MEXUS-Gulf Coastal Pelagic Fish Research, 1977-84

EUGENE L. NAKAMURA

Introduction

The major goal of the MEXUS-Gulf Coastal Pelagics Working Group has been to determine whether coastal pelagic fishes, with emphasis on Spanish mackerel, *Scomberomorus maculatus*, and king mackerel, *S. cavalla*, fished by both Mexico and the United States, comprise a single stock or separate stocks. Accomplishments to attain this goal during 1977-84 consisted of cooperative tagging studies, cooperative tissue sampling for electrophoretic studies, exchange of data and publications, and consultations between biologists of the two countries. Results of the tagging and electrophoretic studies are summarized briefly below.

Mackerel Tagging

Marking, or tagging, fish has long been a practical method of determining movements of fish and making inferences on stock identity. More than 8,000 fish have been tagged and released in the Gulf of Mexico, primarily off Veracruz in Mexico and off Panama City and Grand Isle in the United States (Tables 1, 2). Over 12,000 king mackerel have been tagged and released off the U.S. Atlantic coast by the Florida Department of Natural Resources (Williams and Godcharles[1]). Results of tagging mackerels in the Gulf of Mexico have been summarized by Williams and Sutherland (1979), Sutherland and Fable (1980), Vasconcelos[2], and Ramirez et al.[3]

Two types of tags were used. An anchor tag with a small plastic disc inserted into the pterygiophores was used on Spanish mackerel, while a similar tag but with a slightly larger plastic disc was inserted into the abdominal cavity of

The author is with the Panama City Laboratory, Southeast Fisheries Center, National Marine Fisheries Service, NOAA, 3500 Delwood Beach Road, Panama City, FL 32407-7499.

Table 1.—Coastal pelagic fishes tagged and released in the northern U.S. Gulf of Mexico, MEXUS-Gulf, 1977-84.

Species	No. tagged and released								
	1977	1978	1979	1980	1981	1982	1983	1984	Total
Spanish mackerel, *Scomberomorus maculatus*	262	0	14	240	0	0	28	4	548
King mackerel, *S. cavalla*	631	102	9	8	0	0	1,457	191	2,398
Little tunny, *Euthynnus alletteratus*	0	0	453	1,707	0	0	0	0	2,160
Bluefish, *Pomatomus saltatrix*	0	0	223	145	0	518	360	0	1,246
Blue runner, *Caranx crysos*	0	0	0	0	0	0	135	0	135
Ladyfish, *Elops saurus*	0	0	45	303	0	0	0	0	348
Atlantic bonito, *Sarda sarda*	0	0	63	1	0	0	0	0	64
Dolphin, *Coryphaena hippurus*	0	0	49	38	0	0	0	0	87
Greater amberjack, *Seriola dumerili*	0	0	0	2	0	0	0	0	2
Total	893	102	856	2,444	0	518	1,980	195	6,988

[1]Williams, R. O., and M. F. Godcharles. 1984. Completion report. King mackerel tagging and stock assessment. Project 2-341-R. Presented at Stock Assessment Workshop, Miami, Florida, June 1984. SAW/84/GCP/4.

[2]Vasconcelos, J. 1980. Preliminary aspects on migration of Spanish mackerel in the Gulf of Mexico coast. Paper presented at MEXUS-GULF V, Tampico, Mexico, Oct. 1980.

[3]Ramirez, E., J. Vasconcelos, and D. Mendizábal. 1982. Reporte del grupo pelagicos-costeros, I.N.P., Mexico, 1977-1982. Report presented at MEXUS-GULF VII, Veracruz, Mexico, Aug. 1982.

Table 2.—Coastal pelagic fishes tagged and released in the Mexican Gulf of Mexico, MEXUS-Gulf, 1978-83.

Species	No. tagged and released						
	1978	1979	1980	1981	1982	1983	Total
Spanish mackerel	147	314	564	0	16	0	1,041
King mackerel	0	85	0	0	19	0	104
Little tunny	0	0	1	0	58	0	59
Blue runner	0	0	0	0	3	0	3
Yellowfin tuna, *Thunnus albacares*	0	0	0	0	1	0	1
Total	147	399	565	0	97	0	1,208

Table 3.—Data on recovered fish that demonstrated international migration.

Species	Release location	Release date	Recovery location	Recovery date	Days out	Direct distance (km)
Spanish mackerel	Port Aransas, Texas	9/29/75	Veracruz, Veracruz	1/2/76	96	900
King mackerel	Naples, Florida	3/20/76	Isla Arenas, Yucatan	7/28/77	495	1,000
King mackerel	Fort Pierce, Florida	1/18/78	Veracruz, Veracruz	9/14/78	239	1,930
King mackerel	Veracruz, Veracruz	10/30/79	Port O'Connor, Texas	7/4/81	613	965
King mackerel	Grand Isle, Louisiana	12/13/83	Veracruz, Veracruz	3/13/84	91	1,200

king mackerel (Sutherland and Fable, 1980). Both tags (Fig. 1) had plastic tubing trailing externally. Posters describing the tags and announcing a reward for the recapture information and tag were distributed in both Mexico and the United States.

Recoveries in U.S. waters of king mackerel that were tagged and released in the U.S. Gulf of Mexico indicated that in the eastern Gulf these fish move north in the spring and spend their summer in the northern Gulf, then return south in the fall to spend their winter in south Florida (Sutherland and Fable, 1980, Williams and Godcharles[1]). King mackerel that have been tagged and released off Louisiana in the winter have moved westward; of about 20 recoveries of the more than 1,500 released fish, none has been recovered east of the Mississippi River.

Only one recovery in Mexican waters of a king mackerel tagged and released in Mexican waters has been recorded (Ramirez et al.[3]). This fish was one of the 70 that were tagged and released off Veracruz by biologists of the Florida Department of Natural Resources and the Instituto Nacional de Pesca. It was recovered off Progreso, Yucatan, a distance of about 800 km from Veracruz and had been at liberty for 434 days (released 31 October 1979, recovered 7 January 1981[1]).

Recoveries in U.S. waters of Spanish mackerel that were tagged and released in the northeastern Gulf off Panama City, Fla., have shown a westward spring migration (Sutherland and Fable, 1980); recoveries in Mexican waters of Spanish mackerel tagged and released off Veracruz, Veracruz, indicate a northern spring migration and southern fall migration (Vasconcelos[2], Ramirez et al.[3]).

Thus far, recoveries of four king mackerel and one Spanish mackerel have indicated international migration (Table 3). Three king mackerel tagged and released in U.S. waters have been recovered in Mexican waters, and one king mackerel tagged and released in Mexican waters has been recovered in U.S. waters (Fig. 2). One Spanish mackerel that was tagged and released off Port Aransas, Tex., in 1975 (prior to the formation of MEXUS-Gulf) was recovered off Veracruz, Veracruz, 3 months later (Fig. 2). Data from these five recoveries are obviously insufficient to draw conclusions. Cooperative tagging, therefore, is continuing with a concerted

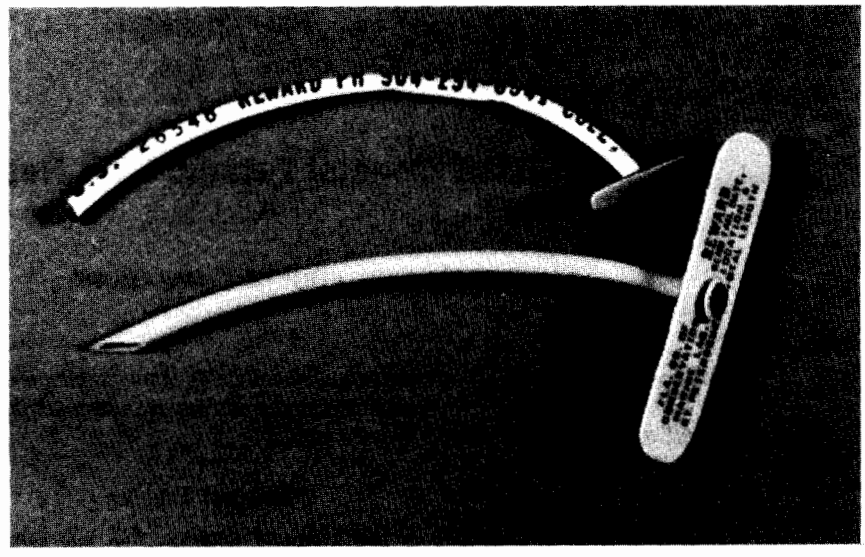

Figure 1.—Tags used in marking king and Spanish mackerels. Tag with message on plastic tubing was used on Spanish mackerel. Tag with message on disc was used on king mackerel.

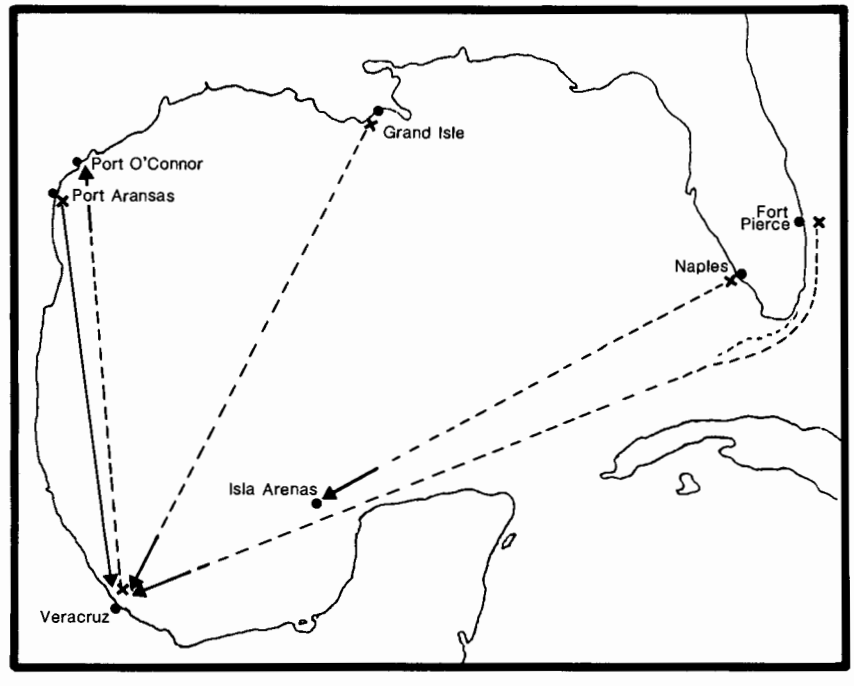

Figure 2.—Direct paths between release and recapture sites of king mackerel (dashed lines) and Spanish mackerel (solid lines). See Table 3 for details.

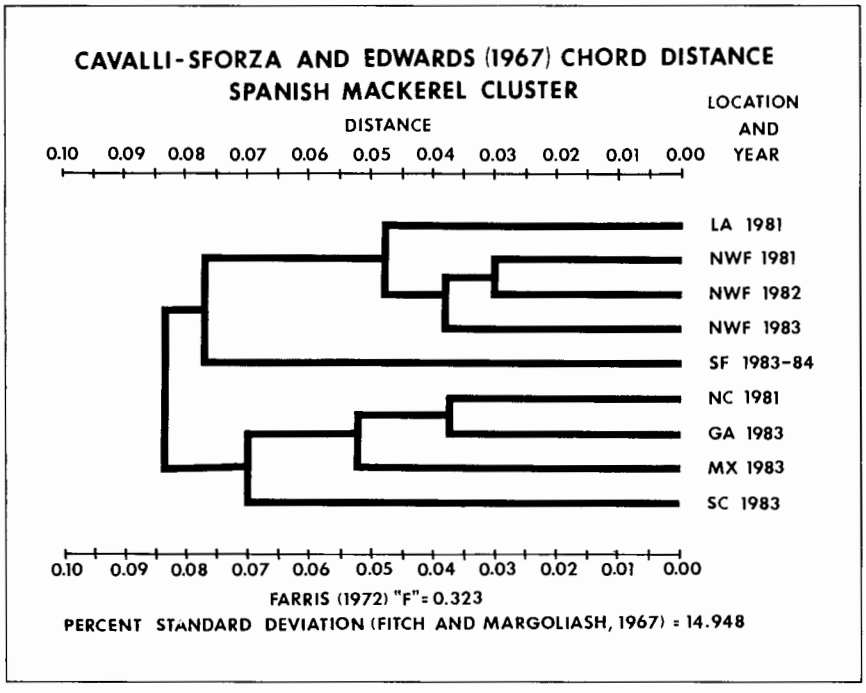

Figure 3.—Cluster dendrogram of results of electrophoretic analyses of muscle enzymes from Spanish mackerel. LA = Louisiana, NWF = northwest Florida, SF = south Florida, NC = North Carolina, GA = Georgia, MX = Veracruz, and SC = South Carolina. See Table 4 for details.

Table 4.—Samples of Spanish mackerel collected from the southeastern United States and Mexico for electrophoretic examination, 1981-84.

Location	Sampling dates	Length range[1]	Number of fish
Louisiana	Apr. 1981 and Aug. 1981	350-450	138
Northwest Florida	Apr. 1981 to Oct. 1981	350-450	295
	Mar. 1982 to Oct. 1982	350-450	281
	Apr. 1983 to Sept. 1983	250-450	305
North Carolina	Aug. 1981 and Nov. 1981	200-300	597
Georgia	May 1983	250-400	167
Mexico (Veracruz)	Oct. 1983	350-550	53
South Florida	Dec. 1983 and Jan. 1984	450-550	140
South Carolina	Oct. 1983	150-180	50

[1]Fork length in millimeters.

effort to tag and release more fish in the northwestern and southwestern sectors of the Gulf of Mexico.

Electrophoresis

Electrophoresis has been shown to be a promising method of analyzing genetic variants of proteins for stock identification. Electrophoretic analyses of muscle enzymes have been conducted on Spanish mackerel from six U.S. localities and one Mexican locality (Table 4). Over 2,000 specimens from the Gulf of Mexico and the U.S. Atlantic coasts have been examined. Forty-four loci were examined; 22 percent of these were polymorphic. Common variants were found in six muscle enzymes, while rare variants were found in six others. Although frequencies of the variants were not significantly different between groups of fish, minor genetic differences between localities were suggested by cluster analysis of the data (Fig. 3). Two major groups were suggested, one along the Georgia-Carolina coast and another in the northeastern Gulf (Louisiana-northwest Florida). The Mexican and South Carolina samples, which were few in number (Table 4), clustered with the Georgia-Carolina group. This suggests that Spanish mackerel from Veracruz may belong to a third group. Sampling in Mexico and in Texas will be emphasized in this continuing cooperative research.

Literature Cited

Sutherland, D. F., and W. A. Fable, Jr. 1980. Results of a king mackerel (*Scomberomorus cavalla*) and Atlantic Spanish mackerel (*Scomberomorus maculatus*) migration study, 1975-79. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Tech. Memo. NMFS-SEFC-12, 23 p.

Williams, R. O., and D. F. Sutherland. 1979. King mackerel migrations [Abstr.] *In* E. L. Nakamura and H. R. Bullis, Jr. (editors), Proceedings: Colloquium on the Spanish and king mackerel resources of the Gulf of Mexico. Gulf States Mar. Fish. Comm. Rep. 4, p. 57.