

National Marine Fisheries Service Habitat Conservation Efforts in the Coastal Southeastern United States for 1987

ANDREAS MAGER, Jr., and RICKEY RUEBSAMEN

Introduction

The coastal southeastern region of the United States covered by the National Marine Fisheries Service (NMFS) includes eight states from North Carolina to Texas and Puerto Rico and the U.S. Virgin Islands, along with the territorial seas and the Exclusive Economic Zone out to 200 miles. The region contains 2,799 miles of coastline with 29,900 miles of tidal shoreline, or about 56 percent and 54 percent, respectively, of the

total coastline and shoreline of the contiguous United States (Shalowitz, 1964; Orlando et al., 1988).

The more than 300 estuarine systems located in the southeast contain about 17.2 million acres of marsh and other estuarine habitat (Lindall and Thayer, 1982) and 5.1 million acres of intertidal areas (de la Cruz, 1981). The region's coastal wetlands comprise about 83 percent of the coastal wetlands in the coterminous United States; 46 percent for the Gulf of Mexico and 37 percent for the South Atlantic area (Alexander et al., 1986). The region contains all of the nation's mangrove swamp wetlands, which total between 400,000 and 650,000 acres (Odum et al., 1982). Most of the nation's seagrasses also are located in the southeast region. These vital wetlands are seldom included in wetland surveys because of the difficulty in mapping them. These remaining seagrasses could increase current wetland acreage in the region by at least 40 percent (Thayer and Fonseca¹).

It is the general consensus of estuarine fisheries scientists that about 96 percent of commercial and 70 percent of recreational fishery resources in the southeast are estuarine dependent. During 1987, about 2.8 billion pounds of fish and shellfish, excluding Puerto Rico and the U.S. Virgin Islands, were commercially harvested from estuarine and marine habitats of the region (NMFS, 1988). These resources were worth

about \$850 million at dockside, but may generate at least three times this value as the product moves through processing stages and wholesale and retail markets. The combined harvest of fish and shellfish in the region represents 41 percent of the amount and 28 percent of the value of the fishery resources taken in the United States. Recreational fisheries information is available only for 1985 and earlier. However, during 1985, 11 million recreational fishermen caught about 222 million fish in the southeast (Schmied and Burgess, 1987). That year the southeast also accounted for over 40 percent of the nation's saltwater anglers, 62 percent of all trips, 50 percent of the catch by number of fish, and over 55 percent (\$3.4 billion) of all direct expenditures made nationally by saltwater anglers (Schmied and Burgess, 1987).

The importance of wetlands and their role in providing habitat for fish and shellfish are well documented (Smith et al., 1966; Douglas and Stroud, 1971; Lindall, 1973; Turner, 1977; Lindall and Saloman, 1977; Peters et al., 1979; Thayer and Ustach, 1981). Despite their great importance, coastal wetlands are being lost at an alarming rate (Tiner, 1977; 1984). Alexander et al. (1986) reported that based on data in Frayer et al. (1983), for the last 25 years, coastal

Andreas Mager, Jr., is with the Habitat Conservation Division, Southeast Region, National Marine Fisheries Service, NOAA, 9450 Koger Boulevard, St. Petersburg, FL 33702. Rickey Ruebsamen is with the Habitat Conservation Division, Southeast Region, National Marine Fisheries Service, NOAA; present address: Louisiana State University, Center for Wetland Resources, Baton Rouge, LA 70803.

ABSTRACT—Data quantifying the cumulative acreage of coastal habitat affected by Corps of Engineers (COE) programs that regulate development in wetlands of the southeastern United States are provided for 1987. The National Marine Fisheries Service (NMFS), Southeast Region, made recommendations on 4,713 water development proposals submitted by or to the COE. Of these, 1,054 proposed to alter 21,756 acres of fishery habitat through 3,506 acres of dredging, 2,899 acres of filling, 1,303 acres of draining, and 14,048 acres of impounding. The NMFS did not object to alteration of 8,135 acres and recommended the conservation of 13,621 acres. To offset habitat losses, 7,139 acres of mitigation were recommended by NMFS or proposed by applicants and/or the COE. Of the wetland alterations accepted by NMFS, nearly 5,000 acres involved impounding for marsh management in Louisiana. A follow-up survey of 266 permits issued by the COE during 1987 revealed that only 46 percent of NMFS recommendations were accepted by the COE. On a permit by permit basis, 25 percent of NMFS recommendations were partially accepted, 21 percent were completely rejected, and 8 percent were withdrawn.

¹Thayer, G. W., and M. S. Fonseca. 1988. Beaufort Laboratory, Southeast Fisheries Center, National Marine Fisheries Service, NOAA, Beaufort, N.C. Personal commun.

wetlands have been depleted at an average annual rate of 20,000 acres. The loss of coastal wetlands is probably greater in the southeast than elsewhere in the United States. Hefner and Brown (1985) determined that in this region these losses accounted for 84 percent of the wetland losses nationwide and this does not include losses to seagrass systems for which there is no documentation. An example is the conversion to open water of about 50 square miles of marsh per year in Louisiana (Turner, 1987).

Wetland loss or change occurs from a variety of natural and man-induced factors. Natural forces such as sea level rise, erosion, subsidence, and hydrologic changes can have a dramatic effect on wetlands, such as converting marsh to open water. Water development (e.g., construction of oil and gas access canals) also alters considerable amounts of coastal wetlands (Lindall et al., 1979). Indirect impacts of canals and spoil banks may be far more important than their direct effects (Scaife et al. 1983). Estimates of shoreline modification, dredged channels, and dredged material disposal areas in 92 of the nation's estuaries were prepared by Orlando et al. (1988). The 46 estuaries (out of 300) surveyed in the southeast comprise a surface area of about 14,500 square miles at mean low water with a shoreline of about 24,000 miles total. About 1,300 miles of the shoreline have been modified, almost 2,000 miles of navigation channels have been built, and resulting dredged material disposal areas cover nearly 300 square miles of surface area.

In view of the importance of fisheries in the southeast and the nation as a whole, the need to actively conserve wetlands and deepwater habitats is paramount. Boesch and Turner (1984) emphasize that the key to fishery management of estuarine dependent species is coastal habitat protection and enhancement. Since NMFS is the lead Federal agency responsible for the management of our nation's living marine resources, the conservation of habitat that supports these resources is of prime importance to the agency. This responsibility is carried out by the Habitat Conservation

Division (HCD), and a description of the HCD and its operations are presented by Lindall and Thayer (1982) and Mager and Thayer (1986).

The HCD has determined from habitat conservation efforts in the southeast since 1981, that direct involvement with the wetland regulatory and civil works programs of the Corps of Engineers (COE) and with other Federal agencies results in significant conservation of fisheries habitat (Lindall and Thayer, 1982; Mager and Thayer, 1986; Mager and Keppner, 1987; Mager and Hardy, 1988). The data in these reports are needed for assessing the cumulative effects of fishery habitat alterations and to determine where the NMFS habitat conservation efforts should best be directed. This paper contains the results of NMFS' 1987 habitat conservation efforts and builds on earlier reports. We recognize that the largely unquantified efforts of other state and federal natural resource agencies also play vital roles in the conservation of wetlands.

Materials and Methods

Lindall and Thayer (1982) and Mager and Thayer (1986) described the methods involved in gathering and structuring the data reported herein. Our data base contains information on the kind of project requested, its location, NMFS recommendations, kind and extent of proposed wetland alterations, and the area of impact the NMFS did not object to. Mitigation acreage also is recorded. These data provide a measure of potential cumulative wetland losses and gains as well as wetlands potentially conserved. The acreage values presented for the projects surveyed for 1987 were obtained from onsite reviews by NMFS contractors or NMFS biologists, from public notices, and from project plans where these were adequate to determine the acreage and habitat types proposed for alteration. Out of the 4,173 projects reviewed, 1,054 were used for our detailed analyses because sufficient information was available to determine accurately the area and type of wetlands requested for alteration. Data are stored on an NBI OASys 64² computer with 120 megabytes of storage and entered

using an NBI 2000 workstation. The results presented were obtained using the DBASE II database management system.

Results

The Southeast Region reviewed 56 percent of all permit requests reviewed by the NMFS throughout the United States in 1987. The NMFS evaluated and responded to 7,378 proposals nationwide for construction in wetlands and 4,173 of these were in the southeastern coastal states. Of the projects reviewed in the southeast, 2,861 (68.6 percent) received a "no objection" response because impacts on fishery habitat were perceived to be minimal or overcome through appropriate mitigation, the projects were inland, or no fishery resources under the purview of the NMFS were present. The last category amounted to 822 projects. In-depth review was given to 1,303 (31.2 percent) of the projects because probable adverse effects to fishery resources would be significant. Nine projects (0.2 percent) were not evaluated because they were in offshore areas where the COE accepts only comments pertaining to navigation or national defense.

The permit requests included the following types and number of projects: Shoreline alterations such as bulkheads, small fills, groins, and ramps (806); docks and other minor structures (740); housing developments (490); maintenance dredging (414); oil and gas exploration (373); navigation channels and marinas (251); industrial and commercial development (219); bridges and causeways (219); water, gas, and chemical pipelines (170); barriers, dams, and impoundments (158); miscellaneous activities (139); irrigation (66); sand, gravel, and other mining (63); electrical transmission lines (38); beach nourishment (22); and electric generating facilities (5).

Activities undertaken by NMFS in regard to these projects are summarized in Table 1 which lists the state, the num-

²Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

Table 1.—Number of proposed projects and acres of habitat by state involved in NMFS habitat conservation efforts for 1987. Numbers in parentheses refer to columns discussed in text.

State	No. of permit applications (1)	Acreage proposed by applicants				Acreage NMFS accepted or did not object to				Potential acreage conserved				Mitigation recommended by NMFS		
		Dredge (2)	Fill (3)	Drain (4)	Impound (5)	Dredge (6)	Fill (7)	Drain (8)	Impound (9)	Dredge (10)	Fill (11)	Drain (12)	Impound (13)	Restore acreage (14)	Generate acreage (15)	Enhance acreage (16)
TX	91	526.3	495.0	0	2.5	429.0	133.0	0	2.0	97.3	362.0	0	0.5	27.0	197.0	42.2
LA	86	548.4	740.2	1,303.0	13,439.4	244.5	284.1	0	4,737.2	303.9	456.1	1,303.0	8,702.2	198.2	60.5	6,148.0
MS	14	166.6	107.5	0	0	22.1	0.1	0	0	144.5	107.4	0	0	0.5	4.4	0
AL	24	200.7	86.8	0	0.7	115.1	29.4	0	0	85.6	57.3	0	0.7	110.0	28.7	0
FL	380	342.1	663.3	0	0.1	139.3	168.1	0	0.1	202.8	495.3	0	0	59.1	61.0	36.7
GA	66	408.5	127.5	0	0	121.3	58.9	0	0	287.2	68.6	0	0	7.2	111.1	0
SC	147	135.7	144.2	0	561.6	107.1	73.7	0	0	28.6	70.5	0	561.6	10.2	3.3	0
NC	236	1,013.8	462.4	0	43.6	986.5	440.8	0	40.0	27.3	21.6	0	3.6	5.2	28.5	0
PR	5	101.3	47.5	0	0	1.3	1.0	0	0	100.0	46.5	0	0	0	0	0
VI	5	62.2	24.2	0	0	0	0	0	0	62.2	24.2	0	0	0	0	0
Total	1,054	3,505.6	2,898.6	1,303.0	14,047.9	2,166.2	1,189.1	0	4,779.3	1,339.4	1,709.5	1,303.0	9,268.6	417.4	494.5	6,226.9

ber of permit applications where NMFS was able to obtain accurate information on area of impact, and habitat acreage involved in dredging, filling, draining, and impounding. Habitat types proposed for alteration appear in Table 2. A survey of alterations by various types of projects tracked is summarized in Table 3. Quantification of these data for the southeastern coastal states follows.

Dredging

During 1987, 3,506 acres of wetlands were proposed for dredging (Table 1, column 2). Of this total, 29 percent of all dredging was in North Carolina, 15 percent each in both Louisiana and in Texas, 11 percent in Georgia, 10 percent in Florida, 6 percent in Alabama, 5 percent in Mississippi, 4 percent in South Carolina, 3 percent in Puerto Rico, and 2 percent in the U.S. Virgin Islands. The NMFS did not object to the dredging of 2,166 acres (Table 1, column 6), but did recommend that 1,339 acres of habitat important to fishery resources not be dredged (Table 1, column 10).

Vegetated wetlands proposed for dredging totaled 605 acres, while unvegetated substrates totaled 2,900 acres. Maintenance and new dredging of existing navigation channels accounted for 1,669 acres (77 percent) of the dredging activities not objected to by NMFS (Table 3, column 6). The NMFS did not recommend against the dredging of 130 acres of vegetated wetlands, but most of

this acreage was in freshwater areas that we felt did not support marine, estuarine, or anadromous fishery resources.

Filling

Over 2,899 acres of wetlands were proposed for filling (Table 1, column 3). More than 25 percent of the total was in Louisiana, followed by Florida (23 percent), Texas (17 percent), North Carolina (16 percent), South Carolina (5 percent), Mississippi and Georgia (4 percent each), Alabama (3 percent),

Puerto Rico (2 percent), and the U.S. Virgin Islands (1 percent). While we did not object to the filling of 1,189 acres (Tables 1 and 3, column 7), we did recommend conservation of 1,710 acres (Tables 1 and 3, column 11).

The acreage proposed for filling during 1987 included 1,530 acres of vegetated wetlands and 1,369 acres of unvegetated bay bottom. The NMFS did not oppose filling of 316 acres of vegetated and 873 acres of unvegetated wetlands. These wetlands mainly were in

Table 2.—Acres of habitat, by habitat type, involved in NMFS habitat conservation efforts during 1987 (based on 1,054 projects sampled).

Habitat type	Proposed for alteration	Accepted by NMFS	Potentially conserved	Requested for mitigation
Red mangrove	35.2	0.2	35.0	40.5
White mangrove	238.5	0.9	237.6	2.1
Black mangrove	134.2	4.2	130.0	1.0
Smooth cordgrass	3,220.9	40.0	3,180.9	156.5
Black needlerush	46.3	10.4	35.9	7.8
Saltmeadow cordgrass	3,317.1	2,184.1	1,133.0	2,612.2
Saltgrass	16.2	1.0	15.2	3.9
Threecorner grass	175.7	0	175.7	0.4
Other marsh	533.9	335.7	198.2	499.0
Shoalgrass	9.0	8.6	0.4	8.7
Widgeongrass	1,952.9	1,850.2	102.7	1,831.8
Manateegrass	0.2	0	0.2	0
Turtlegrass	63.6	1.0	62.6	0.1
Eelgrass	2.8	0	2.8	0
Halophila	0.1	0	0.1	0
Algae	11.9	0.2	11.7	0
Hardwood swamp	4,399.1	135.1	4,264.0	114.4
Freshwater wetlands	1,200.9	140.8	1,060.1	200.2
Unvegetated wetlands	6,333.9	3,373.9	2,960.0	1,650.2
Oyster beds	0.2	0	0.2	0.2
Miscellaneous	62.5	48.3	14.2	9.8
Total	21,755.1	8,134.6	13,620.5	7,138.8

Table 3.—Number of proposed projects and acres of habitat by project type involved in NMFS habitat conservation efforts for 1987. Numbers in parentheses refer to columns discussed in text.

Project type ¹	No. of permit applications (1)	Acreage proposed by applicants				Acreage NMFS accepted or did not object to				Potential acreage conserved				Mitigation recommended by NMFS		
		Dredge (2)	Fill (3)	Drain (4)	Impound (5)	Dredge (6)	Fill (7)	Drain (8)	Impound (9)	Dredge (10)	Fill (11)	Drain (12)	Impound (13)	Restore acreage (14)	Generate acreage (15)	Enhance acreage (16)
SH	276	19.8	71.4	0	0.1	10.9	11.5	0	0.1	8.9	59.9	0	0	3.0	17.4	0
HO	234	150.7	574.3	933.0	2,468.7	17.6	93.1	0	0	133.1	481.2	933.0	2,468.7	33.2	22.8	21.7
NA	115	1,077.8	577.4	0	0	536.8	135.2	0	0	541.0	442.2	0	0	5.5	275.0	38.0
MD	107	1,315.4	512.4	0	0	1,132.7	328.9	0	0	182.7	183.5	0	0	120.1	8.6	0
BR	84	31.4	110.8	0	0	28.5	72.9	0	0	2.9	37.9	0	0	2.0	58.9	4.2
IN	82	231.2	309.8	0	1.1	84.9	57.1	0	0	146.3	252.7	0	1.1	30.4	39.4	15.0
OI	44	302.0	278.2	0	67.7	218.3	120.9	0	2.0	83.7	157.3	0	65.7	184.4	24.6	44.0
BA	35	94.6	79.9	370.0	11,510.3	60.0	33.9	0	4,777.2	34.6	46.0	370.0	6,733.1	15.5	16.9	6,104.0
OT	25	101.1	49.7	0	0	1.3	21.9	0	0	99.8	27.8	0	0	2.5	17.9	0
IR	22	10.5	11.2	0	0	3.9	6.0	0	0	6.6	5.2	0	0	2.2	8.5	0
BE	11	99.5	310.5	0	0	42.6	304.5	0	0	56.9	6.0	0	0	0.1	0.1	0
PI	11	5.5	3.4	0	0	5.1	2.2	0	0	0.4	1.2	0	0	7.5	0	0
TR	4	18.1	1.1	0	0	18.1	1.0	0	0	0	0.1	0	0	0	4.4	0
MI	3	38.0	1.3	0	0	0	0	0	0	38.0	1.3	0	0	0	0	0
EL	1	10.0	7.2	0	0	5.5	0	0	0	4.5	7.2	0	0	11.0	0	0
Total	1,054	3,505.6	2,898.6	1,303.0	14,047.9	2,166.2	1,189.1	0	4,779.3	1,339.4	1,709.5	1,303.0	9,268.6	417.4	494.5	6,226.9

¹(SH) bulkheads, small fills, groins, etc.; (HO) housing developments; (NA) navigation projects, marinas, etc.; (MD) maintenance dredging; (BR) bridges, roads, and causeways; (IN) commercial and industrial development; (OI) oil and gas construction; (BA) barriers, impoundments, and marsh management areas; (OT) unclassified; (IR) irrigation and drainage works; (BE) beach nourishment projects; (PI) oil, gas, and chemical pipelines; (TR) transmission lines; (MI) mining and mineral exploration; and (EL) electric plants.

freshwater areas that did not contain fishery resources under NMFS purview. More than 92 percent of the proposed filling (2,673 acres) was involved in activities related to construction for navigation projects, housing developments, maintenance dredging, beach nourishment, industrial and commercial development, oil and gas development, and bridges and causeways (Table 3, column 3).

Draining and Impounding

The NMFS recommended against the proposed draining for residential development of 1,303 acres of wooded swamp in Louisiana (Table 1, column 4). Impounding of 14,048 acres of coastal wetlands also was proposed (Table 1, column 5). The NMFS did not object to the impounding of 4,737 acres for marsh management in Louisiana (Table 1, column 9). This acreage was largely contained in two projects, one of which was previously impounded and for which management would allow draw-down to stimulate germination of marsh vegetation and provide some fishery utilization. The other project involved an area that was heavily impacted by subsidence, erosion, and saltwater intrusion. For this latter project, NMFS

agreed to limited management, provided that access by fish and shellfish to the site was maintained. In agreeing to such marsh impoundments, NMFS seeks to ensure continued or increased access by fishery resources which use the sites for feeding and maturation.

Of the 9,269 acres of proposed impounding that NMFS recommended against (Table 1, column 13), it was probable that impoundment would not maintain or enhance wetlands or there would be significant loss of use by marine and estuarine organisms. Almost 2,500 acres of this total was intended as a marsh management area to mitigate for the adverse environmental impact of one proposed housing development in Louisiana (Table 3, column 5).

Mitigation

If projects are determined by the NMFS to be water dependent (i.e., require immediate water use or access to achieve their purpose), in the public interest, and the habitat losses are unavoidable, then NMFS may recommend that resulting losses be mitigated to the "maximum extent practicable" (Lindall et al., 1979). Typical examples include navigation projects and restoration of unauthorized activities that may signifi-

cantly alter fisheries habitat. In many cases wetlands which must be only temporarily altered are recommended for restoration when their use is no longer needed. A conservative approach to mitigation is taken because the technology is still experimental; there is no guarantee that man-made wetlands will persist as permanent substitutes for sacrificed natural habitats; and we do not know whether artificial habitats produce fishery resources to the same extent as natural habitats. Coastal managers must be more specific about project requirements and goals before approval for mitigation is granted and continued research on a regional basis is needed to advance marsh establishment techniques into a proven technology (Race, 1985).

We categorized mitigation projects into three categories: Restore, generate, and enhance. The "Restore" category is represented by projects such as pipeline trenches, temporary roadways, temporary borrow areas, and in some cases the restoration of access channels for abandoned oil and gas wells (Table 3, column 14). The "Generate" category was only used when new wetlands would be created (Table 3, column 15). The "Enhance" category (Table 3, col-

Table 4.—Acres of habitat alterations involved in NMFS habitat conservation efforts between 1981-87.

Year	No. ¹	Acres proposed	Acres accepted by NMFS	Acres conserved	Acres mitigated
1981	811	7,949	2,868	5,081	2,471
1982	1,059	81,184	21,831	59,353	7,910
1983	825	20,778	8,658	12,120	26,775
1984	888	8,606	3,981	4,625	54,050
1985	1,802	65,670	11,161	54,509	19,200
1986	969	90,559	70,838	19,721	49,713
1987	1,054	21,755	8,135	13,620	7,139
Total	7,408	296,501	127,472	169,029	167,258

¹Number of projects sampled.

Table 5.—Treatment of NMFS recommendations on permits issued by Corps of Engineers (COE) District for 1987. Values in parentheses represent percent of number of permits sampled for each category.

COE district	No. ¹	NMFS recommendations accepted	NMFS recommendations partially accepted	NMFS recommendations rejected	Applications withdrawn
Wilmington	7	7 (100.0)	0	0	0
Savannah	7	6 (85.7)	0	1 (14.3)	0
Charleston	26	21 (80.8)	2 (7.7)	3 (11.5)	0
Galveston	78	43 (55.1)	11 (14.1)	5 (6.4)	19 (24.4)
Mobile	22	11 (50.0)	5 (22.7)	6 (27.3)	0
New Orleans	49	17 (34.7)	18 (36.7)	11 (22.5)	3 (6.1)
Jacksonville	77	16 (20.8)	31 (40.2)	30 (40.0)	0
Total	266	121 (45.5)	67 (25.2)	56 (21.0)	22 (8.3)

¹Number of permits sampled.

umn 16) was used primarily for marsh management areas when benefits to fisheries could clearly be demonstrated or for minor activities (e.g., oil well canal plugs) that prevent erosion or salt water intrusion or reestablish preproject hydrologic patterns.

During 1987, NMFS' Southeast Region recommended or accepted 417 acres of restoration (Table 1, column 14), 494 acres of habitat generation (Table 1, column 15), and 6,227 acres of wetland enhancement (Table 1, column 16). The greatest amount of mitigation sought was for enhancement of saltmeadow cordgrass marshes and widgeongrass beds (Table 2).

Cumulative Totals

Overall, about 21,755 acres of coastal wetlands (Table 1, columns 2+3+4+5) were proposed for alteration during 1987. The NMFS accepted or did not object to the alteration of 8,135 acres (Table 1, columns 6+7+8+9) and potentially conserved 13,621 acres (Table 1, columns 10+11+12+13). We use the term potentially because the COE may issue permits over our objections. The NMFS also recommended or accepted the restoration, generation, and enhancement of almost 7,139 acres (Table 1, column 14+15+16) to mitigate for adverse project impacts. Vegetated wetlands comprised 71 percent (15,389 acres) of the total area proposed for alteration; 58 percent (4,709 acres) of the area accepted for alteration by NMFS; 78 percent (10,680 acres) of the

area potentially conserved; and 77 percent (5,496 acres) of the area of mitigation.

Between 1981 and 1986, more than 274,746 acres of wetlands were proposed for alteration by 6,354 water-development projects (Mager and Keppner, 1987). The addition of these 1987 data brings the total area proposed to 296,501 acres by 7,408 projects (Table 4). Based on the projects surveyed, the amount of wetlands accepted for alteration by NMFS, the amount potentially conserved, and the amount potentially mitigated total 127,472; 169,029; and 167,258 acres, respectively, for the 7 years we have collected such data. The variations in the amount of potential habitat losses encountered from year to year result mainly from large projects that are sporadically proposed. For example, the larger amount of proposed alterations observed during 1986 resulted mainly from one large maintenance dredging project (>20,000 acres) and several large marsh management areas. Favorable economic conditions also may result in an increased number of proposed projects.

Effect of NMFS Recommendations

We determined how our recommendations were treated by the COE based on a survey of 266 projects (Table 5). These projects were used for our analyses because we already had information in our data base to determine the amount and type of habitat that was proposed for alteration and was recom-

mended for conservation by the NMFS. We also had copies of the issued permits to compare what had been approved by the COE. These permits all were issued during 1987, but because of the length of the review process and other factors the initial public advertisement of the work and the NMFS review may have occurred in previous years.

The overall acceptance of NMFS recommendations, as determined by their incorporation in issued COE permits, was 46 percent. NMFS recommendations were partially accepted and completely rejected 25 percent and 21 percent of the time, respectively. Applications were withdrawn by applicants for 22 (8 percent) of the projects surveyed. Table 5 ranks the COE Districts by their incorporation of NMFS habitat recommendations into issued permits. The District with the highest acceptance of NMFS recommendations was the Wilmington District (100 percent) followed by the Savannah District (85.7 percent), the Charleston District (80.8 percent), the Galveston District (55.1 percent), the Mobile District (50 percent), the New Orleans District (34.7 percent) and the Jacksonville District (20.8 percent). Based on the experiences of HCD biologists, the percentages of acceptance and partial acceptance appear to be more accurately a reflection of the decision of individual applicants to agree or partially agree to our recommendations rather than the COE's determination that applications should be

Table 6.—Acres of habitat permitted for alteration over NMFS objections during 1987 by Corps of Engineers (COE) district.

COE District	No. ¹	Acreage proposed by applicants	Acreage NMFS accepted or did not object to	Acreage COE permitted	Percent difference ²	Acreage NMFS recommended mitigation	Acreage COE permitted mitigation
Wilmington	7	2.3	1.4 (60.9) ³	1.4 (60.9) ³	0	2.5	2.5
Savannah	7	17.2	10.8 (62.8)	10.9 (63.4)	0.6	93.7	93.7
New Orleans	49	7,486.6	6,982.4 (93.2)	7,142.6 (95.4)	2.2	6,880.2	6,915.7
Charleston	26	105.3	5.7 (5.4)	18.1 (17.1)	11.7	10.9	22.9
Galveston	78	2,588.0	427.2 (16.5)	793.3 (30.7)	14.2	292.5	367.1
Jacksonville	77	128.3	47.1 (36.7)	120.1 (93.6)	56.9	17.6	21.1
Mobile	22	295.3	41.1 (13.9)	283.1 (95.9)	82.0	4.4	16.6
Total	266	10,623.0	7,515.7 (70.7)	8,369.5 (78.8)	8.1	7,301.8	7,439.6

¹Number of permits sampled.

²Percent difference column is percent habitat alterations accepted by NMFS subtracted from the percent permitted by the COE.

³Numbers in parentheses refer to percent of the acreage proposed.

revised or permits conditioned.

The 266 proposals surveyed proposed to alter 10,623 acres of estuarine fishery habitat. The NMFS did not oppose the alteration of 7,516 acres, but recommended that the remaining 3,107 acres be conserved (Table 6). Of this latter amount, the COE overrode NMFS objections and issued permits for the removal of 2,254 acres of coastal fisheries habitat. The Mobile District permitted 82 percent more alterations than recommended by NMFS, followed by the Jacksonville District (56.9 percent), Galveston District (14.2 percent), the Charleston District (11.7 percent), the New Orleans District (2.2 percent), the Savannah District (0.6 percent), and the Wilmington District (0 percent). Overall, the COE issued permits authorizing 8 percent more habitat alterations than recommended by NMFS. The variation observed in the way NMFS recommendations are treated among the COE districts may largely result from differences in the way fish and wildlife production and other wetland benefits are considered in the public interest review. This occurs because the COE districts are relatively autonomous (GAO, 1977). The public interest review determines whether or not a permit will be granted.

In 1987, 7,302 acres of mitigation were proposed or recommended to compensate for habitat lost through the permitting process. The COE incorporated 7,440 acres of mitigation into the issued permits. As previously noted, mitigation agreements not required by the COE

often resulted from negotiations between NMFS biologists and permit applicants.

Overall acceptance, partial acceptance, and rejection of NMFS recommendations were 53 percent, 23 percent, and 24 percent, respectively, from 1981 to 1986, based on examination of 1,084 issued permits (Mager and Thayer, 1986; Mager and Keppner, 1987). This trend compares closely with what we observed during 1987. The acreages of wetlands permitted for alteration by the COE exceeded NMFS recommendations by 17 percent from 1981 to 1986 as opposed to 8 percent for 1987. Table 5 provides a better indication of how the various COE districts incorporate NMFS recommendations because many small projects that can cause cumulatively large wetland losses receive equal consideration with the larger projects.

The acreages in Table 6 can change considerably with the addition of individual large projects within a COE district. For example, during 1986 the Charleston District ranked second to the Wilmington District in acceptance of NMFS recommendations on a permit-by-permit basis (Mager and Keppner, 1987). However, when acreages permitted over NMFS recommendations were examined, the Charleston District permitted the greatest amount of wetland alterations against the recommendations of the NMFS. This resulted from the permitting of one large project involving the reimpoundment of 1,050 acres of wetlands (Mager and Keppner, 1987).

Discussion

The area of proposed habitat alterations we report represents primarily that which affects resources under the purview of NMFS. Programs of the Fish and Wildlife Service, the Environmental Protection Agency, and state and local wetland conservation agencies involve additional, but usually unquantified wetland acreages.

Among the COE districts, many general permits have been developed authorizing specific activities that the NMFS is presently unable to monitor. One such example is a general permit in Louisiana that authorizes a large number of activities including oil and gas exploration when only a drilling slip would need to be dredged. During 1987, more than 600 projects were authorized by this one general permit alone. While many of the activities covered by this permit would involve only minor work, nearly 4 acres of wetland alteration are allowed for each authorized drilling slip. Some of these oil and gas activities have recently come under a review process whereby NMFS can recommend impact reduction to less than the amount that would be authorized by the general permit.

Cumulative wetland losses were to be evaluated by the COE and resource agencies on an annual basis. However, we have not been provided the information necessary to conduct a cumulative impact assessment. Similar problems apply to the other general and nationwide permits utilized in the southeast.

Relating such activities to habitat conservation concerns is compounded by the COE delegating the administration of some of the general permits to local authorities.

The importance of conserving fishery habitat has long been recognized by resource agencies, but has received varying levels of attention by the regulatory agencies that permit wetland alterations. We are concerned that public interest determinations, which are required before authorization for a water development project is granted, often may not give sufficient weight to fisheries values associated with wetlands. These values, as well as the need to maintain fishery habitats, however, have been recognized by Congress through amendment of the Magnuson Fishery Conservation and Management Act (MFCMA).

The MFCMA's new consultation procedures appear to be the congressional response to ineffective habitat protection under existing legislation such as the Fish and Wildlife Coordination Act (Kennedy, 1988). The MFCMA gives the regional fishery management councils, including the three councils in the southeast, additional authority to conserve the habitat of fish and shellfish they manage. The Gulf of Mexico Fishery Management Council's area covers the Gulf of Mexico from Texas to Florida; the South Atlantic Fishery Management Council's area covers the eastern United States from North Carolina to Florida; and the Caribbean Fishery Management Council manages fisheries in waters around Puerto Rico and the U.S. Virgin Islands.

Specifically, the regional councils are expected to include habitat information in their fishery management plans and have been given authorization to comment on and recommend changes to Federal and state activities affecting fishery habitat (Kennedy, 1988). The action agencies also are required to respond to the councils within 45 days giving a detailed account on how their concerns were addressed. The three councils in the southeast have established policies and procedures to implement the habitat provisions in the

MFCMA. We expect them to be important new partners in the NMFS habitat conservation efforts.

Conclusions

Data collected by NMFS continue to document the extent of potential wetland alterations affected by regulatory programs in the coastal southeast. In view of the cumulatively large amount of wetlands which would be altered through the COE permit process, we believe there is ample justification for some COE Districts to increase the rate at which they accept and incorporate NMFS and other resource agency recommendations into the public interest review process. The need for habitat conservation programs to manage living marine resources is demonstrated by the large area of wetlands involved in the permitting process.

The recommended mitigation of 7,139 acres could compensate for the habitat losses accepted by NMFS and some of those authorized by the COE during 1987. This, however, assumes that the required mitigation efforts were completed and were successful. It is very important to note that habitat restoration and creation efforts are still experimental. Long-term studies have not been conducted to determine their effectiveness. Efforts are underway at the NMFS Southeast Fisheries Center's Beaufort and Galveston Laboratories to study the efficiency of proposed mitigation projects. However, these efforts must be continued and expanded to obtain information needed to monitor the effectiveness of past mitigation efforts and to develop and improve techniques that NMFS biologists can use to ensure that the impacts of future projects with unavoidable losses of habitat are adequately mitigated.

Research also is necessary to assess the impacts of levees and water control structures used for marsh management, especially in Louisiana. In the last 7 years, the NMFS has been involved in the review of nearly 70 marsh management proposals potentially affecting more than 600 square miles of coastal wetlands. It has been estimated that 25 percent, or about 1 million acres, of

coastal Louisiana could be impounded by the year 2000 (Turner et al., 1988). Decisions to allow construction of new coastal impoundments for marsh management represent major Federal actions being taken without an adequate data base on which to make those decisions. Urgently needed are scientific studies to document marsh management impacts on fish and crustacean movements and habitat accessibility, and the effects of management activities on wetland health and longevity. Until such information becomes available, it is likely that developing and approving marsh management plans, which significantly affect estuarine maintenance functions, fishery productivity, and marsh loss, will continue.

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