SEDAR5 - DW - 9

Preliminary analysis of king mackerel tag data from the Cooperative Tagging Center

by

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Sustainable Fisheries Division Contribution No. 2003 -

Present stock assessments of king mackerel are based on the assumption that Atlantic (ATL) and Gulf of Mexico (GOM) populations are separate stocks (Figs. 1 and 2). From April 1st to October 31st, the GOM stock extends from Texas to the line dividing Monroe and Collier counties on the west coast of FL (latitude 25° 10' 58"). From November 1st to March 31st, the same stock extends its distribution to the FL east coast to the Flagler-Volusia county line ((latitude 29°25' 37"). The ATL stock can be found between Maine and the Flagler-Volusia county line (latitude 29°25' 37") from November 1st to March 31st, and from Maine to the Monroe-Collier county line from April 1st to October 31st.

Table 1 shows the number of king mackerels tagged in each stock during the period 1961-2001 (Figs. 1 and 2). The tagging effort greatly increased in 1983 and remained with high levels until 1995. The annual percentage of recaptures in the period 1983-1995 for both stocks combined ranged from 2.2% to 10.2%. The total number tagged in the GOM stock was approximately 5 times higher than the number tagged in the ATL stock. The overall percentage of recaptures all years and both stocks combined was On the order of 5%.

The GOM and ATL stocks are temporally and spatially separated. Both stock can be found, at different times of the year, in the area that extends south of Monroe-Collier county line on the FL west coast and around the Florida keys north to the Flagler-Volusia county line on the east coast of FL. This zone is referred to as the 'mixing area' (Fig. 3). Table 2 summarizes the total number of animals tagged in the mixing area and later recaptured. Except for 1987, most animals tagged in the mixing area corresponded to the GOM stock.

Ninety two percent of all animals tagged in the ATL stock were recaptured in the same stock (Table 3a, Figure 4a), in contrast to only 71% in the GOM stock (Table 3b, Figure 4b). The same analysis for the mixing area shows that 87% of all the animals of the ATL stock tagged in this area were recaptured in the same stock (Figure 5a), while only 46% of the tagged GOM animals were recaptured with same stock (Figure 5b).

Fifteen of the 18 animals tagged in the ATL stock and recaptured in the GOM stock were originally tagged in the mixing area (Tables 3a and 4a). Similarly, 282 of the 287 GOM animals released and recaptured in the ATL stock were originally tagged in the mixing area (Tables 3b and 4b). Thus, 97% (297 of 305) of the animals moving from one stock to another were initially tagged in the mixing area.

It is interesting to note that most of the stock mixing is from the GOM stock to the ATL stock. Furthermore, almost all the animals that moved from the GOM stock to the ATL stock were initially tagged in the mixing area. The high proportion of GOM animals being recaptured in the ATL stock could be the result of: 1) ATL stock animals remaining in the mixing area from November to March (thus, being cataloged as part of the GOM stock) and later recaptured as part of the ATL stock either in the same area during April through October or north of the mixing area; 2) GOM animals migrating from the Gulf of Mexico into the mixing area where they were tagged and later recaptured from November to March; or 3) GOM animals tagged in the Gulf of Mexico or in the mixing area and later recaptured after migrating north of the mixing area.

The first hypothesis is not supported by the data since only 15 of the 233 ATL stock animals tagged were recovered in the mixing area as GOM animals. Thus, the potential effect of ATL animals remaining in the mixing area from November to March seems to be negligible. The second hypothesis is better supported by the data. A total of 193 GOM animals were tagged in the mixing area from November to March (all years combined) and recovered in the same area as part of the ATL stock

(April to October). Of those, 134 (69%) were recovered within the next 9 months, indicating that these animals most probably remained in the mixing area and became part of the ATL stock. The other 49 animals were recovered between 1 and 4.5 years later. Thus, it is not possible to know their migration patterns between the time of release and recapture. The third hypothesis is supported by the fact that a total of 89 GOM animals, tagged either in the Gulf of Mexico or the mixing area, were later recaptured north of the mixing area as part of the ATL stock. Thus, there is a strong indication that some animals of the GOM stock become part of the ATL stock by either remaining in the mixing area from April to October or by migrating north of the mixing area, in some cases as far as Maine. These results also indicate that the boundaries of the GOM stock might not be properly defined.

Table 1: Annual total number of king mackerel tagged, recaptured, and percent recaptured for the Atlantic stock (ATL), the Gulf of Mexico stock (GOM) and both stocks combined (TOTAL).

	ATL			GOM			TOTAL		
Year	tagged	recaptured	%	tagged	recaptured	%	tagged	recaptured	%
1961	7		0.0	16		0.0	23		0.0
1962	4		0.0	1		0.0	5		0.0
1963	2		0.0	1		0.0	3		0.0
1964				2		0.0	2		0.0
1965	3		0.0				3		0.0
1966				2		0.0	2		0.0
1969				1		0.0	1		0.0
1974	3		0.0				3		0.0
1975	7		0.0	2		0.0	9		0.0
1976	2		0.0	10		0.0	12		0.0
1977	1		0.0				1		0.0
1978				2		0.0	2		0.0
1980				6	1	16.7	6	1	16.7
1983	18	1	5.6	1,475	49	3.3	1,493	50	3.3
1984	19	1	5.3	195	14	7.2	214	15	7.0
1985	436	10	2.3	978	55	5.6	1,414	65	4.6
1986	989	39	3.9	1,162	55	4.7	2,151	94	4.4
1987	1,805	123	6.8	1,134	75	6.6	2,939	198	6.7
1988	174	16	9.2	1,689	174	10.3	1,863	190	10.2
1989	193	24	12.4	1,556	133	8.5	1,749	157	9.0
1990	118	5	4.2	2,058	96	4.7	2,176	101	4.6
1991	130	8	6.2	1,799	42	2.3	1,929	50	2.6
1992	93	4	4.3	4,011	85	2.1	4,104	89	2.2
1993	14		0.0	2,552	142	5.6	2,566	142	5.5
1994	23	1	4.3	834	28	3.4	857	29	3.4
1995	22		0.0	1,050	28	2.7	1,072	28	2.6
1996	5		0.0	222	6	2.7	227	6	2.6
1997	13	1	7.7	10		0.0	23	1	4.3
1998	8		0.0	4		0.0	12		0.0
1999	11		0.0				11		0.0
2000	3		0.0				3		0.0
2001	2		0.0				2		0.0
TOTAL	4,105	233	5.7	20,772	983	4.7	24,877	1,216	4.9

Table 2: Number of king mackerel tagged in the mixing area, recaptured, and percent recaptured for the Atlantic stock (ATL), the Gulf of Mexico stock (GOM) and both stocks combined (TOTAL).

	ATL			GOM			Total		
year	tagged	recaptured	%recaptured	tagged	recaptured	%recaptured	tagged	recaptured	%recaptured
1961				16		0	16	0	0
1962	3		0				3	0	0
1963	2		0	1		0	3	0	0
1965	3		0				3	0	0
1966				2		0	2	0	0
1975	7		0	1		0	8	0	0
1976	1		0				1	0	0
1977	1		0				1	0	0
1980				4	1	25.0	4	1	25.0
1984				1	1	100.0	1	1	100.0
1985				449	16	3.6	449	16	3.6
1986	7		0	456	20	4.4	463	20	4.3
1987	1,003	96	9.6	9	2	22.2	1,012	98	9.7
1988	7		0	688	27	3.9	695	27	3.9
1989	125	15	12.0	1,359	91	6.7	1,484	106	7.1
1990	18		0	1,808	86	4.8	1,826	86	4.7
1991	20	1	5.0	1,156	26	2.2	1,176	27	2.3
1992	57	4	7.0	3,323	73	2.2	3,380	77	2.3
1993	10		0	2,138	134	6.3	2,148	134	6.2
1994	14		0	664	26	3.9	678	26	3.8
1995	9		0	820	22	2.7	829	22	2.7
1996				3		0	3	0	0
1997	8		0	3		0	11	0	0
TOTAL	1,295	116	9.0	12,901	525	4.1	14,196	641	4.5

Table 3: Annual total number of animals recovered in the ATL and GOM stocks from animals tagged in the a) ATL and b) GOM stocks.

a)

	Year	ATL	GOM	Total
ATL	1983	1		1
	1984	1		1
	1985	10		10
	1986	39		39
	1987	115	8	123
	1988	15	1	16
	1989	19	5	24
	1990	4	1	5
	1991	8		8
	1992	1	3	4
	1994	1		1
	1997	1		1
	Total	215	18	233

b)

	Year	ATL	GOM	Total
GOM	1980	1		1
	1983	1	48	49
	1984		14	14
	1985	9	46	55
	1986	14	41	55
	1987	2	73	75
	1988	23	151	174
	1989	52	81	133
	1990	43	53	96
	1991	10	32	42
	1992	32	53	85
	1993	82	60	142
	1994	10	18	28
	1995	8	20	28
	1996		6	6
	Total	287	696	983

Table 4: Annual total number of animals recovered in the ATL and GOM stocks from animals tagged in the mixing area from the a) ATL and b) GOM stocks.

a)

	Year	ATL	GOM	Total
ATL	1987	88	8	96
	1989	11	4	15
	1991	1		1
	1992	1	3	4
	Total	101	15	116

b)

	Year	ATL	GOM	Total
GOM	1980	1		1
	1984		1	1
	1985	9	7	16
	1986	14	6	20
	1987	2		2
	1988	19	8	27
	1989	52	39	91
	1990	43	43	86
	1991	10	16	26
	1992	32	41	73
	1993	82	52	134
	1994	10	16	26
	1995	8	14	22
	Total	282	243	525

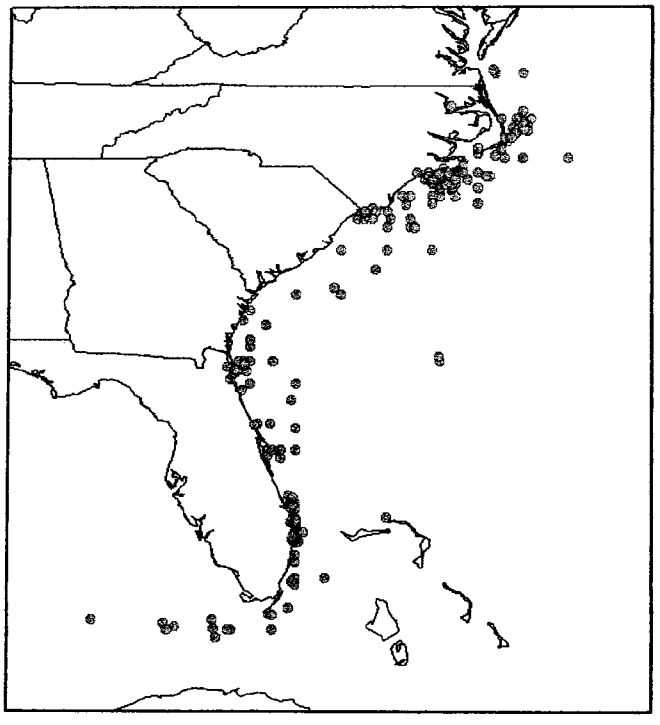


Figure 1: Location of tag releases for the king mackerel Atlantic (ATL) stock.

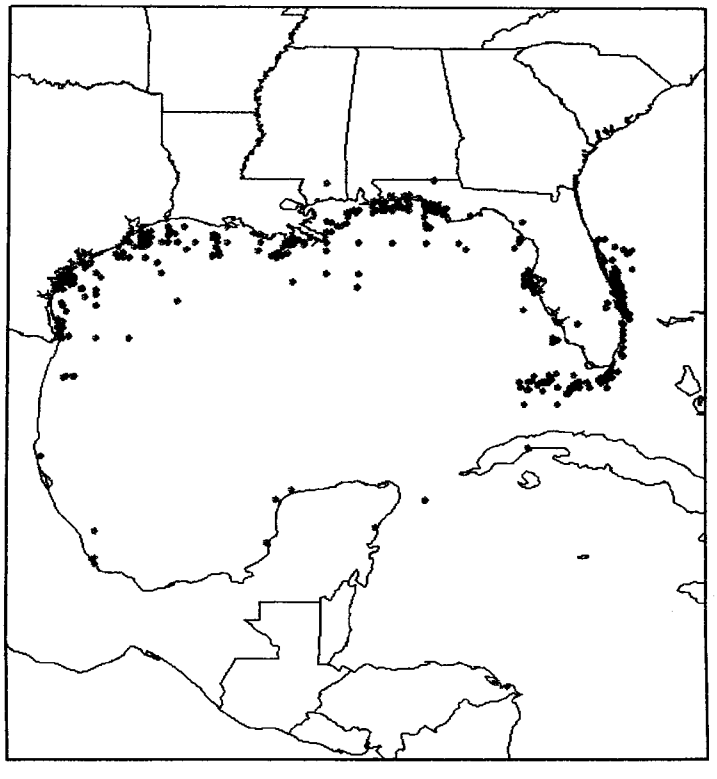


Figure 2: Location of tag releases for the king mackerel Gulf of Mexico (GOM) stock.

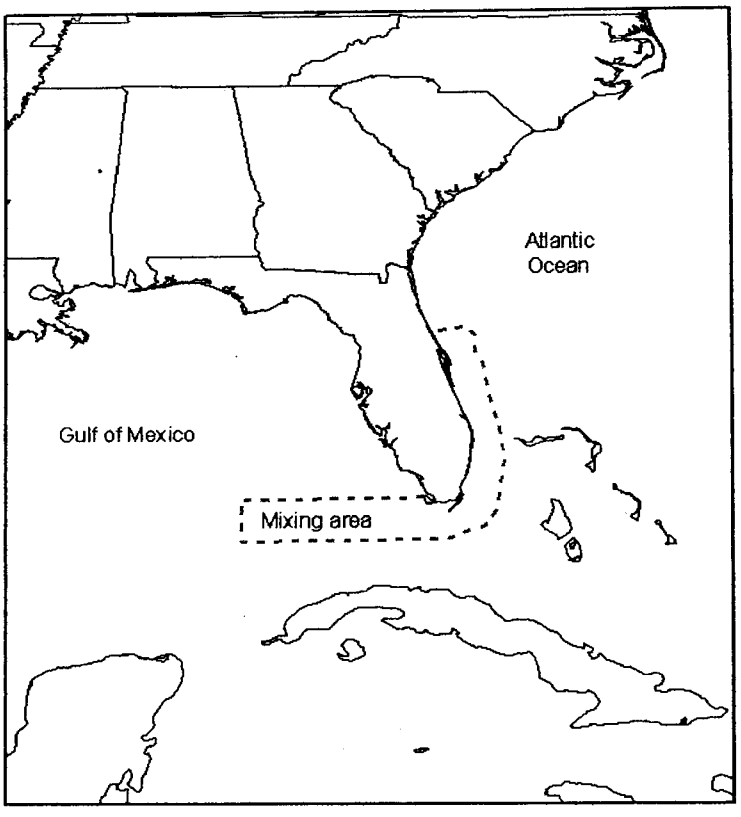
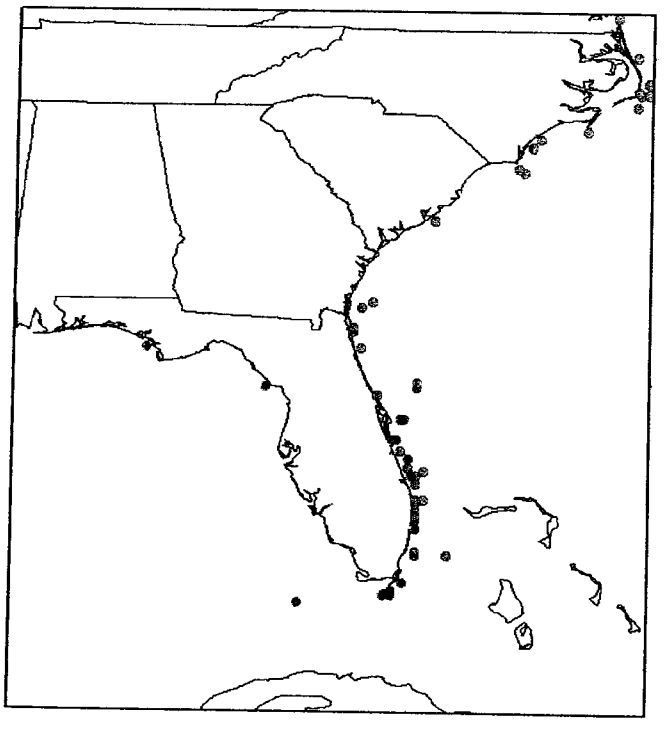


Figure 3: Mixing area of the ATL and GOM stocks. Refer to text for an explanation of the spatial extent of the area and the temporal use of each stock.

a)



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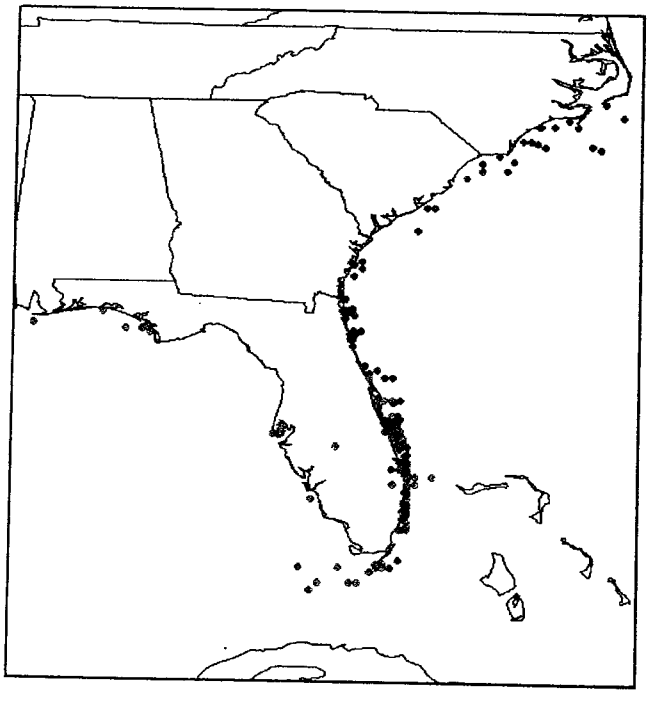
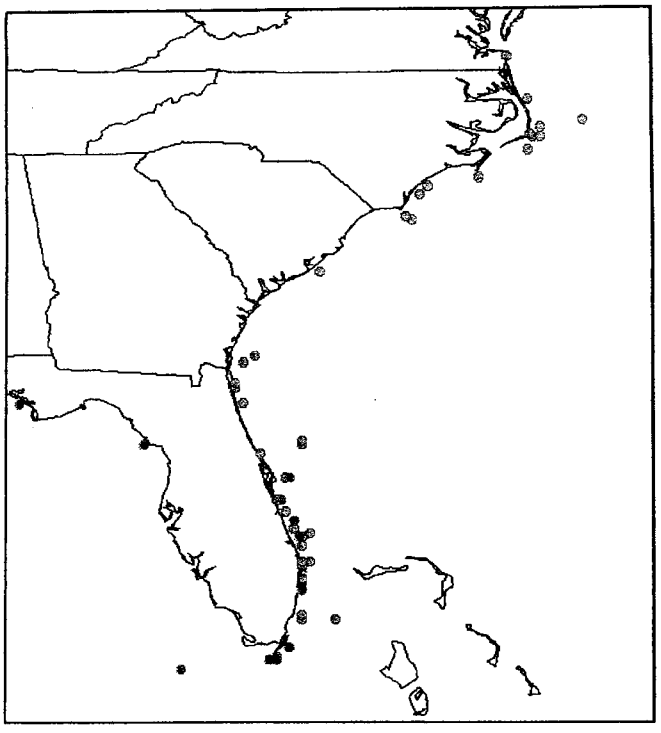


Figure 4: Position of recaptures of animals tagged in the a) ATL and b) GOM stocks. The blue circles indicate animals recaptured within the same stock where they were tagged, the red circles correspond to recaptures in a different stock.

a)



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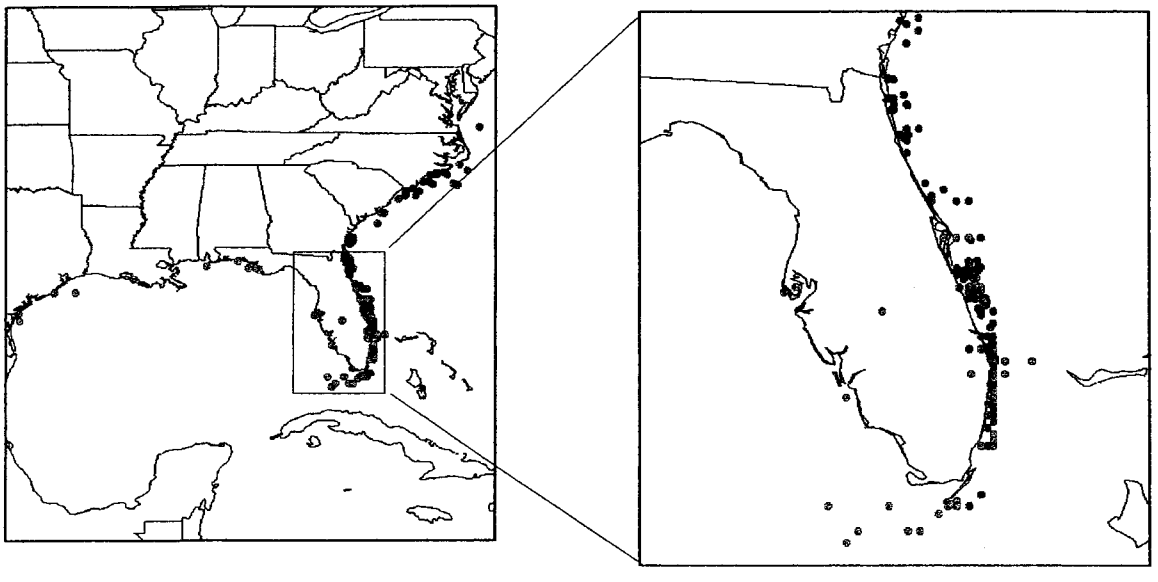

Figure 5: Position of recaptures of animals tagged in the a) ATL and b) GOM stocks. The blue circles indicate animals recaptured within the same stock where they were tagged, the red circles correspond to recaptures in a different stock.