be proven over large coastal areas with variable geography and wetland types. TM is also expensive, up to $6,500 per scene, and requires trained personnel to process.

Land Use/Land Cover data (LU/LC) from the USGS was also mentioned as a possible candidate since coverage is nationwide and consistently derived from high-altitude aerial photography (HAAP). However, participants unanimously dismissed LU/LC data from consideration primarily because wetlands are classified only as forested or non-forested.

Digitizing NWI wetland maps using the current FWS procedure was also proposed. FWS/NCET estimates there are about 2,000 "coastal" NWI wetland maps for the contiguous USA over 600 of which are digitized. However, NOAA estimates that over 4,000 NWI maps would be required to complete coverage for the 92 Estuarine Drainage Areas (EDA's) identified for the NEI. FWS has no plans to digitize large numbers of NWI maps. In addition it is not clear whether the current digitizing procedure is cost-effective for the level of data resolution required by NOAA.

Grid sampling was suggested by NOAA as an alternative to using the existing coastal wetland data (which include some digital data) or digitizing the remaining coastal NWI maps with the FWS procedure. Preliminary tests of grid sampling indicate that a typical 1:24,000 scale NWI map can be accurately measured for six general habitat categories (salt marsh, fresh marsh, tidal flats, swamp, open water, and upland) with approximately 950 sampling points (45 acre cells) in about an hour by two people. The cost of doing this manually (i.e. without computer automation) is less than $100 per map. The cost increases somewhat if a computer is used to automate acreage calculations and print a map based on the classification of each cell. In contrast, digitizing an NWI map by the FWS can cost up to $1,000 per map and take 4-5 working days to complete.

Recommendations: Participants agreed that some techniques for determining areal extent of wetlands, such as digitizing NWI maps, could supply satisfactory data but were generally inadequate in relation to NOAA's cost and time constraints. It was therefore recommended that grid sampling NWI wetland maps be further investigated for the development of a comprehensive national coastal wetland data base. NWI maps were recommended as the most reliable source of coastal wetland information available on a national scale.

Issue 3: Are four wetland categories adequate for a national coastal wetland data base?

Discussion: This issue received more attention than any other issue. NOAA first described how it proposed to consolidate the various wetland types depicted on NWI maps into four general categories: salt marsh; fresh marsh; tidal flats; and swamp.

NMFS was particularly interested in adding submerged aquatic vegetation (SAV) because of its importance to coastal fisheries. However, the FWS pointed out that because of problems in detecting SAV with high altitude photographs, it is not consistently mapped nationwide and therefore should not be included.

NMFS also wanted to see a distinction between high and low salt marsh while FWS wanted to see a distinction between salt marsh and brackish marsh. FWS also felt that the most serious weakness of NOAA's existing four category system was that, when applied to NWI maps, habitats

were lumped across ecological system level boundaries as defined by the FWS wetland classification system (e.g. Cowardin *et al.*, 1979). For example, estuarine scrub/shrub habitats were lumped with palustrine scrub/shrub. This makes it impossible to distinguish the relative abundance and distribution of two very different habitat types.

FWS also suggested that since waters within each estuary of the NEI are classified according to salinity, NOAA should try to break out salt, brackish, and fresh marsh the same way. However, classifing wetlands such that they correspond with the salinity zones defined for each estuary (i.e., tidal fresh: 0.0-0.5 ppt, mixing: 0.5-25.0, seawater: > 25.0) could be difficult since the NWI maps are based on the Cowardin classification system which defines these areas somewhat differently (i.e. fresh: 0.0-0.5, mixohaline (brackish): 0.5-30.0, euhaline: 30.0-40.0, hyperhaline: >40.0).

The COE was interested in separating tidal mudflats from sandflats, beaches, and other "flats" since these categories are treated differently in COE permits. However, participants generally agreed that trying to separate mud flats from other tidal flats would not be worth the additional effort required.

Recommendations: The consensus was that four categories of wetland type (salt marsh, fresh marsh, tidal flats, and swamp) were not adequate. After some discussion the group settled on eleven general categories which it considered an acceptable minimum for the data to be useful. These were:

1. High salt marsh
2. Low salt marsh
3. Brackish marsh
4. Estuarine forested-scrub/shrub
5. Tidal fresh marsh
6. Tidal fresh forested-scrub/shrub
7. Tidal flats (includes beaches etc.)
8. Non-tidal fresh (includes emergents, forested, scrub/shrub)
9. Open water - fresh
10. Open water- non-fresh
11. Upland.

Issue: 4. Is grid sampling an adequate method for developing a coastal wetland data base?

Discussion: Discussion regarding the adequacy of a grid sampling approach focused primarily on comparing data generated by grid sampling with FWS digital estimates for selected areas. Grid sampling estimates for six general habitat categories (four general wetland types and open water and uplands) over 16 NWI maps (over 650,000 acres) were presented by NOAA. These estimates were within two percent of FWS digital totals for the same maps for all but one habitat category, swamp (0.18 percent of the total area), which was within 13 percent of the digital estimate. Accuracy varied somewhat from map to map depending on how much of a particular habitat was present and how it was distributed.

USGS pointed out that if more than six habitat categories are identified (as described above), the accuracy of distribution and acreage estimates will decline, all other factors remaining constant. This led to a discussion about possibly stratifying the sampling effort such that coastal areas with relatively few wetlands are sampled more intensively (smaller cell size) than coastal areas with relatively abundant wetlands. The exact number of sampling points (cell size) required for estimating wetland categories from an NWI map with a reasonable degree of accuracy, based on FWS digital estimates, can be calculated *a priori* using statistical sampling theory methods.

FWS described reservations about the use of grid sampled wetland data to measure trends in coastal wetlands. FWS also described a major weakness in NOAA's proposed grid sampling procedure as being its inability to identify and measure rare, yet possibly important, wetland types with accuracy. COE mentioned that while grid sampling may be incapable of capturing rare habitat, it can still serve as an indicator of general abundance for those habitats.

Finally, the FWS/NWI indicated that if NOAA can demonstrate the accuracy of grid sampling for quantifying NWI maps at a satisfactory level of detail and develop a national coastal wetland data base, the data base could serve to better focus the attention of wetland research and management. The FWS/NWI also suggested that such a grid sampling technique could eventually replace more detailed digitizing procedures for the development of general wetland information over large areas.

Recommendations: Workshop participants generally agreed that grid sampling NWI maps would be more appropriate than using either MSS or TM data from satellite imagery to develop a national coastal wetland data base. However, the USGS recommended that NOAA evaluate stratifying the sampling technique such that the ability to capture relatively rare wetland types represented on NWI maps is improved. USGS also suggested that NOAA do a more complete statistical evaluation of the grid sampling routine. One idea was to first determine exactly the population being sampled (e.g. a single map - 950 points at a 45 acre cell size vs. dozens of maps - many thousands of points) and then determine the appropriate statistical design including standard deviation and standard error as measured against FWS digital data. NOAA's current test results present only percent difference from FWS digital estimates.

(On May 20, 1986 members of the wetlands team met with representatives from the USGS Mapping Division to discuss the adequacy of NOAA's grid sampling procedure. The major focus of the meeting was to determine whether the 45 acre cell size was adequate for capturing the areal extent of 11 habitat categories. Equations to determine minimum acceptable sample size were calculated at several levels of acceptable error and degrees of confidence. These calculations indicate that the 45 acre cell size is more than adequate to fill NOAA's data needs. It was also determined that the 45 acre cell size could be used nationwide and stratification by coastal region would not be necessary.)

The FWS recommended that NOAA not use data derived from grid sampling to look at coastal wetland trends, as these will generally be too small to detect at the proposed level of resolution.

Issue: 5. Will NOAA's efforts to develop a national coastal wetland data base duplicate other wetland inventory programs?

Discussion: Workshop participants knew of no other nationwide projects to develop information on coastal wetlands. Although wetland maps have been completed for most coastal areas by the NWI, only a fraction have been digitized. Therefore very little wetland acreage data are presently available. Since the current FWS digitizing procedure is very expensive and time consuming, a complete data base of NWI coastal maps is not anticipated in the near future.

However, the FWS pointed out that although Rhode Island, New Jersey, and Delaware are the only states completely mapped and digitized by the NWI, Massachusetts, Connecticut, and Maryland are close to completion.

Recommendations: The FWS recommended that, where they are available, NOAA should, if possible, use digital rather than grid sampled data as they are more accurate. FWS suggested that NOAA test an area to see if there will be any difficulty intersecting NOAA's Estuarine Drainage Area (EDA) boundaries with existing digital data. If this turns out to be a simple procedure, FWS recommended that NOAA use it.

References

Alexander, C.E., M.A. Broutman and D.W. Field. 1986. An inventory of coastal wetlands of the USA. National Oceanic and Atmospheric Administration. Washington, D.C. 25 p. (mimeo).

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79/31. Washington, D.C. 103 p.

Conclusions

- Comprehensive coastal wetlands data is not currently available at the national level or expected to be available over the next 2-3 years.

- A comprehensive coastal wetland data base could greatly improve the ability to manage and protect this important natural resource, particularly at the programmatic level of federal resource management.

- Development of such a data base by NOAA will not duplicate any work completed or in progress of any other federal agency.

- Wetland data developed by NOAA will, where applicable, be organized by estuary based on NOAA's National Estuarine Inventory.

- A wetland classification scheme for a national data base should be based on the FWS's system (Cowardin) and, if possible, include a minimum of 10 wetland categories to be useful.

- National Wetland Inventory maps represent the most reliable source of coastal wetland information currently available on a national scale for the contiguous USA. Any program to develop national wetland data should be based upon these maps.

- If NWI wetland maps are to be quantified for wetland data through use of a grid sampling technique, a statistical design should first be developed in order to fully understand the strengths and weaknesses of the technique.

- Where detailed digital data are available for NWI maps, they should, if feasible, be used instead of grid sampled data for development of a national data base.

- Once additional tests with cell size and wetland categories are completed, NOAA will systematically begin grid sampling NWI maps. Results will be published in a series of regional reports and will, where possible, include previously derived digital data. The first report is expected to be completed by early fall 1986.

Work Plan For Developing A Comprehensive Coastal Wetland Data Base

Task	Approximate Date
- Begin grid sampling in Northeast	May 1986
- New computer procedure utilizing a digitizing tablet and color mapping techniques on line	July 1986
- Report on wetlands of the Northeast region	October 1986
- Integrate wetlands data into projects at OAD and NMFS	October 1986-May 1988
- Report on wetlands of the Mid-Atlantic region	February 1987
- Report on the Southeast region	June 1987
- Report on the east Gulf Coast region	September 1987
- Report on the west Gulf Coast region	December 1987
- Report on the West Coast region	March 1988

Workshop Participants

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Workshop Agenda

April 29, 1986

MORNING

1. Background Presentations

9:00	Introduction to Ocean Assessments Division and Strategic Assessment Branch Activities
9:30	National Estuarine Inventory Activities
10:00	Coastal Wetlands Data Collected To Date by the Strategic Assessments Branch
10:30	Break

2. Developing a National Data Base

10:45	Problems and Issues of Developing a National Coastal Wetland Data Base
11:15	A Grid Sampling Procedure Alternative: Test Case Results and Demonstration of Technique

3. Discussion

11:45	Summary of Morning Presentations and Review of Key Issues to be Discussed in Afternoon Session
12:00	Break for Lunch

AFTERNOON

1:15	In Depth Discussion of Key Issues
3:00	Break
3:15	Outline Methods to Address Key Issues
4:00	Outline Workshop Recommendations and Possible Follow-Up Action
4:30	Workshop Ends