Review of Catch, Catch at Size, Sex ratios and Catch at Age of king mackerel from the U.S. Gulf of Mexico and South Atlantic fisheries.

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Summary

Catch data from commercial and recreational fisheries for king mackerel are sized by sex to estimate the catch at size (CAS) by sex tables. Then the CAS data are converted to Catch-at-Age (CAA) by sex using age length keys when available, or a stochastic ageing method. A review of the size samples, age samples for ALK, sex ratios at size, and protocols applied is presented.

Sustainable Fisheries Division Contribution No. 2008-00#

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Introduction

King mackerel commercial and recreational fisheries in the US extend from the Northeast states of New England to Texas in the Gulf of Mexico. Presently, this resource is managed under the Coastal Migratory Pelagic Resources Fishery Management Plant implemented in February 1983. The FMP recognized two different stocks for the purpose of fishery management: the Atlantic migratory stock extending from New England to the South Florida Atlantic coast, and the Gulf of Mexico migratory stock extending from the Florida Keys and West Coast to the Texas border with Mexico. The FMP also recognized the seasonal mixing of these stocks on the Florida East coast and Florida Keys region. At present, for management and assessment purposes, there is a mobile boundary between the Atlantic and Gulf stocks. In the winter (Nov 1st through Mar 31st), the boundary is defined as a line due east from the Volusia and Flagler County coastal border (about 29˚25' latitude north); in the summer (Apr 1st through Oct 31st), the boundary is defined as the line due west from the Monroe and Collier County coast border (about 25˚48' latitude north) (Fig 1).

Commercial and Recreational landings data

Catch data from commercial fisheries have been collected by NMFS and the individual State programs, and compiled by the SEFSC Accumulated Landing System (ALS). Catches from the North Atlantic states were provided by the NMFS Northeast Regional Office. Recreational catch was estimated by the Marine Recreational Fishery Statistics Survey (MRFSS), NMFS Headboat Survey, and the Texas Parks and Wildlife Coastal Creel Survey (TPWD). Commercial catch is recorded in weight units and standardized to whole fish weight; recreational catch estimates are provided in numbers of fish landed (AB1) and number of fish released (B2). Table 1 and Fig 2 show the catch from commercial fisheries for king mackerel Atlantic and Gulf stocks by calendar year. Because of the interest in the mixing zone dynamics of these stocks, plots and tables show the distribution of the catch by regions; Atlantic no mixing (north of including Flagler County to New England), the mixing zone (between Volusia and Monroe Counties FL), and the Gulf no mixing (north and west of Collier county FL to Texas). Commercial catch by state is presented in Fig 3 and Table 2. For the Atlantic stock over 95% of the catch is landed by Florida and North Carolina. In the Gulf, about 75% of the catch is landed in Florida, followed by Louisiana (23%). Commercial catch is caught mainly by hook and line, and by trolling fishing gears, however smaller catches have been reported from other gears (including gillnets, purse seines, beach seines, traps, and trawls) (Table 3 and Fig 4). Before 1997, reporting of fishing gear was incomplete in the ALS data; therefore, some of the information of gear catch proportion was obtained from the Florida General Canvass files, and from discussions of the Mackerel stock assessment panel (MSAP) (SEDAR5-DW Ortiz et al 2003).

Florida is the main landing state for commercial fisheries of king mackerel stocks; ALS data provide information on county level landings for Florida (Table 4). For the Gulf no mix zone stock, the major counties of landings are Collier, Bay, Okaloosa, Franklin, Pinellas, Lee, and Manatee (Fig 5). For

the Atlantic no mix zone, Duval and Flagler are the main counties of landings, although the landing are much lower than in the mixing zone. For the mixing zone, landings are greater during the winter months (GOM stock) than in summer (ATL stock), with Palm Beach, Monroe, St Lucie, Indian River, and Martin the main landing areas. However, the information provided by ALS is from fish-houses and trip ticket data; there are reservations regarding what information is reported in trip ticket fishing locations. It is likely that the county catch distribution from ALS commercial data reflect more the economic trade statistics than fishing location (Orhun & Turner 2008).

MRFSS Recreational catch estimates are in the numbers of fish by state (Florida is split into Florida East [Nassau-Dade], and Florida West [Monroe-Escambia]), mode (i.e. private, shore, charter boat, headboat), and bi-month (Jan-Feb, …, Nov-Dec). The allocation of mixing zone MRFSS catch is done at the Florida east-west split, by bi-month (splitting equally catch in Mar-Apr). Headboat catch estimates started in 1986; prior year estimates were combined with MRFSS charter boat (1981-85) (Matter 2008). Texas recreational estimates started in 1982; however in 2005 the TPWD provided revised estimates for the whole time series (1983-2004) which were different than estimates used in last assessment(s). Unfortunately, no verification or documentation support were provided with the "revised Texas" recreational estimates; therefore, it was decided to defer whether or not to replace the TPWD estimates for the SEDAR working group discussions.

MRFSS also provided estimates of discards (live releases of king mackerel) B2 component of the catch. Prior assessments have ignore those estimates mainly because of the low numbers compared to the total catch retained (AB1). However, in recent years B2 estimates are rapidly increasing, and it is likely that some portion of these releases die. Table 6 and Fig 6 and 7 show the distribution of MRFSS recreational catch estimates (numbers) of landed fish (AB1) and releases (B2) by stock unit and region. As with the commercial catch, the proportions of recreational catch are higher in the mixing zone for the Atlantic stock, although this is not the case for the Gulf stock. As noted before, the number of releases is increasing since 2000 in Atlantic and Gulf; lately, the B2 release catch has been about 35% of the retained catch in the Atlantic stock, and 50% in the Gulf stock. Above 90% of the recreational catch is from the MRFSS estimates (Table 7, Fig 8), Headboat catch is about 5% of total recreational removals. Recreational AB1 catches by state are shown in Table 8 and Fig 9. For the Atlantic stock, most of the recreational activity is off of Florida and North Carolina; for the Gulf stock, it is mainly off Florida, with smaller proportions off Alabama and Texas. Fig 10 and Table 9 present the distribution of recreational AB1 catches by region and season. For the Gulf no mix and Atlantic no mix zones, most of the recreational catch is taken during the summer (Apr-Oct) months; while in the mixing zone, recreational activity is all year around, with proportional equivalent catches during winter and summer periods.

In past assessments of king mackerel catch data started from 1981 due to model requirements (primarily a full Catch-at-age matrix for VPA analysis). However, the fishery for king mackerel goes back to the 19th century (NMFS 1999). Other documents are presented at the SEDAR16 DW that detailed the information source, methods and estimates of king mackerel catch both recreational and commercial prior to 1980 (Walter 2008, Orhun and Turner 2008). Here we present those estimates added to the ALS data to get an overview of the catch trends for king mackerels stocks. Following recommendations from the last assessment review panel and the scientific management councils, the dynamics of king

mackerel are modeled for both stock units integrated in a single assessment model that considers two stocks (ATL and GLF) with 3 main areas/regions: 1) Atlantic no mix, 2) A mixing zone, and 3) Gulf no mix partitions. The stocks will "migrate" between the respective no mix to the mixing zone and return to their original stock area for spawning. This model assumes that the information from the mixing area represents a combination of data for both stocks, while the information from the no mix zones represents each individual stock unit. Thus catch series, indices of abundance, and biological data are arranged or estimated under these region conventions for input into the multi-stock unit model. Table 10 shows the commercial catch of king mackerel stocks by region and season from 1930 to 2007. Annual historic estimates of catch (1930-1978) were partitioned by season using the average proportion by season of the 1979-1989 before management implementations (Fig 12). Similar estimates of catch were done for the recreational fisheries of king mackerel. Tables 11 and 12 show the retained catch (AB1) in numbers of fish by region and season (Fig 13). Recreational fisheries were estimated independently for Headboat (Table 11) and other MRFSS recreational fisheries (Table 12).

Catch At Size and Sex ratios At Size

Document Ortiz et al (2003) details the procedures for sizing the commercial and recreational catch of king mackerel. Document SEDAR16-DW-13 (Ortiz 2008) also describes the size and size-frequency samples available for king mackerel assessment. Briefly, catch were matched to size frequency samples to estimate catch at size and multiplied by sex-ratios at size to convert the Catch-at-size into Catch-at-size by sex. The assessment review panel in 2004 recommended updating the sex ratios at size for king mackerel. Sex information is routinely collected with biological information (otolith ageing samples), and with some size frequency data. Table 13 summarizes the available sex and size information available for king mackerel stocks. For the Atlantic stock, there were 68,831 male and 66,077 female samples (Fork length ≥ 30 cm); for the Gulf stock, there were 117,589 male and 77,539 female samples (FL ≥ 30 cm). However, the distribution of samples by year and by season is not uniform (Fig 14), with fewer sex samples in the winter (Nov-Mar) for the Atlantic stock. Fig 15 and 16 show the proportions of males at size (5 cm bin size intervals) for king mackerel for all years combined. As expected, the proportions of males decline with size: above 120 cm there are practically no males. However, there is a large variation and year; seasonal effects were investigated using a GAM model to estimate sex ratios (proportion of males) at size.

The GAM model fitted the ratio of males/(males+females) as function of a spline smoother of size (fish ≥ 50 cm FL) and fixed factors stock unit (MigGrp), year, season and the interaction year*season. It assumed a binomial error distribution and used the logit as link function between the linear predicted component and the binomial sex proportion distribution. Table 14 summarizes the GAM model fit; all parametric terms were significant, as well the interaction year*season. The model explained about 68% of the observed deviance, and had the lowest AIC (Akaike information criteria) of alternative fitting models evaluated. Fig 17 and 18 shows the predicted sex ratio for males at size by year and season for Atlantic and Gulf king mackerel stock units, respectively. Appendix 1 shows the fit of two comparable models and the observed proportions of males by region, year and season.

Appendix 2A shows the CAS by Sex for each stock unit and region, by year and season using the sex at size ratios of last stock assessment (Restrepo 1996). Appendix 2B shows similar information, but using the updated sex ratios at size.

Catch At Age

Ageing protocols for king mackerel have been describe previously by Cummings and Turner (2003) and Ortiz et al (2003), as well as reports regarding the ageing methods, number and source of otolith samples, etc, (Palmer et al 2008). Briefly, the majority of the king otoliths were collected from commercial and recreational fisheries, with fewer collected from scientific research projects. The Panama City laboratory provided the age-size data available for king mackerel since 1986 (SEDAR16-DW-12, Ortiz and Palmer 2008). This information was used to construct Age Length Keys (ALK) for each stock unit and year. ALK were constructed by aggregating aged fish into 5 cm size bins, from 30 to 200 FL cm sizes. Table 15 summarizes the number of aged fish by stock, year and season. For the Atlantic unit, over 90% of samples are from the Apr-Oct months, very few or none samples in Jan-Mar and Nov-Dec seasons. By year, all except 2005 had above 400 otolith samples. Ageing sampling has increased in recent years; however, due to staff and time limitations, the reading of the otoliths in more recent years is a subsample of the field collected sample (Fig 19). For the Gulf stock, there are more aged samples which are more uniformly distributed between seasons. All years, except 1986, have over 400 samples; sampling has also increased in recent years (Fig 19).

Tables 16 and 17 provide the number of fish per age and size bin (5 cm interval) for Atlantic and Gulf stock units, respectively (Fig 20). These matrices are for all years combined, and the cell shades represent the ranges of fish samples. Most of the samples are from ages 1 through 7, although the oldest age was 26 and 24 for Atlantic and Gulf fish, respectively. Appendix 3 shows the ALK distribution by stock unit and year for king mackerel. Number of samples per bin size and number of samples per ALK follow the recommendations from the SEDAR5 review panel that considered 400 samples as minimum per year for an ALK, and 10 samples for size in the lower size boundary. It also assumed that the fish of size FL 15 or below are age 0 by definition. In the past, only the sexed fish were included in the construction of ALK; however, unidentified fish of age 0 and 1 were included with sexed fish to increase the number of size samples, particularly of smaller fish. There are not significant size differences by sex for those age classes.

The preferred method for ageing the CAS by sex king data is to use ALK; the alternative method is the stochastic length deconvolution of Shepherd (1985). For king mackerel, the CAS by sex was converted to Catch At Age by sex (CAAS) for each year, stock unit and quarter. Decision rule(s) on what method to apply depended on whether the ALKs were available for a given stock, year, and quarter. Table 18 shows the instruction file for ageing current CAS by sex data, KEY code refers to use of ALK, while the SAR code refers to the stochastic length deconvolution method. (Note that the SAR method used the king mackerel growth parameters by stock and sex adopted by the SEDAR5 panel).

Table 19 and Fig 21 show the estimated Catch at Age for Atlantic king stock unit 1981-2006 calendar year. Total catch numbers increased since 2002 from 441,591 fish to 756,320 in 2006. Ages 2, 3, 4 and 5 were the main components of the catch. Catch by age proportions varied in 2002 and 2005, years when no ALKs were available and the ageing was defaulted to the SAR method. Table 20 and Fig 22 show the estimated CAA for Gulf kings 1981-2006. Here also the catch increased from 848,497 fish in 2001, first with a peak in 2003 of 1.006 million fish and a second peak in 2006 of 1.165 million fish. As with Atlantic kings, most of the catch is from ages 2, 3, 4 and 5. Catch by age proportions also varied in 2005 when no ALK were available. CAA estimates and proportion by age was similar to the CAA base model of last assessment (SEDAR5-2003) (Fig 23).

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Table 1. Commercial landed catch (t) by stock unit and region from 1979 to 2007 (partial reports for 2007).

Commercial catch t						
	ATL			**GOM**		
Year	MixZone	ATLnoMix	Total	GLFnoMix	MixZone	Total
1979	662	239	901	95	1,598	1,692
1980	814	483	1,297	384	1,638	2,022
1981	663	426	1,088	60	2,986	3,046
1982	1,109	677	1,786	166	1,906	2,071
1983	586	496	1,082	704	1,452	2,155
1984	448	445	893	371	1,163	1,535
1985	623	492	1,114	470	923	1,394
1986	650	621	1,271	201	1,146	1,347
1987	811	728	1,539	275	552	827
1988	934	502	1,436	230	401	631
1989	691	435	1,125	330	210	540
1990	511	640	1,151	322	731	1,053
1991	463	702	1,165	334	416	751
1992	381	637	1,018	598	651	1,249
1993	468	503	971	499	1,137	1,636
1994	482	448	930	601	383	984
1995	386	527	913	422	765	1,187
1996	578	432	1,011	513	797	1,310
1997	614	767	1,382	604	853	1,457
1998	536	585	1,121	661	841	1,502
1999	526	538	1,064	745	943	1,688
2000	474	533	1,007	654	675	1,329
2001	460	420	880	590	779	1,369
2002	404	386	791	576	746	1,322
2003	493	371	864	598	912	1,510
2004	738	460	1,198	622	690	1,312
2005	468	597	1,064	521	923	1,444
2006	788	566	1,354	646	837	1,483
2007	554	456	1,011	209	623	832

Table 2. Commercial landed catch (t) Atlantic and Gulf stocks by state 1979 to 2007 (partial reports for 2007).

	Atlantic Stock					Gulf Stock				
Year	FLEK	GA-SC	NE	Total	**Year**	FLW	FLEK	MS-AL	TX-LA	
1979	36	41	691	769	1979	95	1598	0	0	
1980	94	103	854	1051	1980	384	1638	0	0	
1981	61	62	693	817	1981	60	2986	0	0	
1982	84	91	1154	1330	1982	62	1906	0	104	
1983	81	84	619	784	1983	27	1452	1	676	
1984	63	64	487	613	1984	30	1163	2	340	
1985	37	42	699	778	1985	27	923	1	441	
1986	43	45	771	859	1986	48	1146	1	152	
1987	58	65	869	993	1987	32	552	2	241	
1988	56	63	978	1097	1988	20	401	4	206	
1989	80	82	719	882	1989	31	210	2	296	
1990	73	79	565	717	1990	32	731	1	289	
1991	121	126	544	791	1991	70	416	0	264	
1992	116	119	433	668	1992	80	651	5	514	
1993	73	73	495	642	1993	90	1137	1	408	
1994	42	42	512	595	1994	202	374	2	396	
1995	37	42	416	495	1995	77	765	1	343	
1996	43	44	608	696	1996	179	797	2	332	
1997	28	28	648	703	1997	244	853	2	358	
1998	32	33	571	635	1998	129	841	2	530	
1999	31	33	542	606	1999	250	943	1	494	
2000	33	34	501	567	2000	185	675	2	468	
2001	22	22	478	523	2001	191	779	9	390	
2002	16	16	421	454	2002	132	746	2	442	
2003	10	10	509	529	2003	145	912	6	447	
2004	11	11	754	776	2004	142	690	15	466	
2005	12	12	487	512	2005	95	923	6	420	
2006	15	15	801	832	2006	164	837	27	455	
2007	4	4	561	568	2007	176	623	31	3	

Table 3. Commercial landed catch (t) king mackerel by fishing gears and year.

Catch MT stock	year	Gillnet	GillNtDrif	GillNtPoun	H&L_comm	NetTrammel	PurseSeine	SeineBeach	SeineLongH	Trap	Trawl	unknown	*Total*
ATL	1979	25	6		859						4	5	901
	1980	163			1,118						7	8	1,297
	1981	149			918						21	1	1,088
	1982	417			1,357						7	6	1,786
	1983	138		3	935						4	2	1,082
	1984	27	0	0	862				0		3	1	893
	1985	12	39		1,058						5	0	1,114
	1986	9	126		1,132			0			2	2	1,271
	1987	18	328		1,184			0			7	2	1,539
	1988	136	353		885		53				1	7	1,436
	1989	6	315	1	798		3		0		3		1,125
	1990	21	3	2	1,122					0	3	0	1,151
	1991	5	6	1	1,151			0		0	0	1	1,165
	1992	8	7	2	1,000			0		0	1	0	1,018
	1993	4	7	0	955			0		0	5	0	971
	1994	28	0	0	908			0	0	1	2	0	939
	1995	28	0	0	881			0		1	0	2	913
	1996	25	0	0	984			0		1	1		1,011
	1997	183	0	1	1,197		0	0	0	0	1	0	1,382
	1998	40	1	0	1,077			0		1	1	2	1,121
	1999	30	1	0	1,031			0		0	0	2	1,064
	2000	60		1	944			0		0	0	0	1,007
	2001	33		0	846			0		0	0	0	880
	2002	44			747			0		0	0	0	791
	2003	18		0	845			0		0	1	0	864
	2004	64	0	0	1,134			0		0	0	0	1,198
	2005	112	2	0	948			0		0	0	2	1,064
	2006	82		0	1,271			0		0	0	1	1,354
	2007	82	0		928			0			0	1	1,011
GOM	1979	951			741								1,692
	1980	1,031			991								2,022
	1981	1,485			1,561								3,046
	1982	1,016			1,055								2,071
	1983	875			1,280						1		2,155
	1984	568			967		0				0		1,535
	1985	480			913						0		1,394
	1986	686			647		15				0		1,347
	1987	167			659		0				0		827
	1988	207			424		0				0		631
	1989				539		0						540
	1990	211			841		1						1,053
	1991	104			383							264	751
	1992				754							495	1,249
	1993	643			585							408	1,636
	1994	1			578							396	975
	1995	169			1,018								1,187
	1996	223			1,087								1,310
	1997	223			1,234						0	0	1,457
	1998	284			1,215			1			0	3	1,502
	1999	463			1,224		0	0		1	0	0	1,688
	2000	186			1,143			0		0	0	0	1,329
	2001	207			1,162		0	0		0	0	0	1,369
	2002	150			1,172			0	0			0	1,322
	2003	179			1,331		0	0	0	0		0	1,510
	2004	218			1,094		0	1				0	1,312
	2005	311			1,133		0					0	1,444
	2006	233			1,248		0	-	0	0	0	1	1,483
	2007	223			602	2	0			4	0	1	832

Table 6. Recreational landed (AB1) and releases (B2) catch (numbers of fish) for king mackerel by stock unit, year and region. Partial reports for 2007.

N fish		Landed AB1			Releases B2			Totals	
stock	year	ATLnoMix	GLFnoMix	MixZone	ATLnoMix	GLFnoMix	MixZone	AB1	B2
ATL	1981	302,172		114,287	-		2,182	416,459	2,182
	1982	287,773		321,972	-		1,172	609,745	1,172
	1983	327,925		341,592	-		240	669,517	240
	1984	330,568		283,554	878		205	614,122	1,083
	1985	589,986		216,125	-		10,550	806,111	10,550
	1986	516,450		167,647	7,412		6,438	684,097	13,850
	1987	424,161		143,226	37,248		5,398	567,387	42,646
	1988	382,425		163,839	15,226		17,409	546,264	32,635
	1989	208,632		160,126	7,013		15,566	368,758	22,579
	1990	270,730		193,580	5,513		8,361	464,310	13,874
	1991	344,273		246,139	10,002		40,730	590,412	50,732
	1992	417,691		298,152	4,090		22,316	715,843	26,406
	1993	174,696		183,352	7,026		25,144	358,048	32,170
	1994	191,657		206,167	8,424		10,664	397,824	19,088
	1995	183,173		281,174	9,085		32,182	464,347	41,267
	1996	141,581		223,386	13,460		33,970	364,967	47,430
	1997	299,113		230,352	63,497		19,426	529,465	82,923
	1998	225,971		223,293	20,029		55,682	449,264	75,711
	1999	108,436		251,260	37,161		53,306	359,696	90,467
	2000	219,621		330,507	32,637		46,766	550,128	79,403
	2001	145,218		194,774	29,257		55,385	339,992	84,642
	2002	85,530		192,662	15,544		54,418	278,192	69,962
	2003	138,543		307,064	23,519		100,316	445,607	123,835
	2004	129,505		219,430	50,153		69,914	348,935	120,067
	2005	180,855		217,917	83,686		82,058	398,772	165,744
	2006	143,863		303,555	32,610		110,163	447,418	142,773
	2007	116,258		190,378	15,689		80,032	306,636	95,721
GOM	1981		438,330	229,334		8,619	-	667,664	8,619
	1982		742,365	169,381		16,138	1,172	911,746	17,310
	1983		293,859	30,435		179	-	324,294	179
	1984		294,915	105,818		925	-	400,733	925
	1985		154,489	41,874		8,655	8,002	196,363	16,657
	1986		147,940	73,644		7,905	11,850	221,584	19,755
	1987		401,679	145,355		31,061	1,643	547,034	32,704
	1988		354,702	120,468		27,986	14,913	475,170	42,899
	1989		240,021	124,498		125,045	32,282	364,519	157,327
	1990		383,720	179,332		89,817	28,335	563,052	118,152
	1991		584,626	143,278		89,161	77,121	727,904	166,282
	1992		346,967	145,496		99,310	63,192	492,463	162,502
	1993		430,021	264,913		47,880	20,851	694,934	68,731
	1994		419,912	234,318		114,371	40,758	654,230	155,129
	1995		355,183	299,811		105,694	54,708	654,994	160,402
	1996		463,873	269,288		120,188	66,593	733,161	186,781
	1997		381,011	360,003		96,880	43,504	741,014	140,384
	1998		330,791	292,345		39,071	66,899	623,136	105,970
	1999		301,679	232,055		65,836	39,423	533,734	105,259
	2000		396,553	142,944		102,089	50,997	539,497	153,086
	2001		359,409	167,867		122,003	187,015	527,276	309,018
	2002		376,216	192,419		165,609	35,870	568,635	201,479
	2003		321,243	258,083		126,945	144,631	579,326	271,576
	2004		309,942	142,084		166,823	48,845	452,026	215,668
	2005		276,227	155,169		149,208	58,109	431,396	207,317
	2006		566,661	208,447		517,535	70,366	775,108	587,901
	2007		220,125	116,346		35,748	34,309	336,471	70,057

Table 7. Recreational retained catch (AB1) by source, stock unit and year. Units numbers of fish, partial reports for 2007.

	ATL stock		GOM stock		
Year	HeadB	MRFSS	HeadB	MRFSS	TPWD
1981	-	416,459	-	667,664	-
1982	-	609,745	-	864,081	47,665
1983	-	669,517	-	276,629	47,665
1984	-	614,122	-	373,557	27,176
1985	-	806,111	-	164,207	32,156
1986	28,187	655,910	17,263	187,508	16,813
1987	29,428	537,959	44,248	469,626	33,160
1988	22,072	524,192	11,666	441,287	22,217
1989	24,022	344,736	20,488	325,473	18,558
1990	27,865	436,445	32,892	502,544	27,616
1991	41,296	549,116	30,675	669,526	27,703
1992	23,175	692,668	30,168	407,315	54,980
1993	21,657	336,391	34,149	586,051	74,734
1994	25,090	372,734	35,853	601,256	17,121
1995	18,708	445,639	35,080	605,553	14,361
1996	31,607	333,360	39,376	674,105	19,680
1997	18,708	510,757	41,833	665,442	33,739
1998	16,355	432,909	31,213	531,676	60,247
1999	20,022	339,674	28,604	472,227	32,903
2000	20,037	530,091	27,375	480,068	32,054
2001	12,554	327,438	20,287	489,956	17,033
2002	11,670	266,522	19,131	526,668	22,836
2003	9,099	436,508	27,418	528,051	23,857
2004	13,632	335,303	24,855	400,255	26,916
2005	21,688	377,084	35,393	376,189	19,814
2006	17,445	429,973	38,409	693,604	43,095
2007	5,903	300,733	22,783	295,426	18,262

Table 8. Recreational AB1 catch by stock unit, state and year king mackerel

	Atlantic						Gulf of Mexico						
Year	FLK	FLE	GA	SC	NC	NE	TX	LA	MS	AL	FLW	FLK	FLE
1981	-	114,287	4,718	16,316	278,264	2,874	204,979	23,487	978	34,323	-	332,242	71,655
1982	-	321,972	22,502	36,548	228,723	-	47,665	39,709	5,196	599,987	-	89,091	130,098
1983	-	341,592	27,448	80,497	219,980	-	49,660	34,994	2,092	23,198	-	200,140	14,210
1984	-	283,554	29,542	33,463	267,563	-	28,004	13,184	1,632	74,657	-	213,860	69,396
1985	-	216,125	7,166	157,484	424,967	369	32,156	7,602	16,322	43,994	-	72,038	24,251
1986	1,884	166,318	2,805	246,753	256,676	9,661	24,918	7,362	5,512	20,778	312	130,041	32,661
1987	2,675	141,020	11,739	79,305	325,715	6,933	41,198	9,108	4,450	38,074	771	362,755	90,678
1988	518	163,669	3,448	154,431	211,055	13,143	30,344	13,932	16,290	36,851	209	257,154	120,390
1989	1,025	159,353	2,805	86,704	111,583	7,288	28,350	4,183	4,868	16,537	426	238,534	71,621
1990	1,330	192,571	10,939	59,759	197,248	2,463	37,262	306	805	66,478	1,314	308,008	148,879
1991	2,431	244,227	13,874	139,898	179,673	10,309	37,764	3,157	17,837	27,219	2,176	549,607	90,144
1992	1,623	297,381	24,470	220,791	158,787	12,791	70,433	14,247	13,807	44,690	1,256	279,202	68,828
1993	2,616	180,939	2,287	51,557	103,202	17,447	86,757	4,998	1,121	70,491	2,188	376,400	152,979
1994	2,231	204,072	11,438	72,405	105,278	2,400	31,836	10,933	4,376	70,993	3,137	458,399	74,556
1995	1,131	280,258	10,062	56,878	115,125	893	33,119	8,782	7,254	65,140	1,571	416,407	122,721
1996	1,303	222,150	5,746	57,664	76,279	1,825	36,143	5,910	8,913	33,112	2,053	536,793	110,237
1997	1,316	229,066	1,744	81,806	199,402	16,131	51,922	16,190	32,190	65,826	2,046	416,657	156,183
1998	822	222,567	2,406	115,802	101,288	6,379	72,567	4,289	4,984	37,599	1,346	375,333	127,018
1999	364	251,091	9,264	18,809	76,878	3,290	49,460	3,845	4,307	44,733	1,330	286,342	143,717
2000	520	330,457	20,184	41,019	138,205	19,743	45,923	6,819	4,201	104,649	1,798	295,775	80,332
2001	1,393	193,523	8,969	17,459	114,211	4,437	28,674	378	3,125	77,351	1,418	339,968	76,362
2002	2,483	190,266	1,708	14,600	67,008	2,127	35,747	10,937	3,893	48,377	1,555	366,527	101,599
2003	1,484	305,713	11,931	11,762	114,686	31	43,758	6,255	5,123	64,706	1,356	271,008	187,120
2004	958	218,625	2,263	21,404	105,525	160	43,253	3,280	2,243	83,201	1,161	244,747	74,141
2005	958	217,319	4,330	20,205	143,158	12,802	37,465	3,711	6,023	50,201	968	234,031	98,997
2006	507	303,231	1,655	16,835	124,431	759	64,789	8,993	2,357	75,999	2,017	494,043	126,910
2007	298	190,172	1,862	17,975	96,329	-	29,251	1,505	245	19,860	639	195,850	89,121

Table 9. Recreational AB1 catch by season and region.

NumFish	ATLnoMix				MixZone				GLFnoMix			
year	JanMar	AprJun	JulOct	NovDec	JanMar	AprJun	JulOct	NovDec	JanMar	AprJun	JulOct	NovDec
1981		33,541	268,631		285,621	43,208	71,079	17,464		220,893	143,687	
1982	80,157	111,172	96,445		82,412	101,979	219,993	92,693		54,969	681,284	388
1983		195,629	132,296		21,958	88,583	253,009	8,893	1,744	24,548	266,764	388
1984	1,544	64,776	264,248		52,944	72,818	210,736	59,374	898	11,920	266,041	9,556
1985		63,894	519,921	6,171	35,920	133,983	82,142	18,407	264	26,676	115,000	97
1986	12,189	175,625	292,766	35,870	32,010	61,285	106,362	44,203	13	18,127	126,893	338
1987	28,068	145,217	234,849	16,028	98,470	82,595	60,631	57,452	20	172,279	218,768	46
1988	4,312	104,872	267,520	5,722	12,574	56,810	107,029	108,753		13,999	339,840	5
1989	14,426	52,957	121,227	20,022	43,501	64,289	95,837	83,103	344	33,152	201,548	2,871
1990	25,893	46,343	158,594	39,901	98,527	76,675	116,905	113,722	1,179	126,829	222,751	44
1991	1,052	86,387	221,443	35,391	88,580	95,924	150,215	72,307	411	76,335	490,238	34
1992	49,155	94,820	259,301	14,415	63,874	78,067	220,085	87,165	971	110,698	229,254	502
1993	6,038	52,507	89,326	26,825	207,189	54,906	128,446	85,572	528	107,321	293,048	1,276
1994	22,990	61,064	76,650	30,953	190,121	71,524	134,643	85,700	2,547	112,627	258,748	4,488
1995	6,868	26,517	107,411	42,377	278,769	117,061	164,113	105,346	2,057	162,239	106,576	8
1996	6,010	47,179	68,545	19,847	236,053	103,236	120,150	105,222	506	185,939	203,392	2,050
1997	23,412	69,665	187,057	18,979	245,779	116,055	114,297	143,427	1,806	104,574	240,893	4,535
1998	15,302	122,880	64,231	23,558	223,276	130,142	93,151	107,265	2,273	99,457	187,264	3,602
1999	4,506	25,139	53,181	25,610	155,713	130,812	120,448	106,169	873	106,657	159,391	4,931
2000	4,056	61,503	126,014	28,048	97,343	107,160	223,347	61,423	5,560	98,279	246,634	30,259
2001	5,395	50,104	77,138	12,581	145,784	107,404	87,370	51,584	2,949	97,951	208,969	20,039
2002	1,885	13,889	35,730	34,026	130,596	99,627	93,035	88,334	2,427	154,531	191,450	1,298
2003	1,108	33,194	82,608	21,633	207,663	158,727	148,337	70,686	5,250	106,286	177,429	12,012
2004	3,507	39,133	67,405	19,460	101,978	96,279	123,151	53,493	2,956	114,172	172,211	7,216
2005	1,143	46,452	111,707	21,553	112,568	97,987	119,930	64,987	2,491	135,330	113,840	2,181
2006	6,885	61,926	67,448	7,604	155,930	145,218	158,337	82,388	5,948	221,246	307,018	2,578
2007	1,391	226,764			176,378	337,477			2,572	379,222		

Table 10. King mackerel commercial catch (t) trends 1930 – 2007. Partial reports for 2007, see text for details.

Catch (MT) by Region (Mix, GLFnM,ATLnM) , season (trimest), and Calendar Year King Mackerel
split by season for historical (1930-1978) is using the avg % by season of years 1979-1989

Year ref	1989															
Avg %by season 1979-1989		31.9%	9.9%	31.0%	27.1%	3284.18	49.3%	21.9%	14.5%	14.3%	21965.468	6.0%	19.0%	43.6%	31.5%	5542.737
	10 region	season														
Sum of Catch	GLFnoMix					GLFnoMix To MixZone					MixZone Tota	ATLnoMix				ATLnoMix Tot
	JanMar	AprJun	JulOct	NovDec		JanMar	AprJun	JulOct	NovDec			JanMar	AprJun	JulOct	NovDec	
year	GLFnoMixJan	GLFnoMixApr	GLFnoMixJul	GLFnoMixNo	Total	MixZoneJanM	MixZoneAprJ	MixZoneJulO	MixZoneNovD	Total		ATLnoMixJan	ATLnoMixApr	ATLnoMixJul	ATLnoMixNo	Total
1930	203.343	63.448	197.924	173.037	637.75	510.708	226.181	150.359	147.850	1035.10		0.786	2.497	5.730	4.141	13.15
1931	108.324	33.800	105.437	92.179	339.74	597.766	264.737	175.989	173.054	1211.55		0.488	1.550	3.557	2.570	8.16
1932	86.052	26.850	83.759	73.227	269.89	605.598	268.206	178.296	175.321	1227.42		0.352	1.119	2.569	1.856	5.90
1933	99.791	31.137	97.132	84.918	312.98	522.122	231.236	153.719	151.155	1058.23		0.922	2.927	6.718	4.855	15.42
1934	102.250	31.904	99.525	87.011	320.69	442.449	195.951	130.262	128.089	896.75		1.030	3.272	7.508	5.426	17.24
1935	137.249	42.825	133.592	116.794	430.46	496.832	220.036	146.274	143.833	1006.97		1.220	3.875	8.891	6.426	20.41
1936	145.348	45.352	141.475	123.685	455.86	658.415	291.597	193.845	190.612	1334.47		1.491	4.736	10.867	7.854	24.95
1937	199.004	62.094	193.701	169.344	624.14	443.792	196.545	130.658	128.478	899.47		2.087	6.630	15.214	10.995	34.93
1938	124.956	38.989	121.626	106.333	391.90	627.307	277.820	184.687	181.606	1271.42		3.800	12.072	27.702	20.020	63.59
1939	227.206	70.894	221.151	193.343	712.59	546.516	242.039	160.901	158.217	1107.67						
1940	285.200	88.989	277.600	242.694	894.48	337.040	149.267	99.229	97.573	683.11		0.949	3.014	6.916	4.998	15.88
1941	237.908	74.233	231.568	202.450	746.16	477.810	211.611	140.673	138.326	968.42						
1942	233.280	72.789	227.063	198.512	731.64	486.985	215.675	143.374	140.983	987.02						
1943	225.615	70.397	219.602	191.989	707.60	501.980	222.315	147.789	145.324	1017.41						
1944	210.429	65.659	204.822	179.067	659.98	532.193	235.696	156.684	154.070	1078.64		0.217	0.689	1.581	1.142	3.63
1945	164.583	51.354	160.197	140.054	516.19	622.383	275.639	183.237	180.180	1261.44		0.244	0.775	1.778	1.285	4.08
1946	156.629	48.872	152.455	133.285	491.24	568.000	251.554	167.226	164.437	1151.22		0.325	1.033	2.371	1.714	5.44
1947	154.026	48.060	149.921	131.070	483.08	554.349	245.508	163.207	160.484	1123.55		0.434	1.378	3.161	2.285	7.26
1948	148.674	46.390	144.712	126.516	466.29	614.327	272.071	180.865	177.848	1245.11		0.623	1.980	4.545	3.284	10.43
1949	205.223	64.035	199.754	174.636	643.65	486.538	215.476	143.243	140.853	986.11		0.932	2.962	6.797	4.912	15.60
1950	60.497	18.876	58.884	51.480	189.74	259.718	115.023	76.464	75.189	526.39		1.597	5.071	11.638	8.411	26.72
1951	166.463	51.941	162.027	141.654	522.08	442.427	195.941	130.256	128.083	896.71		0.464	1.472	3.379	2.442	7.76
1952	117.291	36.598	114.165	99.810	367.86	342.053	151.488	100.705	99.025	693.27		0.317	1.007	2.312	1.671	5.31
1953	184.975	57.717	180.046	157.407	580.14	291.833	129.246	85.919	84.486	591.48		0.285	0.904	2.075	1.499	4.76
1954	156.629	48.872	152.455	133.285	491.24	206.118	91.285	60.684	59.671	417.76		0.019	0.060	0.138	0.100	0.32
1955	171.814	53.610	167.236	146.207	538.87	311.304	137.869	91.652	90.123	630.95		0.352	1.119	2.569	1.856	5.90
1956	174.128	54.332	169.488	148.176	546.13	543.181	240.562	159.919	157.251	1100.91		0.198	0.629	1.442	1.042	3.31
1957	128.861	40.208	125.427	109.655	404.15	549.873	243.526	161.889	159.189	1114.48		1.255	3.987	9.148	6.611	21.00
1958	203.343	63.448	197.924	173.037	637.75	402.837	178.407	118.600	116.622	816.47		1.634	5.192	11.915	8.611	27.35
1959	179.190	55.912	174.415	152.484	562.00	491.461	217.657	144.692	142.278	996.09		0.976	3.100	7.113	5.141	16.33
1960	258.155	80.551	251.276	219.680	809.66	404.516	179.151	119.094	117.108	819.87		1.355	4.305	9.879	7.140	22.68
1961	243.447	75.961	236.960	207.164	763.53	464.628	205.773	136.792	134.510	941.70		1.748	5.554	12.744	9.210	29.26
1962	184.874	57.685	179.947	157.320	579.83	629.836	278.940	185.431	182.338	1276.54		1.531	4.865	11.164	8.068	25.63
1963	134.646	42.013	131.058	114.578	422.29	906.137	401.307	266.778	262.327	1836.55		1.843	5.855	13.436	9.710	30.84
1964	42.433	13.240	41.302	36.109	133.08	679.027	300.725	199.914	196.579	1376.24		2.586	8.214	18.850	13.623	43.27
1965	86.037	26.846	83.745	73.214	269.84	859.722	380.751	253.112	248.890	1742.47		4.060	12.898	29.599	21.391	67.95
1966	242.941	75.804	236.467	206.733	761.94	611.641	270.882	180.075	177.071	1239.67		2.719	8.636	19.818	14.322	45.50
1967	181.403	56.602	176.569	154.367	568.94	1077.791	477.329	317.315	312.021	2184.46		0.697	2.213	5.078	3.670	11.66
1968	247.612	77.261	241.014	210.708	776.60	1001.296	443.451	294.794	289.876	2029.42		0.306	0.973	2.233	1.614	5.13
1969	158.364	49.414	154.144	134.762	496.68	1138.664	504.288	335.236	329.644	2307.83		0.529	1.679	3.853	2.785	8.85
1970	164.843	51.435	160.451	140.275	517.00	1246.132	551.883	366.876	360.756	2525.65		0.417	1.326	3.043	2.199	6.99
1971	210.661	65.731	205.047	179.264	660.70	933.911	413.607	274.955	270.368	1892.84		0.824	2.618	6.007	4.341	13.79
1972	161.850	50.501	157.537	137.728	507.62	836.715	370.562	246.339	242.230	1695.85		0.530	1.683	3.862	2.791	8.87
1973	111.376	34.752	108.408	94.776	349.31	1141.998	505.765	336.218	330.609	2314.59		2.498	7.934	18.207	13.158	41.80
1974	324.018	101.101	315.383	275.726	1016.23	1822.346	807.075	536.521	527.571	3693.51		1.847	5.866	13.461	9.728	30.90
1975	196.285	61.246	191.054	167.031	615.62	1103.393	488.667	324.852	319.433	2236.35		3.813	12.112	27.795	20.087	63.81
1976	144.754	45.167	140.897	123.180	454.00	1532.265	678.605	451.118	443.592	3105.58		6.907	21.940	50.349	36.386	115.58
1977	45.710	14.263	44.491	38.897	143.36	2026.953	897.690	596.760	586.804	4108.21		10.579	33.603	77.113	55.729	177.02
1978	32.278	10.072	31.418	27.467	101.23	1138.591	504.256	335.215	329.623	2307.69		7.356	23.366	53.620	38.751	123.09
1979	4.485	29.334	48.828	12.15	94.797	1296.023	392.986	268.754	301.511	2259.274		1.691	37.117	108.393	91.56	238.761
1980	245.719	78.362	50.266	9.842	384.189	1255.907	379.812	434.1	381.703	2451.522		3.657	58.895	220.117	200.221	482.89
1981	5.736	36.373	16.146	1.263	59.518	2204.938	344.763	317.934	781.237	3648.872		13.36	67.201	231.559	113.577	425.697
1982	44.387	2.86	11.899	106.383	165.529	1715.273	659.936	449.488	190.523	3015.22		9.196	144.833	294.03	228.966	677.025
1983	431.634	50.181	168.449	53.433	703.697	1313.87	427.825	158.307	137.841	2037.843		9.176	83.831	212.673	190.509	496.189
1984	29.172	20.947	78.989	242.39	371.498	938.183	164.293	284.075	225.051	1611.602		33.908	121.085	163.882	125.767	444.642
1985	81.917	50.529	78.73	258.938	470.114	774.723	426.454	196.138	148.755	1546.07		24.235	120.227	144.072	203.031	491.565
1986	66.336	40.496	55.352	38.702	200.886	1017.177	349.899	299.816	129.126	1796.018		41.959	123.123	331.136	125.077	621.295
1987	134.944	7.282	126.903	5.543	274.672	302.973	500.967	310.356	248.96	1363.256		57.812	115.424	340.258	214.06	727.554
1988	1.491	8.656	121.598	97.801	229.546	2.355	714.654	219.286	398.805	1335.1		85.047	81.402	211.888	123.918	502.255
1989	1.318	1.713	262.074	64.629	329.734	16.144	438.118	252.457	193.972	900.691		51.182	99.004	156.458	128.22	434.864
1990	2.911	2.139	296.196	20.302	321.548	360.471	361.821	149.056	370.701	1242.049		121.343	151.769	186.113	181.132	640.357
1991	1.316	1.793	291.738	39.442	334.289	133.46	282.896	180.029	282.845	879.23		184.181	111.302	218.136	188.401	702.02
1992	19.562	2.317	544.585	31.545	598.009	324.317	227.899	153.126	326.945	1032.287		160.666	138.177	183.627	154.64	637.11
1993	14.23	1.482	440.463	42.793	498.968	713.87	315.007	153.267	423.06	1605.204		152.638	122.425	104.878	123.155	503.096
1994	0.716	12.629	463.844	132.252	609.441	255.501	323.979	158.299	118.746	856.525		96.533	91.355	123.395	136.692	447.975
1995	4.394	6.553	365.72	44.932	421.599	590.233	300.186	85.557	175.239	1151.215		154.373	62.938	130.673	179.009	526.993
1996	48.251	10.738	405.712	48.134	512.835	554.869	399.829	178.596	242.289	1375.583		89.904	72.577	122.846	146.986	432.313
1997	27.779	2.059	505.138	69.333	604.309	573.135	418.55	195.803	279.877	1467.365		304.814	88.279	171.351	203.014	767.458
1998	108.726	5.297	466.209	80.676	660.908	583.295	326.116	209.665	258.01	1377.086		140.781	73.278	110.818	260.228	585.105
1999	107.537	4.241	564.758	68.695	745.231	849.325	393.664	132.316	93.584	1468.889		176.324	46.371	75.292	240.143	538.13
2000	79.422	1.084	541.674	32.085	654.265	538.485	306.972	167.457	136.411	1149.325		126.511	69.967	156.992	179.086	532.556
2001	51.364	4.65	413.696	120.453	590.163	630.56	284.385	175.63	148.052	1238.627		74.601	78.877	107.699	158.935	420.112
2002	38.045	5.123	495.746	37.237	576.151	604.822	263.759	140.399	141.16	1150.14		111.91	26.872	101.717	145.964	386.463
2003	38.362	7.965	533.056	18.502	597.885	743.69	253.321	239.941	168.574	1405.526		112.872	37.618	56.658	163.724	370.872
2004	78.512	4.178	510.623	28.546	621.859	640.567	498.895	239.078	49.9	1428.44		33.745	53.635	95.407	277.034	459.821
2005	56.034	12.223	377.935	74.722	520.914	807.621	318.545	149.108	115.299	1390.573		115.032	58.533	101.64	321.346	596.551
2006	42.466	41.473	513.921	47.874	645.734	719.27	514.042	273.811	117.76	1624.883		79.131	49.879	133.841	303.325	566.176
2007	149.716	14.632	44.828		209.176	622.865	384.529	169.527		1176.921		47.108	71.765	94.497	243.088	456.458

Table 11. King mackerel recreational HeadBoat AB1 catch 1930-2007. Partial reports for 2007 see text for details.

Catch_Numb	HeadBoat															
	ATLnoMix					GLFnoMix					MixZone					
Year	JanMar	AprJun	JulOct	NovDec	Total	JanMar	AprJun	JulOct	NovDec	Total	JanMar	AprJun	JulOct	NovDec	Total	
1930	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1931	-	15	15	-	31	14	40	155	8	217	40	21	53	28	142	
1932	-	31	31	-	62	28	80	310	16	434	80	42	106	56	283	
1933	-	46	46	-	92	42	120	466	24	651	120	62	159	84	425	
1934	-	62	61	-	123	56	160	621	32	868	160	83	211	112	566	
1935	-	77	76	-	154	69	200	776	40	1,085	200	104	264	140	708	
1936	-	93	92	-	185	83	240	931	48	1,302	240	125	317	168	850	
1937	-	108	107	-	215	97	280	1,086	56	1,519	280	145	370	196	991	
1938	-	124	122	-	246	111	320	1,241	64	1,737	320	166	423	223	1,133	
1939	-	139	138	-	277	125	360	1,397	72	1,954	360	187	476	251	1,274	
1940	-	155	153	-	308	139	400	1,552	80	2,171	400	208	528	279	1,416	
1941	-	170	168	-	339	153	440	1,707	88	2,388	441	229	581	307	1,558	
1942	-	186	184	-	369	167	480	1,862	96	2,605	481	249	634	335	1,699	
1943	-	201	199	-	400	180	520	2,017	104	2,822	521	270	687	363	1,841	
1944	-	217	214	-	431	194	560	2,172	112	3,039	561	291	740	391	1,982	
1945	-	232	229	-	462	208	600	2,328	120	3,256	601	312	793	419	2,124	
1946	-	248	245	-	493	222	640	2,483	129	3,473	641	332	846	447	2,266	
1947	-	263	260	-	523	236	680	2,638	137	3,690	681	353	898	475	2,407	
1948	-	279	275	-	554	250	720	2,793	145	3,907	721	374	951	503	2,549	
1949	-	294	291	-	585	264	760	2,948	153	4,124	761	395	1,004	531	2,690	
1950	-	310	306	-	616	278	800	3,104	161	4,341	801	416	1,057	559	2,832	
1951	-	325	321	-	646	291	840	3,259	169	4,558	841	436	1,110	587	2,974	
1952	-	341	337	-	677	305	880	3,414	177	4,775	881	457	1,163	615	3,115	
1953	-	356	352	-	708	319	920	3,569	185	4,993	921	478	1,215	642	3,257	
1954	-	372	367	-	739	333	959	3,724	193	5,210	961	499	1,268	670	3,398	
1955	-	387	382	-	770	347	999	3,879	201	5,427	1,001	519	1,321	698	3,540	
1956	-	403	398	-	800	361	1,039	4,035	209	5,644	1,001	519	1,321	698	3,540	
1957	-	418	413	-	831	375	1,079	4,190	217	5,861	1,001	519	1,321	698	3,540	
1958	-	434	428	-	862	389	1,119	4,345	225	6,078	1,001	519	1,321	698	3,540	
1959	-	449	444	-	893	402	1,159	4,500	233	6,295	1,001	519	1,321	698	3,540	
1960	-	465	459	-	924	416	1,199	4,655	241	6,512	1,001	519	1,321	698	3,540	
1961	-	480	474	-	954	430	1,239	4,811	249	6,729	989	518	1,327	692	3,526	
1962	-	496	489	-	985	444	1,279	4,966	257	6,946	976	517	1,333	685	3,512	
1963	-	511	505	-	1,016	458	1,319	5,121	265	7,163	964	516	1,339	679	3,498	
1964	-	527	520	-	1,047	472	1,359	5,276	273	7,380	951	515	1,345	672	3,484	
1965	-	542	535	-	1,077	486	1,399	5,431	281	7,597	939	514	1,351	666	3,470	
1966	-	558	551	-	1,108	500	1,439	5,586	289	7,814	927	513	1,357	659	3,456	
1967	-	573	566	-	1,139	513	1,479	5,742	297	8,031	914	512	1,363	653	3,442	
1968	-	589	581	-	1,170	527	1,519	5,897	305	8,248	902	511	1,369	647	3,428	
1969	-	604	597	-	1,201	541	1,559	6,052	313	8,466	889	510	1,375	640	3,414	
1970	-	620	612	-	1,231	555	1,599	6,207	321	8,683	877	509	1,380	634	3,400	
1971	-	635	627	-	1,262	569	1,639	6,362	329	8,900	864	508	1,386	627	3,386	
1972	-	650	642	-	1,293	583	1,679	6,517	337	9,117	852	507	1,392	621	3,372	
1973	-	666	658	-	1,324	597	1,719	6,673	345	9,334	839	506	1,398	614	3,358	
1974	-	681	673	-	1,354	611	1,759	6,828	353	9,551	827	505	1,404	608	3,344	
1975	-	697	688	-	1,385	624	1,799	6,983	361	9,768	814	504	1,410	601	3,330	
1976	-	712	704	-	1,416	638	1,839	7,138	370	9,985	802	503	1,416	595	3,316	
1977	-	728	719	-	1,447	652	1,879	7,293	378	10,202	790	502	1,422	588	3,302	
1978	-	743	734	-	1,478	666	1,919	7,449	386	10,419	777	501	1,428	582	3,288	
1979	-	759	749	-	1,508	680	1,959	7,604	394	10,636	765	500	1,434	575	3,274	
1980	-	774	765	-	1,539	694	1,999	7,759	402	10,853	752	499	1,440	569	3,260	
1981	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1982	-	-	-	-	-	-	819	2,013	388	-	-	-	-	-	-	
1983	-	-	-	-	-	-	819	2,013	388	3,220	-	-	-	-	-	
1984	-	-	-	-	-	-	1,299	6,166	97	7,562	-	-	-	-	-	
1985	-	-	-	-	-	264	1,307	5,335	97	7,003	-	-	-	-	-	
1986	-	568	1,224	-	1,792	13	2,780	6,003	38	8,834	3,770	11,587	14,808	4,659	34,824	
1987	-	895	2,243	-	3,138	20	2,044	7,533	46	9,643	30,634	15,885	10,405	3,971	60,895	
1988	-	1,307	1,792	-	3,099	-	1,384	8,111	5	9,500	480	10,106	8,867	1,703	21,156	
1989	-	1,440	877	-	2,317	17	1,347	9,071	52	10,487	2,746	6,820	14,885	7,286	31,737	
1990	-	716	1,301	-	2,017	596	1,538	9,125	30	11,289	10,575	13,318	12,530	11,062	47,485	
1991	-	1,357	3,797	-	5,154	2	553	12,271	34	12,860	7,425	12,369	23,773	10,390	53,957	
1992	-	1,470	3,373	-	4,843	7	3,308	14,601	12	17,928	5,994	6,943	11,389	6,246	30,572	
1993	-	1,267	1,495	-	2,762	98	3,154	11,871	130	15,253	11,705	5,819	13,076	7,191	37,791	
1994	-	881	1,404	-	2,285	425	5,970	12,868	152	19,415	10,956	9,349	13,456	5,482	39,243	
1995	-	825	1,626	-	2,451	13	6,339	15,367	8	21,727	9,717	7,786	8,471	3,636	29,610	
1996	-	691	885	-	1,576	4	5,173	14,001	642	19,820	7,274	9,635	20,396	12,282	49,587	
1997	20	867	2,951	245	4,083	1,729	5,456	13,624	649	21,458	11,141	8,524	6,101	9,234	35,000	
1998	38	2,114	1,664	261	4,077	1,027	4,122	8,826	683	14,658	10,765	5,046	7,232	5,790	28,833	
1999	5	956	1,405	313	2,679	611	4,540	13,662	601	19,414	3,485	3,757	13,586	5,705	26,533	
2000	111	1,494	3,297	496	5,398	2,049	3,820	9,698	662	16,229	7,062	5,655	8,984	4,084	25,785	
2001	99	958	1,492	215	2,764	679	2,431	9,434	701	13,245	5,025	3,676	6,114	2,017	16,832	
2002	2	533	899	228	1,662	549	3,397	9,767	940	14,653	2,317	3,693	6,315	2,161	14,486	
2003	2	642	607	55	1,306	3,987	7,104	9,644	806	21,541	2,841	1,721	6,072	3,036	13,670	
2004	10	639	1,092	972	2,713	1,270	2,706	13,865	416	18,257	3,006	3,762	7,157	3,592	17,517	
2005	34	782	1,268	753	2,837	2,032	5,223	11,711	412	19,378	9,555	7,089	11,762	6,460	34,866	
2006	22	943	1,515	553	3,033	5,156	6,815	11,413	1,086	24,470	10,812	4,938	9,474	3,127	28,351	
2007	22	285	-	-	307	-	-	-	-	-	-	1,199	-	-	1,199	

Table 12. King mackerel recreational MRFSS AB1 catch 1930-2007. Partial reports for 2007 see text for details.

Sum of Catch_Numb	MRFSS														
	ATLnoMix					GLFnoMix					MixZone				
year	JanMar	AprJun	JulOct	NovDec	Total	JanMar	AprJun	JulOct	NovDec	Total	JanMar	AprJun	JulOct	NovDec	Total
1930	463	5,493	-	-	5,956	-	-	-	-	-	-	-	-	-	-
1931	1,053	6,522	3,475	353	11,403	-	319	6,519	23	6,861	1,467	21	53	28	1,569
1932	1,643	7,550	6,951	706	16,850	-	638	13,039	45	13,722	2,934	42	106	56	3,137
1933	2,233	8,579	10,426	1,059	22,297	-	957	19,558	68	20,583	4,401	62	159	84	4,706
1934	2,823	9,608	13,902	1,412	27,744	-	1,276	26,078	90	27,444	5,868	83	211	112	6,274
1935	3,413	10,636	17,377	1,765	33,191	-	1,595	32,597	113	34,305	7,335	104	264	140	7,843
1936	4,003	11,665	20,853	2,118	38,638	-	1,914	39,117	135	41,166	8,802	125	317	168	9,411
1937	4,593	12,694	24,328	2,471	44,085	-	2,233	45,636	158	48,028	10,269	145	370	196	10,980
1938	5,182	13,722	27,804	2,824	49,532	-	2,552	52,156	180	54,889	11,736	166	423	223	12,549
1939	5,772	14,751	31,279	3,189	54,991	-	2,871	58,675	203	61,750	13,203	187	476	251	14,117
1940	6,406	15,983	34,754	3,566	60,709	-	3,190	65,195	226	68,611	14,670	208	528	279	15,686
1941	7,044	17,231	38,230	3,944	66,448	-	3,510	71,714	248	75,472	16,137	229	581	307	17,254
1942	7,682	18,479	41,705	4,322	72,188	-	3,829	78,234	271	82,333	17,604	249	634	335	18,823
1943	8,319	19,727	45,181	4,700	77,927	-	4,148	84,753	293	89,194	19,071	270	687	363	20,392
1944	8,957	20,975	48,656	5,078	83,666	-	4,467	91,273	316	96,055	20,538	291	740	391	21,960
1945	9,594	22,223	52,132	5,456	89,405	-	4,786	97,792	338	102,916	22,005	312	793	419	23,529
1946	10,232	23,471	55,607	5,835	95,144	-	5,105	104,312	361	109,777	23,472	332	846	447	25,097
1947	10,870	24,719	59,082	6,213	100,884	-	5,424	110,831	383	116,638	24,939	353	898	475	26,666
1948	11,507	25,967	62,558	6,591	106,623	-	5,743	117,351	406	123,499	26,406	374	951	503	28,234
1949	12,145	27,215	66,033	6,969	112,362	-	6,062	123,870	428	130,360	27,874	395	1,004	531	29,803
1950	12,874	28,886	69,509	7,372	118,641	-	6,381	130,389	451	137,221	29,341	416	1,057	559	31,372
1951	13,528	30,211	72,984	7,755	124,479	-	7,195	136,909	634	144,738	30,808	436	1,110	587	32,940
1952	14,183	31,536	76,460	8,138	130,317	-	8,096	143,428	819	152,343	32,275	457	1,163	615	34,509
1953	14,837	32,862	79,935	8,521	136,155	-	8,997	149,948	1,003	159,948	33,742	478	1,215	642	36,077
1954	15,492	34,187	83,411	8,903	141,993	1,159	9,898	156,467	1,188	168,712	35,209	499	1,268	670	37,646
1955	16,146	35,513	86,886	9,286	147,831	2,690	10,799	162,987	1,372	177,848	36,676	519	1,321	698	39,215
1956	16,800	36,838	90,361	9,669	153,669	4,221	11,700	169,506	1,557	186,984	38,143	519	1,321	698	40,682
1957	17,455	38,163	93,837	10,052	159,507	5,752	12,601	176,026	1,741	196,120	39,610	519	1,321	698	42,149
1958	18,109	39,489	97,312	10,434	165,345	7,283	13,502	182,545	1,925	205,256	41,077	519	1,321	698	43,616
1959	18,764	40,814	100,788	10,817	171,183	8,814	14,403	189,065	2,110	214,392	42,544	519	1,321	698	45,083
1960	19,527	42,640	104,263	11,230	177,659	11,876	15,886	195,584	2,456	225,803	44,011	519	1,321	698	46,550
1961	20,119	43,679	107,739	11,595	183,132	12,848	16,575	202,104	2,582	234,109	45,478	518	1,327	692	48,015
1962	20,711	44,719	111,214	11,961	188,606	13,821	17,264	208,623	2,707	242,415	46,945	517	1,333	685	49,481
1963	21,304	45,759	114,689	12,327	194,079	14,794	17,953	215,143	2,833	250,722	48,412	516	1,339	679	50,946
1964	21,896	46,799	118,165	12,693	199,552	15,766	18,642	221,662	2,958	259,028	49,879	515	1,345	672	52,411
1965	22,488	47,838	121,640	13,058	205,025	16,739	19,330	228,182	3,083	267,334	51,346	514	1,351	666	53,877
1966	23,081	48,878	125,116	13,424	210,499	17,712	20,019	234,701	3,209	275,641	52,813	513	1,357	659	55,342
1967	23,673	49,918	128,591	13,790	215,972	18,684	20,708	241,221	3,334	283,947	54,280	512	1,363	653	56,808
1968	24,265	50,957	132,067	14,156	221,445	19,657	21,397	247,740	3,460	292,254	55,747	511	1,369	647	58,273
1969	24,858	51,997	135,542	14,521	226,918	20,630	22,086	254,260	3,585	300,560	57,214	510	1,375	640	59,739
1970	25,496	53,251	139,018	14,900	232,665	22,575	23,144	260,779	3,813	310,312	58,681	509	1,380	634	61,204
1971	26,159	54,613	142,493	15,285	238,550	24,378	24,149	267,298	4,027	319,851	60,148	508	1,386	627	62,670
1972	26,821	55,975	145,968	15,670	244,434	26,180	25,153	273,818	4,240	329,391	61,615	507	1,392	621	64,135
1973	27,483	57,337	149,444	16,055	250,319	27,983	26,157	280,337	4,656	339,134	63,082	506	1,398	614	65,601
1974	28,146	58,699	152,919	16,440	256,203	29,785	27,161	286,857	5,263	349,067	64,549	505	1,404	608	67,066
1975	28,808	60,061	156,395	16,825	262,088	31,588	28,166	293,376	5,870	359,000	66,016	504	1,410	601	68,531
1976	29,470	61,423	159,870	17,209	267,973	33,391	29,170	299,896	6,477	368,934	67,483	503	1,416	595	69,997
1977	30,133	62,784	163,346	17,594	273,857	35,193	30,174	306,415	7,084	378,867	68,950	502	1,422	588	71,462
1978	30,795	64,146	166,821	17,979	279,742	36,996	31,179	312,935	7,691	388,800	70,417	501	1,428	582	72,928
1979	31,457	65,508	170,297	18,364	285,626	38,798	32,183	319,454	8,298	398,733	71,884	500	1,434	575	74,393
1980	32,236	67,407	173,772	18,781	292,196	42,404	35,058	325,974	9,489	412,924	73,351	499	1,440	569	75,859
1981	-	33,541	268,631	-	302,172	-	220,893	143,687	-	364,580	285,621	43,208	71,079	17,464	417,372
1982	80,157	111,172	96,445	-	287,773	-	54,150	679,271	-	733,421	82,412	101,979	219,993	92,693	497,077
1983	-	195,629	132,296	-	327,925	1,744	23,729	264,751	-	290,224	21,958	88,583	253,009	8,893	372,443
1984	1,544	64,776	264,248	-	330,568	898	10,621	259,875	9,459	280,853	52,944	72,818	210,736	59,374	395,872
1985	-	63,894	519,921	6,171	589,986	-	25,369	109,665	-	135,034	35,920	133,983	82,142	18,407	270,452
1986	12,189	175,057	291,542	35,870	514,658	-	15,347	120,890	300	136,537	28,240	49,698	91,554	39,544	209,036
1987	28,068	144,322	232,606	16,028	421,023	-	170,235	211,235	-	381,470	67,836	66,710	50,226	53,481	238,253
1988	4,312	103,565	265,728	5,722	379,326	-	12,615	331,729	-	344,344	12,094	46,704	98,162	107,050	264,010
1989	14,426	51,517	120,350	20,022	206,315	327	31,805	192,477	2,819	227,428	40,755	57,469	80,952	75,817	254,993
1990	25,893	45,627	157,293	39,901	268,713	583	125,291	213,626	14	339,514	87,952	63,357	104,375	102,660	358,344
1991	1,052	85,030	217,646	35,391	339,119	409	75,782	477,967	-	554,158	81,155	83,555	126,442	61,917	353,069
1992	49,155	93,350	255,928	14,415	412,848	964	107,390	214,653	490	323,497	57,880	71,124	208,696	80,919	418,619
1993	6,038	51,240	87,831	26,825	171,934	430	104,167	281,177	1,146	386,920	195,484	49,087	115,370	78,381	438,322
1994	22,990	60,183	75,246	30,953	189,372	2,122	106,657	245,880	4,336	358,995	179,165	62,175	121,187	80,218	442,745
1995	6,868	25,692	105,785	42,377	180,722	2,044	155,900	91,209	-	249,153	269,052	109,275	155,642	101,710	635,679
1996	6,010	46,488	67,660	19,847	140,005	502	180,766	189,391	1,408	372,066	228,779	93,601	99,754	92,940	515,074
1997	23,392	68,798	184,106	18,734	295,030	77	99,118	227,269	3,886	330,350	234,638	107,531	108,196	134,193	584,558
1998	15,264	120,766	62,567	23,297	221,894	1,246	95,335	178,438	2,919	277,938	212,511	125,096	85,919	101,475	525,001
1999	4,501	24,183	51,776	25,297	105,757	262	102,117	145,729	4,330	252,438	152,228	127,055	106,862	100,464	486,609
2000	3,945	60,009	122,717	27,552	214,223	3,511	94,459	236,936	29,597	364,503	90,281	101,505	214,363	57,339	463,488
2001	5,296	49,146	75,646	12,366	142,454	2,270	95,520	199,535	19,338	316,663	140,759	103,728	81,256	49,567	375,310
2002	1,883	13,356	34,831	33,798	83,868	1,878	151,134	181,683	358	335,053	128,279	95,934	86,720	86,173	397,106
2003	1,106	32,552	82,001	21,578	137,237	1,263	99,182	167,785	11,206	279,436	204,822	157,006	142,265	67,650	571,743
2004	3,497	38,494	66,313	18,488	126,792	1,686	111,466	158,346	6,800	278,298	98,972	92,517	115,994	49,901	357,384
2005	1,109	45,670	110,439	20,800	178,018	459	130,107	102,129	1,769	234,463	103,013	90,898	108,168	58,527	360,606
2006	6,863	60,983	65,933	7,051	140,830	792	214,431	295,605	1,492	512,320	145,118	140,280	148,863	79,261	513,522
2007	1,369	226,479	-	-	227,848	2,572	379,222	-	-	381,794	176,378	336,278	-	-	512,656

Table 13. Numbers of sexed king mackerels by stock unit, year, season available for sex-ratio at size estimation.

		season	Values						
		JanMar		AprJun		JulOct		NovDec	
MigGrp	year	Sum of females	Sum of males	Sum of females	Sum of males	Sum of females	Sum of males	Sum of females	Sum of males
ATL	1980			1	1	18	7		
	1981			356	486				
	1983			193	333				
	1984			404	884	1663	1213	28	13
	1985			406	115	2255	1269	227	94
	1986			708	670	3527	2660	80	72
	1987	8	1	1401	2070	5597	3101	422	456
	1988	38	17	1411	1840	3354	2217	144	96
	1989	11	3	2300	2584	2579	1635	169	136
	1990	10	9	1008	1609	3511	2555	360	237
	1991	53	64	829	1127	3597	2605	162	199
	1992	9	22	1033	1361	2832	2262	218	185
	1993	155	104	948	1220	1219	1124	70	39
	1994	53	33	1597	2812	1046	1003	50	43
	1995	14	13	569	981	455	389	27	26
	1996	16	10	931	1574	1098	520	1	0
	1997	0	1	228	305	396	296	13	10
	1998	37	25	634	1001	1024	941	19	6
	1999	19	13	1469	1978	966	818	55	36
	2000	14	12	1301	2087	1196	1086	26	9
	2001			1029	1618	1333	1203	38	15
	2002	14	11	884	936	878	806		
	2003			1332	2324	1464	1239	23	17
	2004			1022	1095	1424	651		
	2005	0	47	428	579	538	439		
	2006			869	986	635	535	0	34
	2007	0	239	313	544	39	36		
ATL Total		**451**	**624**	**23604**	**33120**	**42644**	**30610**	**2132**	**1723**
GLF	1981	5479	5768	144	275			1603	1119
	1982	3084	3525					1054	212
	1983	3287	2900	74	267	2256	1050	113	71
	1984	8808	6390			1876	1146	5598	2671
	1985	1568	1417	609	896	1985	1142	900	241
	1986	2076	1771	399	253	1460	986	58	86
	1987	1136	591	853	367	2815	1457	82	50
	1988	77	22	357	149	1852	988	314	144
	1989	123	112	305	181	2267	856	303	165
	1990	579	488	390	243	964	380	521	360
	1991	50	12	400	202	2528	1369	2032	918
	1992	1890	863	977	435	2863	1074	1621	665
	1993	2104	1680	606	143	1546	993	1874	737
	1994	517	385	743	153	1532	680	402	93
	1995	1098	1188	451	111	628	325	1033	440
	1996	2357	1530	518	300	963	424	1851	694
	1997	2144	1015	301	96	798	380	398	214
	1998	1658	1232	91	38	189	60	745	484
	1999	2670	2930	60	45	153	74	675	388
	2000	3025	2113	47	9	96	36	166	81
	2001	1858	1528	5	4	433	444	593	387
	2002	2007	2085	192	95	879	709	639	421
	2003	2255	2141	313	130	968	842	563	213
	2004	906	800	99	40	982	610	176	69
	2005	1500	1151	168	59	469	302	122	30
	2006	1090	672	274	103	996	732	249	54
	2007	233	106	130	83	321	381		
GLF Total		**53579**	**44415**	**8506**	**4677**	**31819**	**17440**	**23685**	**11007**
Grand Total		**54030**	**45039**	**32110**	**37797**	**74463**	**48050**	**25817**	**12730**

Table 14. Summary fit of the GAM final model to estimate sex-ratios (proportion males) at size of king mackerel.

Family: binomial
Link function: logit

Formula: males/(males+females) ~ s(size) + MigGrp + year + season + year *season

Parametric Terms:	df	Chi.sq	p-value
MigGrp	1	1523.29	< 2e-16
year	26	1137.89	< 2e-16
season	3	42.67	2.89E-09
year:season	75	1375.01	< 2e-16
AIC	29436.61		

Approximate significance of smooth terms:

	edf	Est.rank	Chi.sq	p-value
s(size)	6.39	9	16022	<2e-16
R-sq.(adj)	=	0.973		
Deviance explained	=	67.60%		
UBRE score	=	3.4459		
Scale est.	=	1		
n	=	3966		

Table 15. Otolith aged king mackerel available for construction of Age Length Keys by stock, year and season. Shade bars are proportional to the number of samples per cell, under the total column cells with 400 or more samples per year are shaded. Partial reports for 2007 samples.

MigGrp	Year	JanMar	AprJun	JulOct	NovDec	Total
ATL	1986		207	314		521
	1987		216	175	110	501
	1988		304	148	16	468
	1989		147	675	13	835
	1990	19	221	685	44	969
	1991	36	120	577	51	784
	1992	31	261	912	83	1287
	1993	124	430	306	45	905
	1994	86	273	476	44	879
	1995	27	359	258	14	658
	1996	19	414	483		916
	1997		114	386	24	524
	1998	65	230	424	25	744
	1999	32	429	346	82	889
	2000	26	147	453	35	661
	2001		289	536	53	878
	2002	29	253	610		892
	2003		883	905	40	1828
	2004		680	1016		1696
	2005		105	245		350
	2006		237	380		617
	2007		6			6
ATL Total		**494**	**6325**	**10310**	**679**	**17808**
GLF	1986		15	336	6	357
	1987	48	274	584	1	907
	1988	87	171	517	45	820
	1989	124	275	621	35	1055
	1990	189	351	357	44	941
	1991	62	523	872	355	1812
	1992	141	475	836	76	1528
	1993	70	264	912	154	1400
	1994	130	287	590	132	1139
	1995	41	246	331	408	1026
	1996	300	374	622	517	1813
	1997	640	166	374	38	1218
	1998	293	104	111	199	707
	1999	194	91	192	106	583
	2000	530	56	126	179	891
	2001	1105	9	412	177	1703
	2002	977	200	899	422	2498
	2003	1034	307	942	483	2766
	2004	622	40	602	263	1527
	2005	462	151	503	86	1202
	2006	249	292	520	64	1125
	2007	308	141			449
GLF Total		**7606**	**4812**	**11259**	**3790**	**27467**

Table 16. Atlantic king size at age information available. Shades code: grey for cells [5-15] samples, salmon [16-40], ochre [41-100], and red >100.

MigGrp ATL — **Size at Age ALL Years ATLANTIC KING**

N / SzBin_5cm	Age 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total
152.5													1						2	1		1	1	1				7
147.5											1				1	1			2		2		3	1				11
142.5								1							2	3		2		4	1	3				1		17
137.5										1	1	1	4	8	5	5	5	10	5	6	4	4	3		3	1	1	67
132.5							2	2	3	7	7	5	21	15	14	20	11	7	12	9	6	1	1					143
127.5							2	7	17	29	26	32	33	31	29	30	17	18	15	8	5	5	2					306
122.5						1	14	31	32	58	73	41	54	35	38	34	18	16	10	6	5	2	2		1			471
117.5					1	8	36	58	90	96	94	70	33	36	31	25	24	10	5	5	5	4	7		1			639
112.5					6	28	80	108	117	92	93	77	54	38	21	27	18	15	8	9	2	3	1	1				798
107.5				3	29	91	157	138	172	94	70	54	45	36	30	28	12	11	11	6	2		1		1			991
102.5				6	63	165	209	175	120	105	77	73	44	54	36	30	19	16	11	8	4	3	1					1219
97.5				42	148	256	244	174	139	89	78	57	58	28	22	20	18	8	6		1	1						1389
92.5			4	98	264	297	261	221	151	111	106	61	34	37	22	10	8	9	4			1						1699
87.5			50	296	453	457	308	175	114	66	46	28	30	4	4	4	2	1				1						2039
82.5		2	168	599	646	469	217	82	37	23	10	6	2			2	1				1							2265
77.5		12	562	932	467	146	24	4	2	1	1		1															2152
72.5		45	952	540	96	6			1																			1640
67.5		152	561	80	7																							800
62.5	1	232	268	10																								511
57.5	1	166	76																									243
52.5		124	3																									127
47.5		139	3																									142
42.5	1	71	1	1																								74
37.5	18	26																										44
32.5	3	5																										8
27.5	1																											1
22.5	4																											4
17.5	1																											1
Total	30	974	2648	2607	2180	1924	1554	1176	995	772	683	505	414	322	255	239	153	123	91	62	38	29	22	3	6	2	1	17808

Table 17. Gulf king size at age information available. Shades code: grey for cells [5-15] samples, salmon [16-40], ochre [41-100], and red >100.

MigGrp GLF — **Size at Age ALL Years GULF KING**

N / SzBin_5cm	Final Age 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total
157.5																			1									1
152.5												1				3			1	2		1						8
147.5											1	1	4	4	7	7	3	2	2	1	1	1						34
142.5									3	2	4	6	1	8	11	1	5	6	4	3	2	1			1			58
137.5								4	2	10	12	15	14	13	18	7	2	6	7									110
132.5							1	3	10	12	26	27	27	26	25	14	13	10	3	6		1	2					206
127.5						2	1	18	30	42	47	39	40	32	23	12	12	5		2	2	1	1					309
122.5							8	32	51	58	78	76	43	41	18	22	10	5	3	4	1							450
117.5						7	31	66	97	91	89	56	49	24	16	7	8	3	3		3							550
112.5					2	22	74	101	112	101	83	48	40	21	16	5	6	2	3	6	2	1		2				647
107.5					4	48	147	174	121	96	65	43	32	18	18	12	9	4	1	4	1	1	1					799
102.5					32	148	194	177	127	106	60	34	27	38	15	10	8	7	2		1	1			1			988
97.5				4	74	279	316	215	123	72	61	51	36	38	30	10	6	3	2									1320
92.5	1		54	266	414	365	221	162	103	96	64	47	27	4	4	3			1		1							1833
87.5		2	231	671	634	396	264	173	124	68	26	12	10	3					1									2615
82.5		49	617	1063	808	449	269	127	61	26	14	5	2	1	1													3492
77.5	1	116	1034	1423	812	230	66	17	7	1	2	2	3															3714
72.5		243	1925	1250	314	73	11	1	3		1	2	1	1	1													3826
67.5		571	1866	368	48	6			1	1			1															2862
62.5	2	756	1137	98	4			1																				1998
57.5	8	615	292	9	2																							926
52.5	6	370	49	4																								429
47.5	21	169	7																									197
42.5	8	43	1																									52
37.5	5	16	1																									22
32.5	4	11																										15
27.5	2	3																										5
22.5																												
17.5																												
12.5	1																											1
Total	59	2964	7218	5264	3542	2291	1617	1156	882	713	498	385	301	195	134	93	49	33	37	17	8	7	2	1	1	0	0	27467

Table 18. Ageing protocol used to convert king mackerel Catch at size by sex to Catch at Age by sex. Codes: KEY Age length keys, SAR Stochastic length deconvolution.

Year	Stock Unit	Q1	Q2	Q3	Q4	Stock Unit	Q1	Q2	Q3	Q4	Stock Unit	Q1	Q2	Q3	Q4
1981	ATL	SAR	SAR	SAR	SAR	EGF	SAR	SAR	SAR	SAR	WGF	SAR	SAR	SAR	SAR
1982	ATL	SAR	SAR	SAR	SAR	EGF	SAR	SAR	SAR	SAR	WGF	SAR	SAR	SAR	SAR
1983	ATL	SAR	SAR	SAR	SAR	EGF	SAR	SAR	SAR	SAR	WGF	SAR	SAR	SAR	SAR
1984	ATL	SAR	SAR	SAR	SAR	EGF	SAR	SAR	SAR	SAR	WGF	SAR	SAR	SAR	SAR
1985	ATL	SAR	SAR	SAR	SAR	EGF	SAR	SAR	SAR	SAR	WGF	SAR	SAR	SAR	SAR
1986	ATL	SAR	SAR	SAR	SAR	EGF	SAR	SAR	SAR	SAR	WGF	SAR	SAR	SAR	SAR
1987	ATL	SAR	KEY	KEY	KEY	EGF	KEY	KEY	KEY	SAR	WGF	SAR	SAR	SAR	SAR
1988	ATL	SAR	KEY	KEY	KEY	EGF	SAR	SAR	SAR	SAR	WGF	SAR	SAR	SAR	SAR
1989	ATL	SAR	KEY	KEY	KEY	EGF	KEY	KEY	KEY	SAR	WGF	SAR	SAR	SAR	SAR
1990	ATL	SAR	KEY	KEY	KEY	EGF	KEY	KEY	KEY	SAR	WGF	SAR	SAR	SAR	SAR
1991	ATL	SAR	KEY	KEY	KEY	EGF	SAR	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1992	ATL	SAR	KEY	KEY	KEY	EGF	KEY	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1993	ATL	KEY	KEY	KEY	KEY	EGF	SAR	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1994	ATL	KEY	KEY	KEY	KEY	EGF	SAR	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1995	ATL	SAR	KEY	KEY	KEY	EGF	SAR	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1996	ATL	SAR	KEY	KEY	KEY	EGF	KEY	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1997	ATL	SAR	KEY	KEY	KEY	EGF	KEY	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1998	ATL	KEY	KEY	KEY	KEY	EGF	KEY	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
1999	ATL	SAR	KEY	KEY	KEY	EGF	KEY	KEY	KEY	KEY	WGF	SAR	SAR	SAR	SAR
2000	ATL	SAR	KEY	KEY	KEY	EGF	KEY	SAR	KEY	KEY	WGF	SAR	SAR	SAR	SAR
2001	ATL	SAR	KEY	KEY	KEY	EGF	KEY	SAR	KEY	KEY	WGF	SAR	SAR	SAR	SAR
2002	ATL	SAR	SAR	SAR	SAR	EGF	KEY	KEY	SAR	SAR	WGF	SAR	SAR	SAR	SAR
2003	ATL	SAR	KEY	KEY	KEY	EGF	KEY	SAR	KEY	KEY	WGF	SAR	SAR	SAR	SAR
2004	ATL	SAR	KEY	KEY	KEY	EGF	KEY	SAR	KEY	KEY	WGF	SAR	SAR	SAR	SAR
2005	ATL	SAR	SAR	SAR	SAR	EGF	KEY	SAR	KEY	KEY	WGF	SAR	SAR	SAR	SAR
2006	ATL	SAR	KEY	KEY	KEY	EGF	KEY	SAR	KEY	KEY	WGF	SAR	SAR	SAR	SAR
2007	ATL	SAR	KEY	KEY	KEY	EGF	KEY	SAR	KEY	KEY	WGF	SAR	SAR	SAR	SAR

Table 19. Catch at age Atlantic king stock unit.

Catch at age numbers of fish by year Atlantic stock unit													
Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11+	Total
1981	15,016	111,739	42,034	52,235	65,952	72,641	105,164	49,795	48,885	40,364	32,692	54,776	691,294
1982	5,590	11,334	24,660	16,574	67,554	113,238	180,085	160,567	127,703	82,018	47,495	155,837	992,655
1983	2,008	18,649	31,512	64,288	106,574	79,042	139,089	74,788	163,996	39,392	19,797	161,499	900,632
1984	18,141	33,495	8,249	10,519	52,326	97,633	124,240	143,418	76,554	43,330	21,394	167,444	796,742
1985	26,832	7,709	98,501	108,027	39,249	78,679	121,937	88,309	170,504	129,190	17,053	148,317	1,034,308
1986	41,440	50,818	118,326	62,646	108,361	98,120	80,863	89,950	79,431	67,904	28,053	127,903	953,815
1987	1,675	139,044	193,970	121,141	109,929	85,868	61,330	25,271	56,195	20,622	10,380	88,762	914,188
1988	275	15,299	159,054	213,492	127,434	38,362	40,660	55,890	27,817	72,121	23,304	119,669	893,375
1989	1	46,833	63,242	107,374	93,464	72,033	50,871	28,056	24,717	16,423	62,202	69,480	634,694
1990	-	97,915	127,448	79,018	97,418	88,152	70,676	38,295	22,377	30,251	19,308	89,886	760,742
1991	25	52,039	253,274	114,607	52,361	98,169	96,915	56,952	37,737	21,604	14,657	89,932	888,271
1992	4,439	39,590	176,458	290,705	86,959	77,832	75,262	62,421	37,609	20,874	17,551	99,096	988,796
1993	2,483	23,126	59,562	105,902	125,075	42,253	33,948	44,343	55,123	26,146	20,871	63,488	602,320
1994	-	44,062	113,234	52,532	93,128	109,556	50,178	23,516	27,206	36,073	20,600	37,743	607,829
1995	-	68,071	142,807	73,251	51,960	65,649	95,653	32,617	21,637	31,377	29,311	45,162	657,494
1996	-	27,878	151,548	94,920	74,974	44,868	50,028	77,435	22,872	15,409	10,925	36,267	607,123
1997	-	71,773	206,127	133,542	108,816	78,370	46,850	67,849	61,581	26,265	12,762	59,973	873,909
1998	1,018	28,076	133,456	182,641	126,697	69,314	31,098	22,478	43,072	50,410	6,912	31,830	727,002
1999	-	46,683	81,239	110,804	138,470	79,337	47,499	21,081	18,652	27,453	26,575	20,915	618,707
2000	1,479	4,733	221,427	105,875	168,817	115,125	52,448	21,187	10,936	13,615	28,801	47,230	791,674
2001	-	6,871	51,148	119,357	79,289	100,249	59,248	27,571	12,998	6,957	10,944	56,057	530,688
2002	4,678	7,045	29,017	26,774	32,345	55,575	66,764	65,123	41,785	22,519	3,643	86,323	441,591
2003	3	9,039	158,312	65,207	92,742	134,734	47,955	63,933	32,989	14,491	4,510	21,890	645,803
2004	-	34,114	99,824	156,628	48,800	69,691	104,067	25,671	40,610	17,391	9,219	18,921	624,936
2005	25,148	3,197	16,749	50,229	113,485	154,947	72,450	35,857	66,081	22,150	6,026	89,496	655,813
2006	-	8,773	119,281	244,539	100,275	141,716	25,703	14,029	45,745	5,173	19,833	31,254	756,320

Table 20. Catch at age Gulf of Mexico king stock unit.

Catch at age numbers of fish by year Gulf stock unit													
Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age 11+	Total
1981	-	22,594	28,542	330,093	610,095	346,481	104,263	74,457	25,884	4,423	12,673	17,091	1,576,596
1982	-	29,862	59,988	196,861	411,109	332,368	171,319	32,927	51,400	22,374	5,524	119,941	1,433,671
1983	89	47,464	38,203	227,308	147,812	179,890	40,278	51,566	31,678	15,541	9,760	22,229	811,817
1984	0	48,433	35,148	131,363	344,786	81,530	74,227	40,942	19,460	6,242	3,288	7,770	793,188
1985	-	21,053	26,511	58,464	102,981	155,500	48,433	56,539	14,617	5,323	4,889	11,606	505,915
1986	48	16,615	27,265	100,993	190,723	97,595	88,904	17,717	9,774	6,591	2,703	4,452	563,380
1987	4,036	77,977	255,851	197,648	61,557	93,237	36,440	22,472	10,003	11,880	3,345	12,299	786,745
1988	-	51,754	36,172	42,314	139,665	160,443	56,478	57,957	17,599	8,087	3,648	21,992	596,109
1989	1,796	101,098	54,374	106,742	60,729	57,696	25,240	24,689	9,538	6,406	5,564	16,136	470,006
1990	-	59,754	206,427	175,882	188,983	70,520	48,890	20,434	22,599	9,329	2,959	13,980	819,756
1991	22,890	188,600	287,693	118,282	111,464	56,416	33,029	14,920	14,849	25,688	3,595	16,049	893,473
1992	130	50,804	238,313	194,343	94,973	55,556	55,557	31,414	16,266	4,055	24,956	17,052	783,419
1993	2,565	134,685	119,915	160,748	302,240	145,214	73,438	44,248	23,795	26,935	10,216	47,564	1,091,565
1994	-	162,221	118,706	116,225	175,267	141,734	56,791	39,499	27,450	14,200	3,592	24,074	879,759
1995	2,780	49,071	111,005	121,156	191,165	201,601	101,955	47,633	39,999	34,187	22,386	31,135	954,073
1996	-	87,436	359,233	252,279	103,978	78,050	87,298	53,746	25,385	3,684	8,776	26,403	1,086,268
1997	-	47,762	379,042	263,770	167,607	78,814	35,825	51,399	57,674	27,721	-	47,428	1,157,042
1998	-	76,116	119,463	322,363	148,319	111,501	53,513	34,704	40,423	32,477	19,207	12,385	970,471
1999	-	100,142	138,766	164,084	250,331	122,686	55,752	26,053	25,534	40,345	8,886	16,000	948,579
2000	-	81,236	216,297	162,556	172,275	110,102	33,076	34,571	8,666	19,529	15,033	22,215	875,554
2001	19,847	44,768	112,760	258,592	144,552	79,845	65,486	44,215	27,651	10,918	8,826	31,038	848,497
2002	61	62,802	122,487	179,589	217,908	143,380	75,910	47,747	25,719	12,253	7,871	21,804	917,532
2003	-	66,637	303,113	170,099	165,563	116,402	62,538	27,263	35,918	19,784	18,184	21,402	1,006,904
2004	-	41,342	172,797	163,493	131,994	90,155	72,707	33,940	12,779	23,968	12,311	19,489	774,976
2005	654	22,799	268,216	150,013	158,596	82,484	43,959	47,683	16,750	13,174	10,868	20,883	836,078
2006	59,707	35,514	228,593	239,864	187,222	141,644	88,200	59,595	57,067	11,936	12,816	43,339	1,165,499

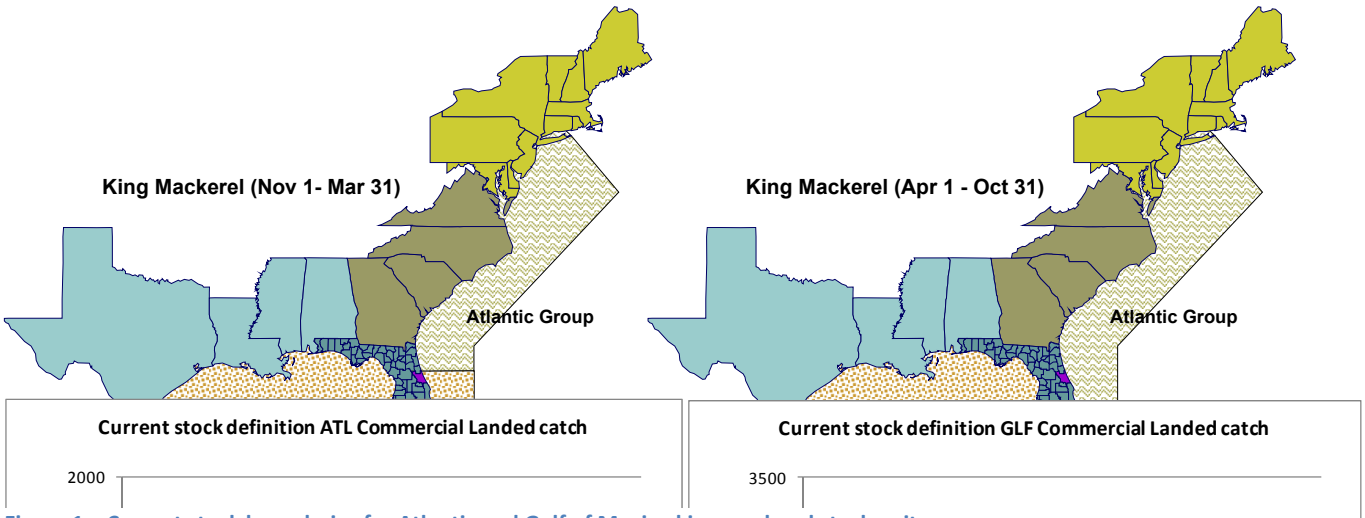


Figure 1. Current stock boundaries for Atlantic and Gulf of Mexico king mackerel stock units.

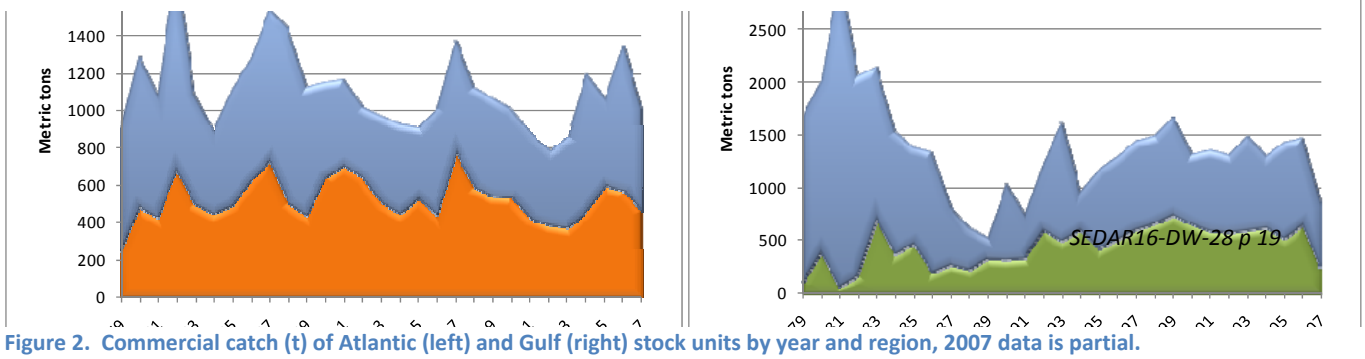


Figure 2. Commercial catch (t) of Atlantic (left) and Gulf (right) stock units by year and region, 2007 data is partial.

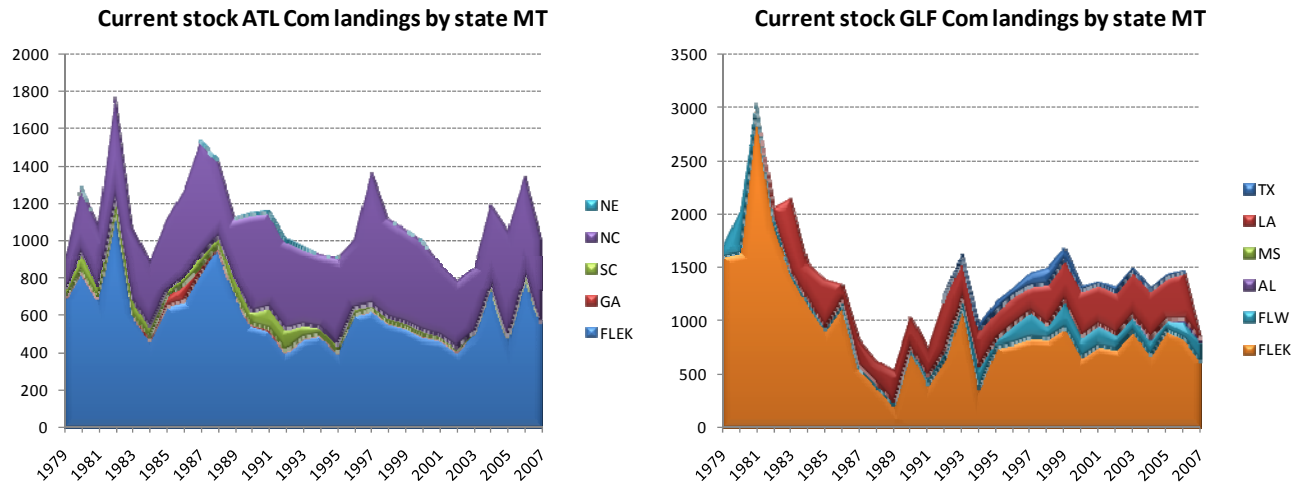


Figure 3. Commercial catch (t) of Atlantic and Gulf stocks by year and state since 1979.

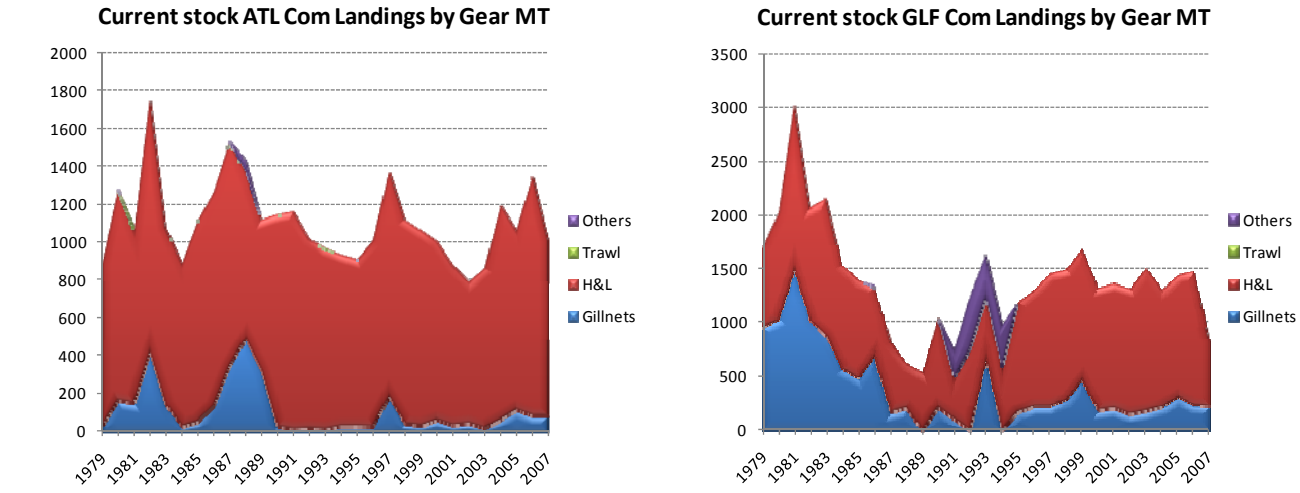


Figure 4. Commercial catch (t) of Atlantic and Gulf stocks by year and main fishing gear.

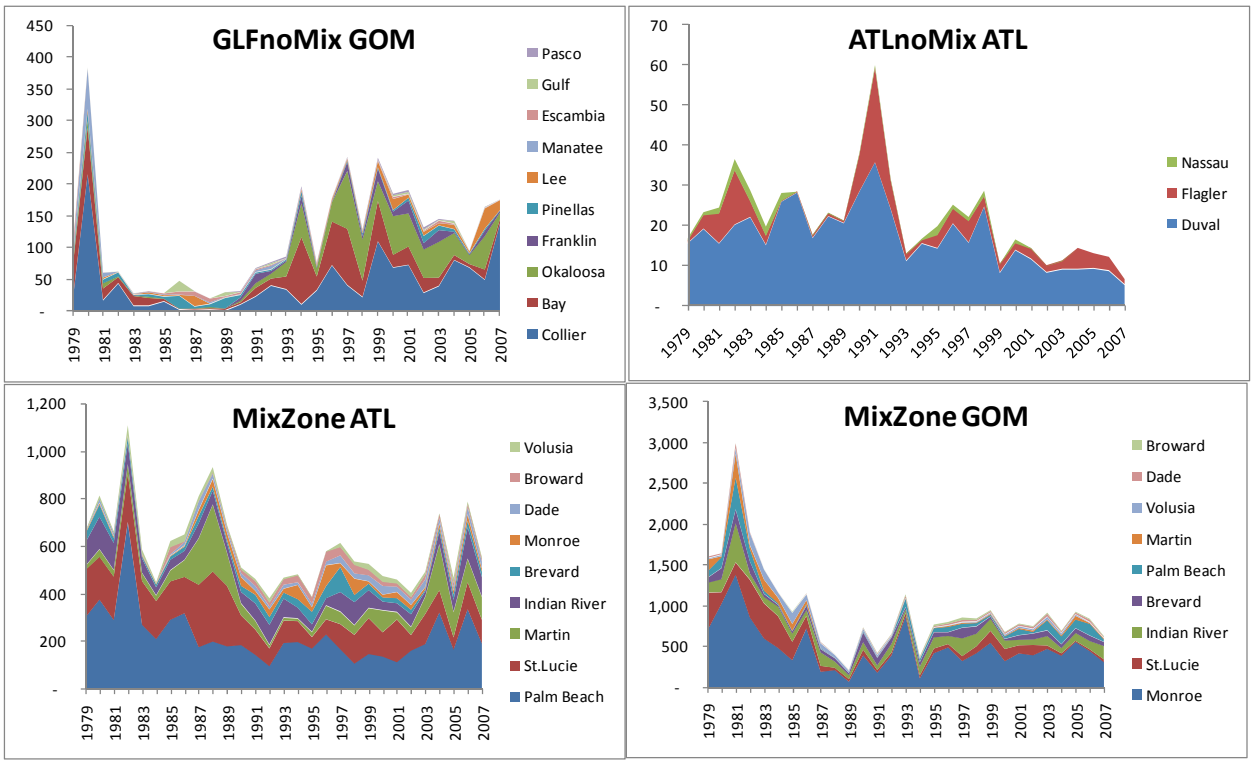


Figure 5.

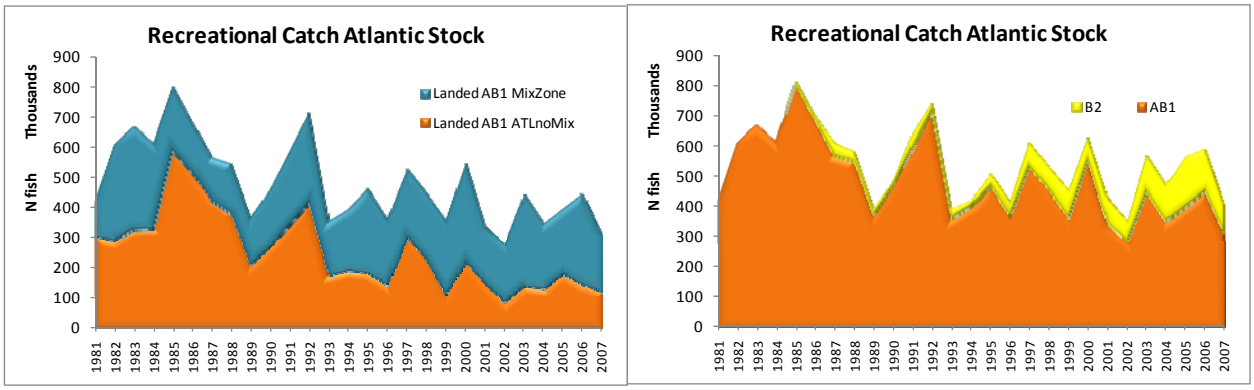


Figure 6. Recreational Catch Atlantic stock unit by region (left) of landed catch (AB1) and total catch including landings plus releases (B2) (right) of king mackerel 1981-2007. (2007 is partial data).

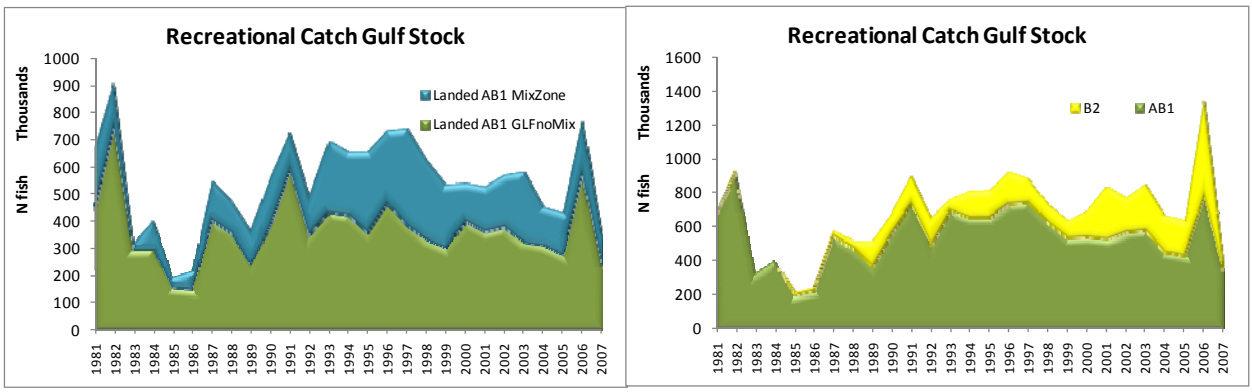


Figure 7. Recreational Catch Gulf of Mexico stock unit by region (left) of landed catch (AB1) and total catch including landings plus releases (B2) (right) of king mackerel 1981-2007. (2007 is partial data).

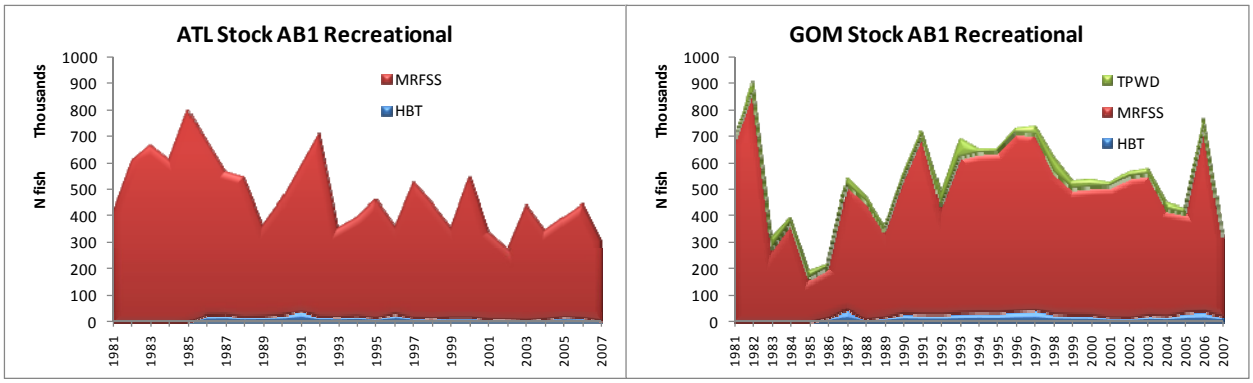


Figure 8. Distribution of recreational retained catch (AB1) by source for the Atlantic (left) and Gulf stock units.

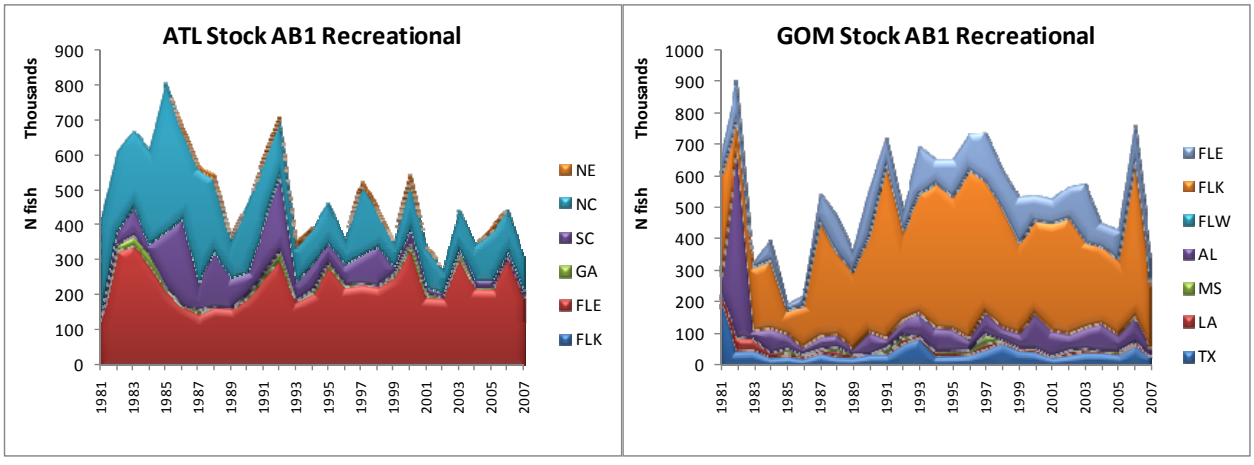


Figure 9. Distribution of recreational retained (AB1) catch by state.

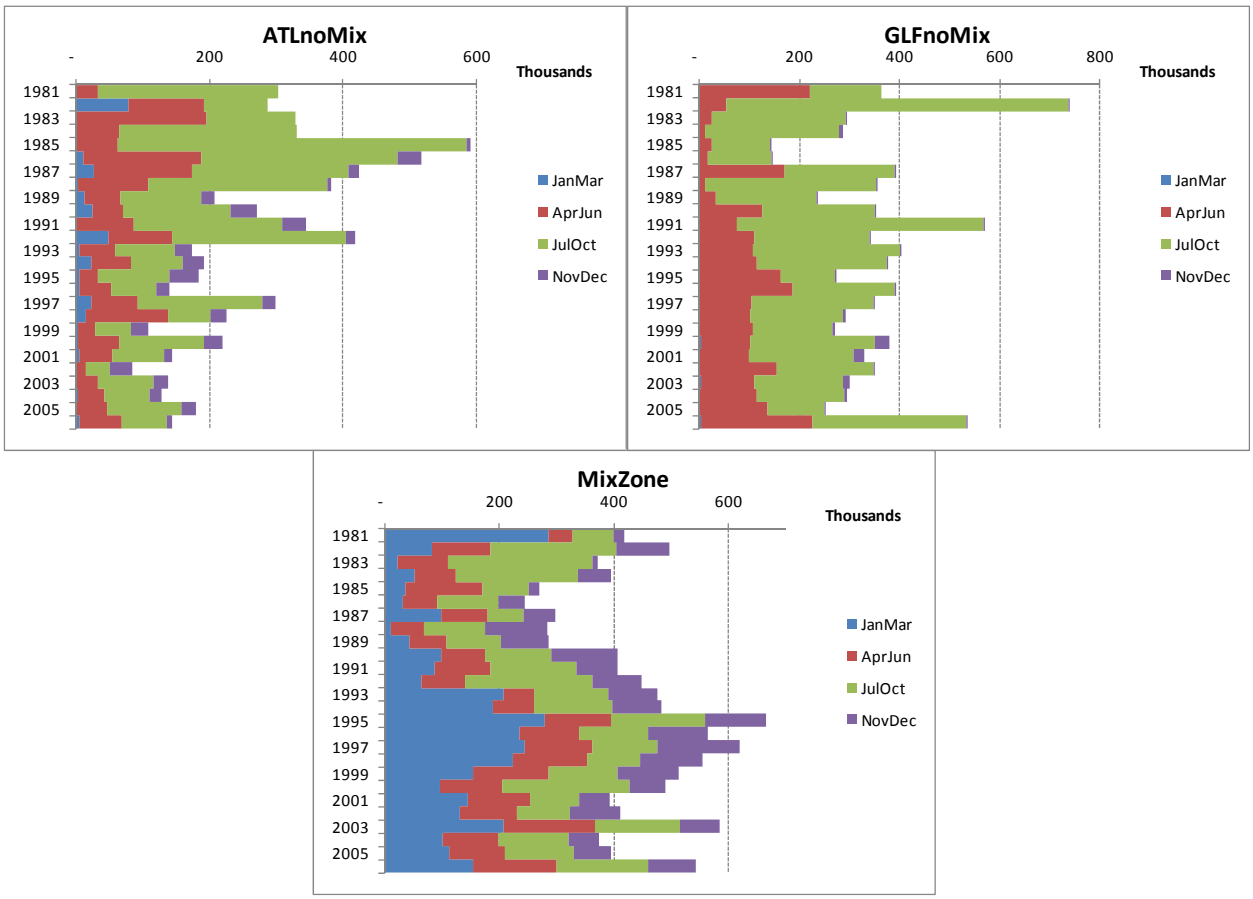


Figure 10. Distribution of recreational AB1 catch by region and by season.

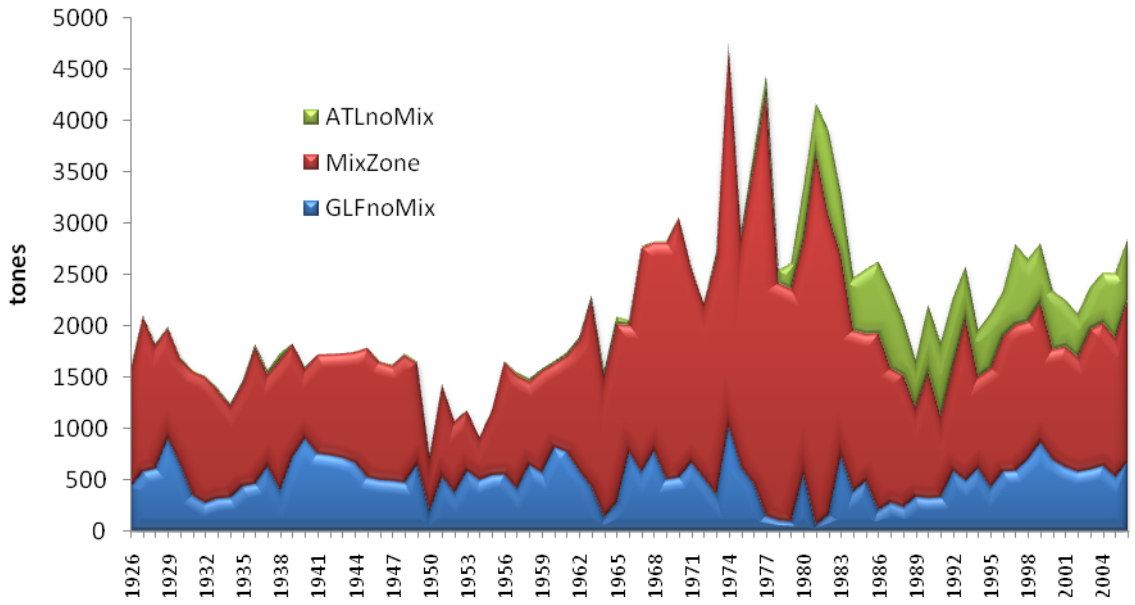


Figure 11. King mackerel commercial catch (t) trends 1926-2006 ALS estimates by region for both Atlantic and Gulf stock units.

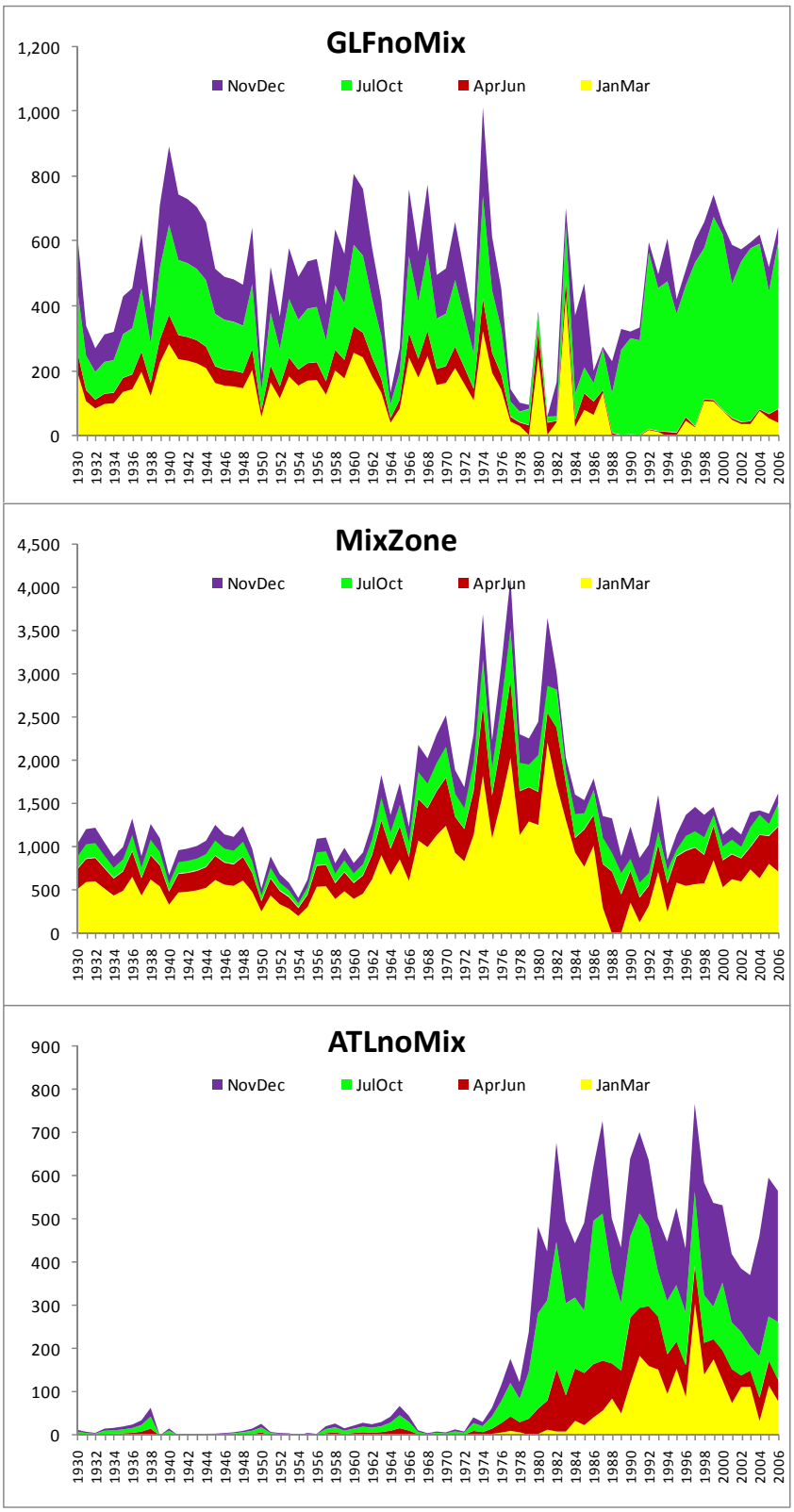


Figure 12. King mackerel commercial catch (t) by region and season from 1930 to 2006.

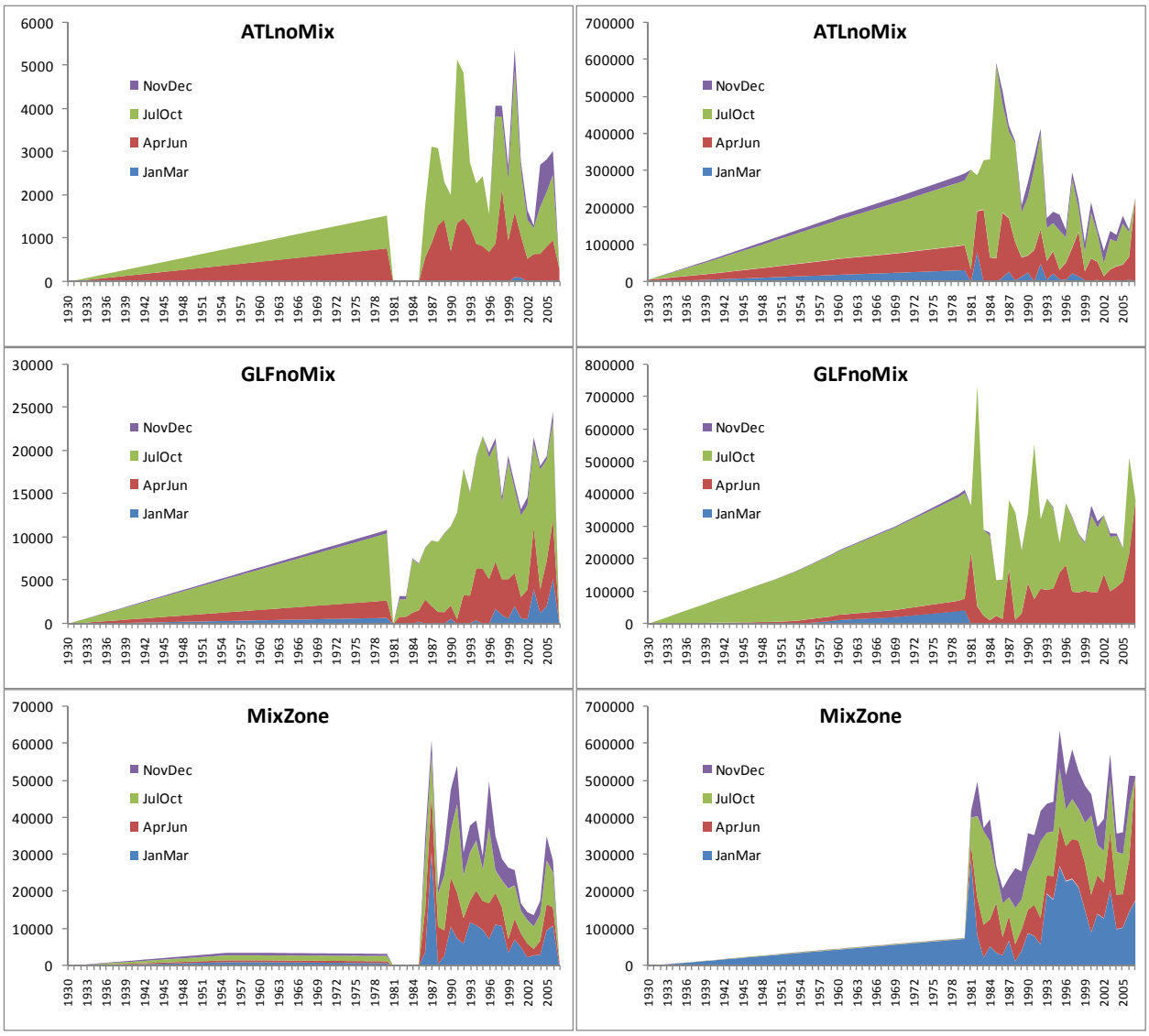


Figure 13. King mackerel recreational catch (AB1 numbers of fish) by region and season from 1930 to 2006, from Headboat (left column) and MRFSS (right column) fisheries.

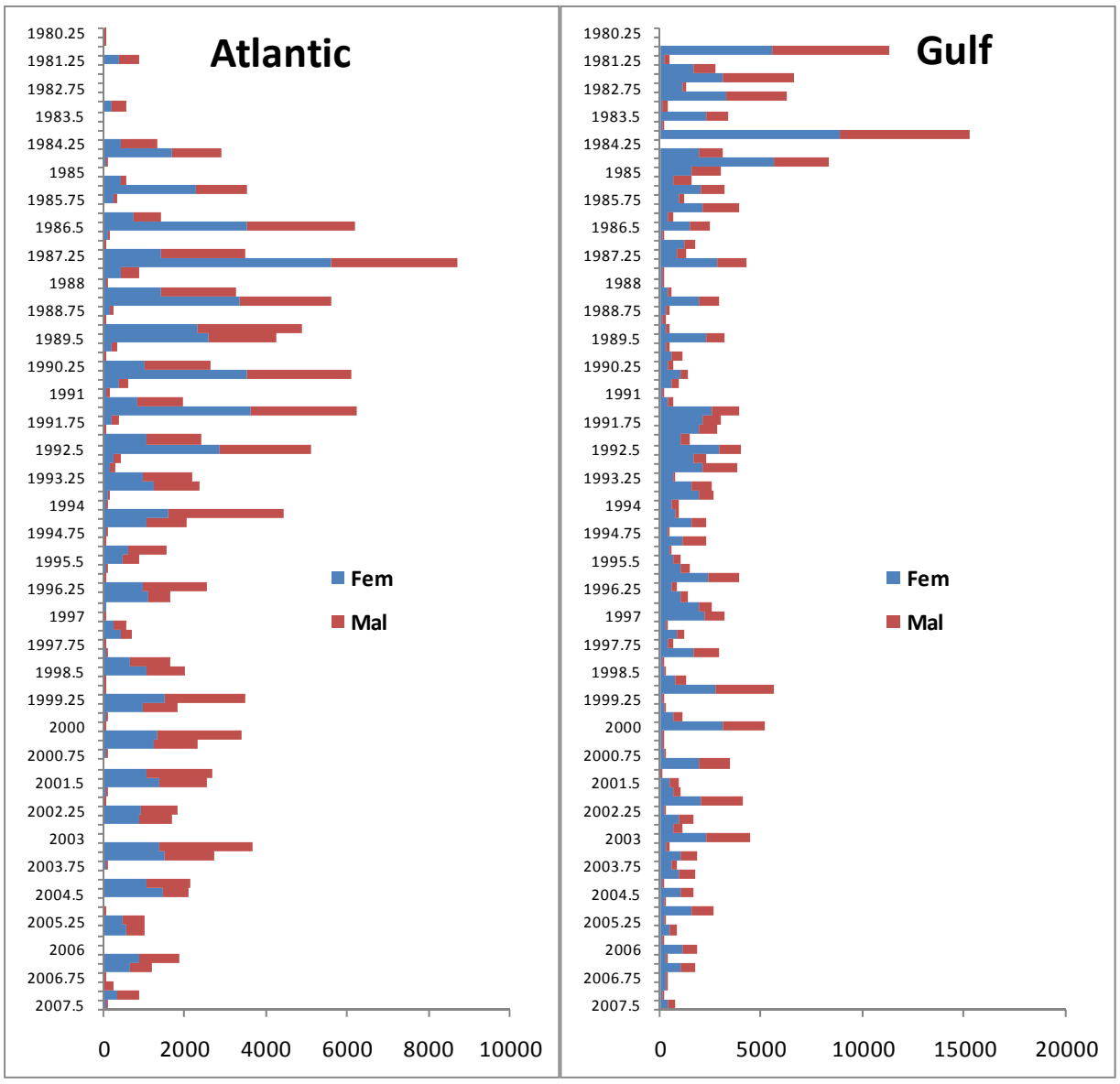


Figure 14. Number of sexed king mackerel by stock and year-season available for estimating sex-ratios at size 1980-2006.

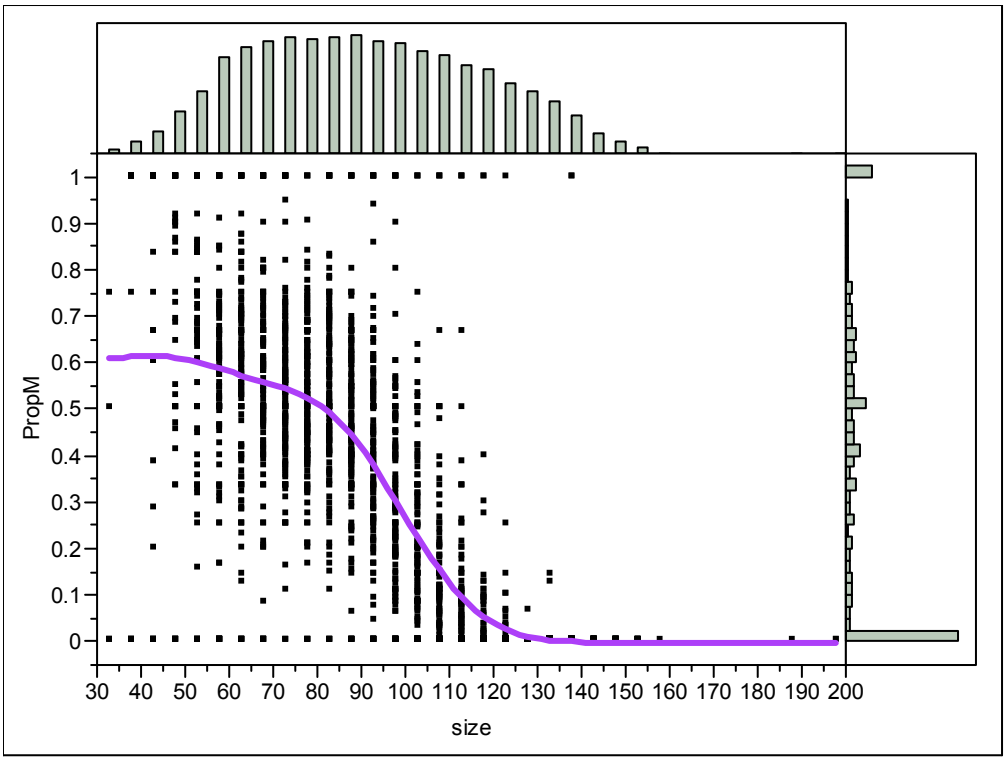


Figure 15. Proportion of males king at size (FL cm) for the Atlantic stock unit all years, line represents a smoothing spline fit, histograms show the number of samples per 5 cm size bin for fish >= 30 cm FL.

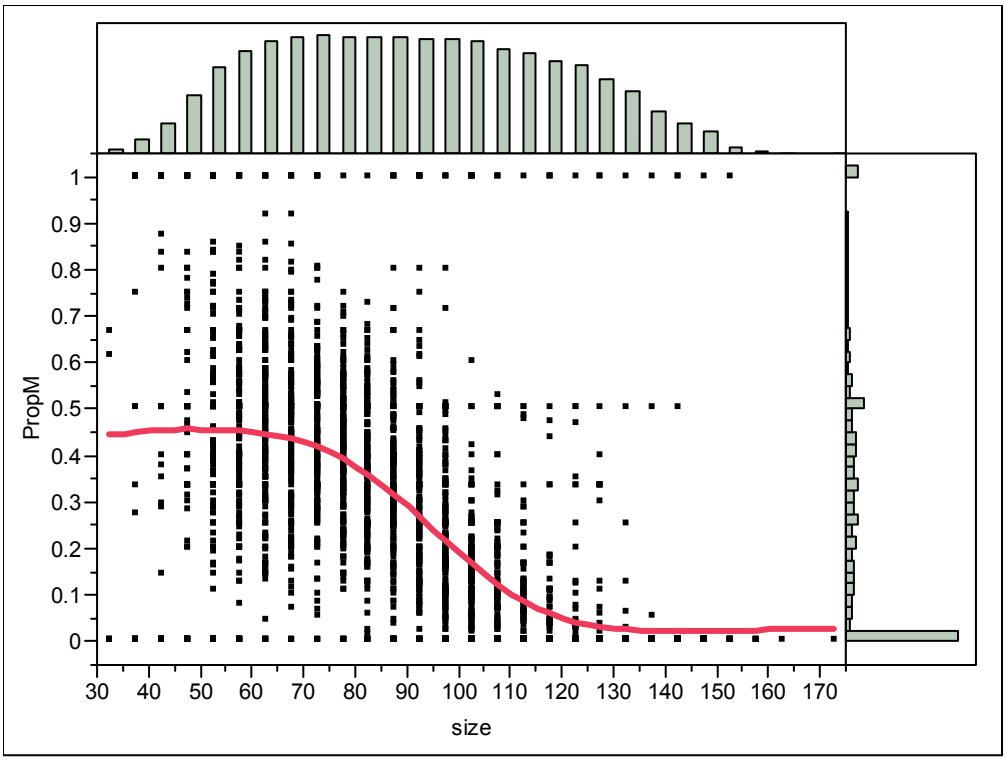


Figure 16. Proportion of males king at size (FL cm) for the Gulf stock unit all years, line represents a smoothing spline fit, histograms show the number of samples per 5 cm size bin for fish >= 30 cm FL.

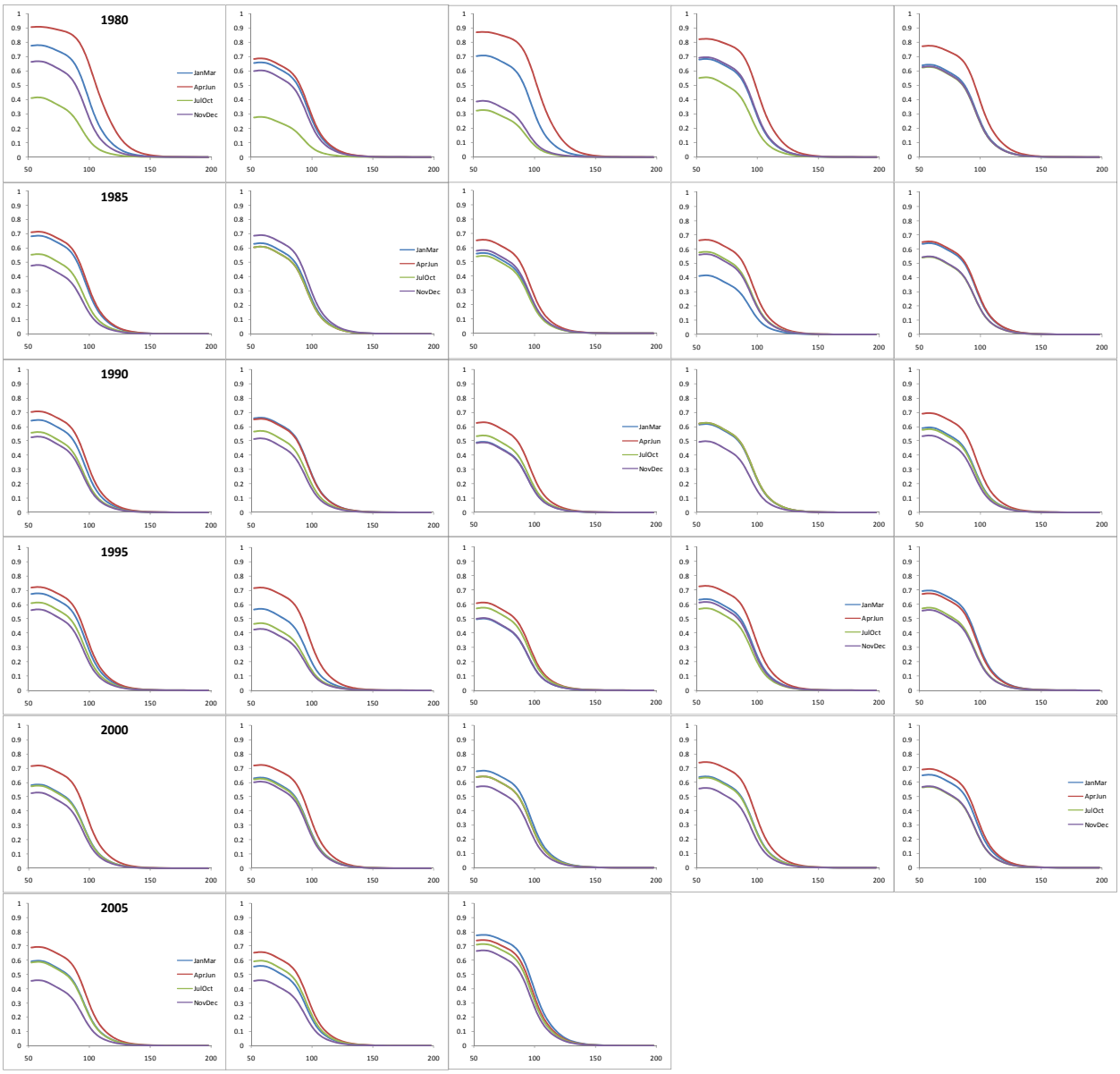


Figure 17. Predicted sex ratio (males) at size for Atlantic king mackerel by year (rows) and season (each color line) by the GAM fit model 1980 -2007.

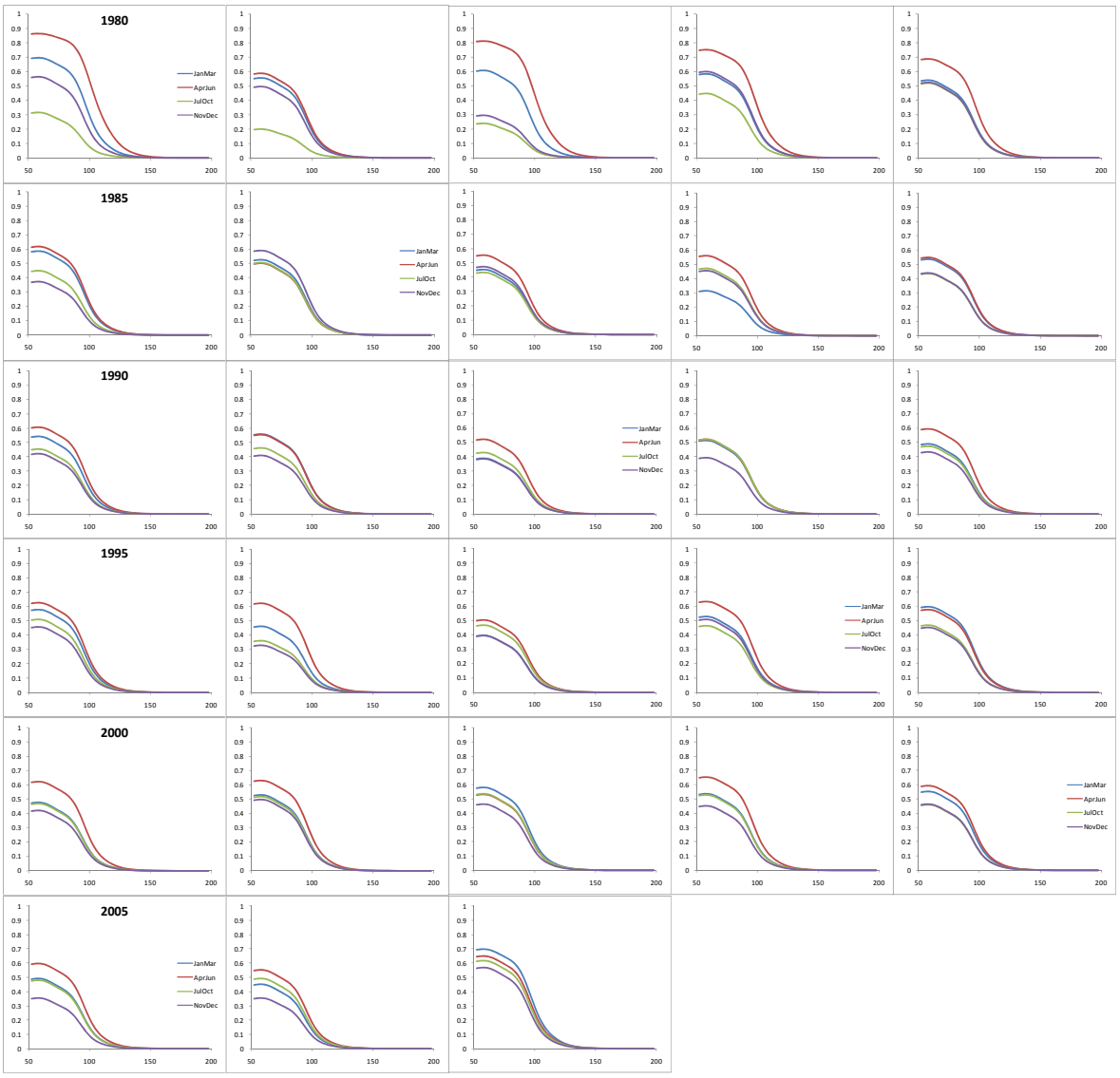


Figure 18.. Predicted sex ratio (males) at size for Gulf of Mexico king mackerel by year (rows) and season (each color line) by the GAM fit model 1980 -2007.

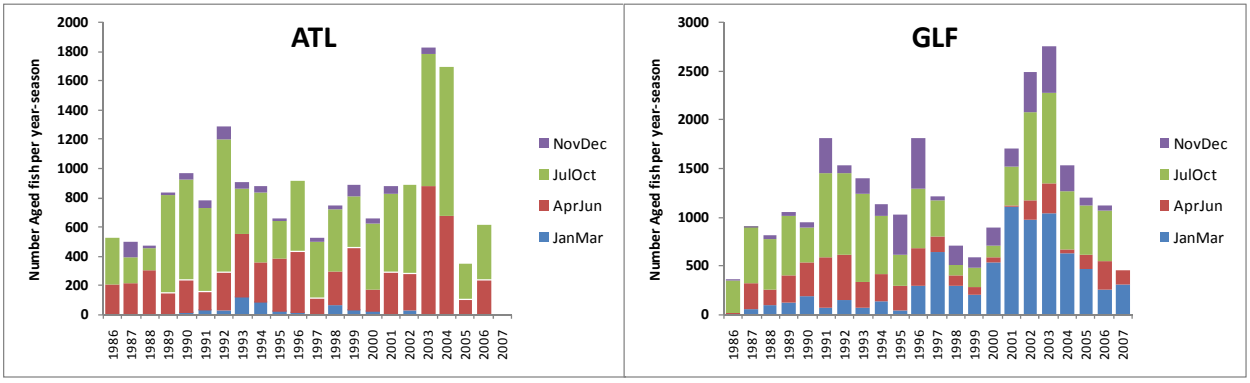


Figure 19. Number of aged samples for king mackerel by stock unit, year and season available for construction of Age Length Keys.

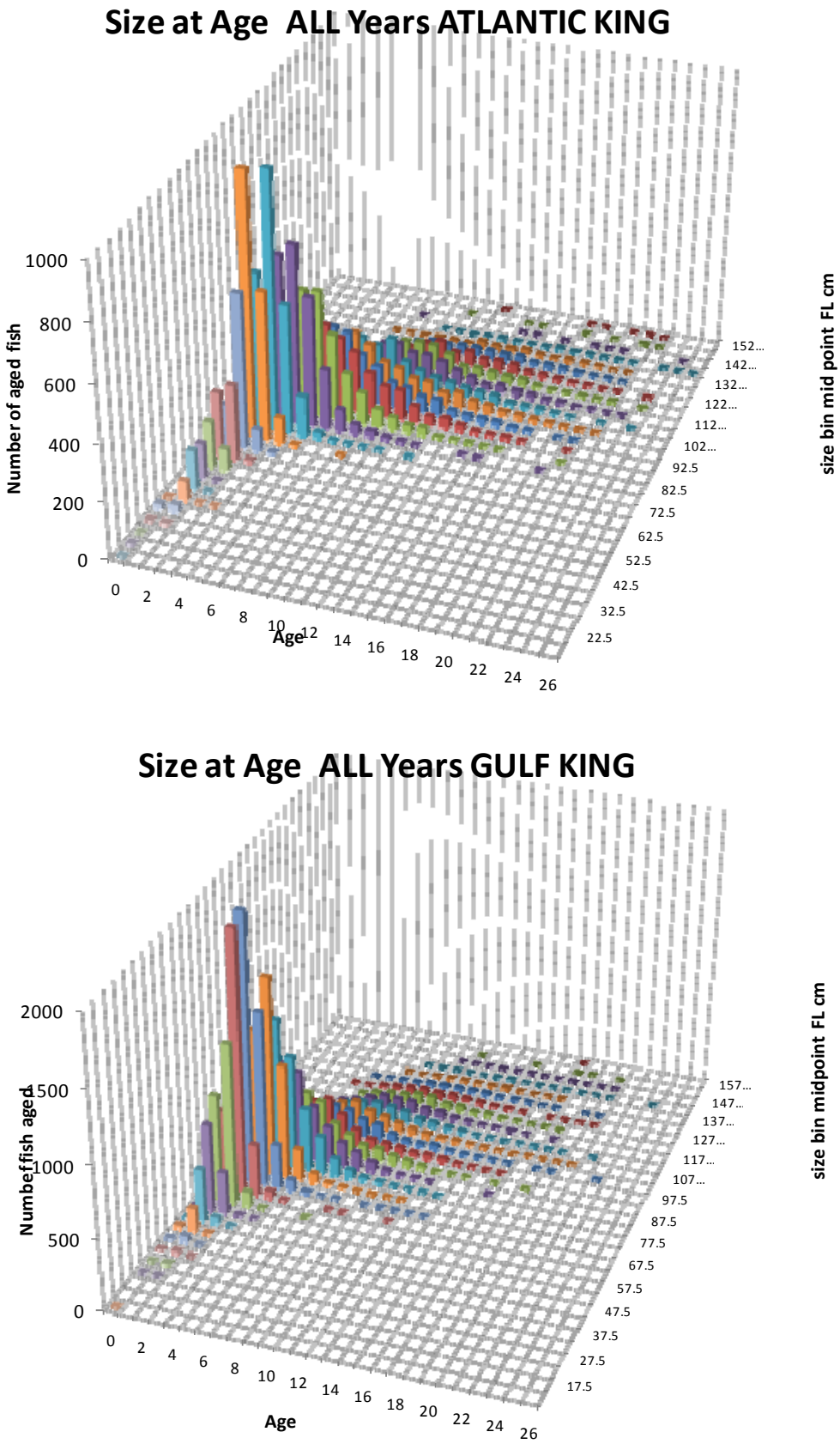


Figure 20. Distribution of aged king by age and size all years, for Atlantic stock unit (top) and Gulf of Mexico stock unit (bottom).

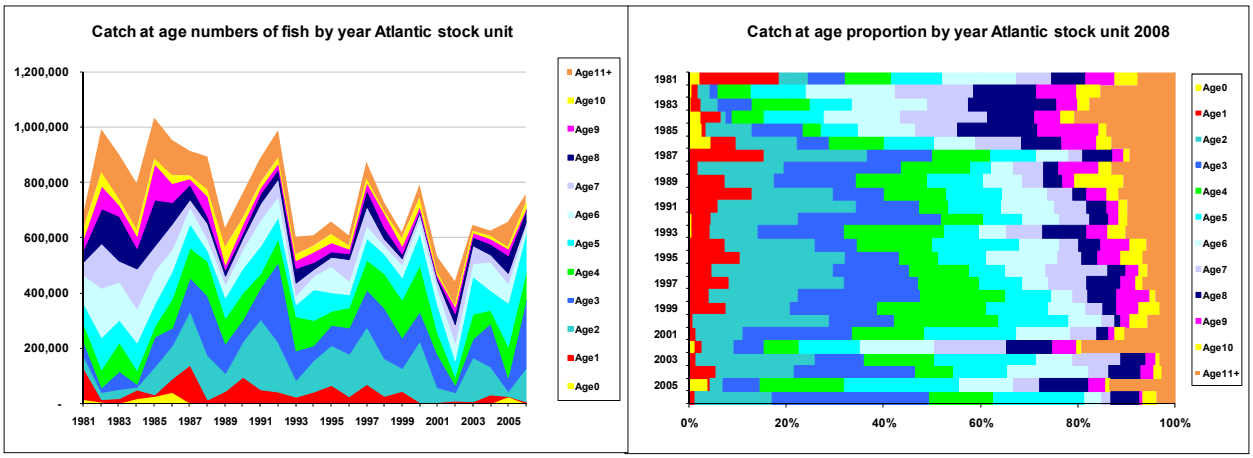


Figure 21. Estimated catch at age for Atlantic king 1981-2007. Numbers of fish (right) and proportions by age (left).

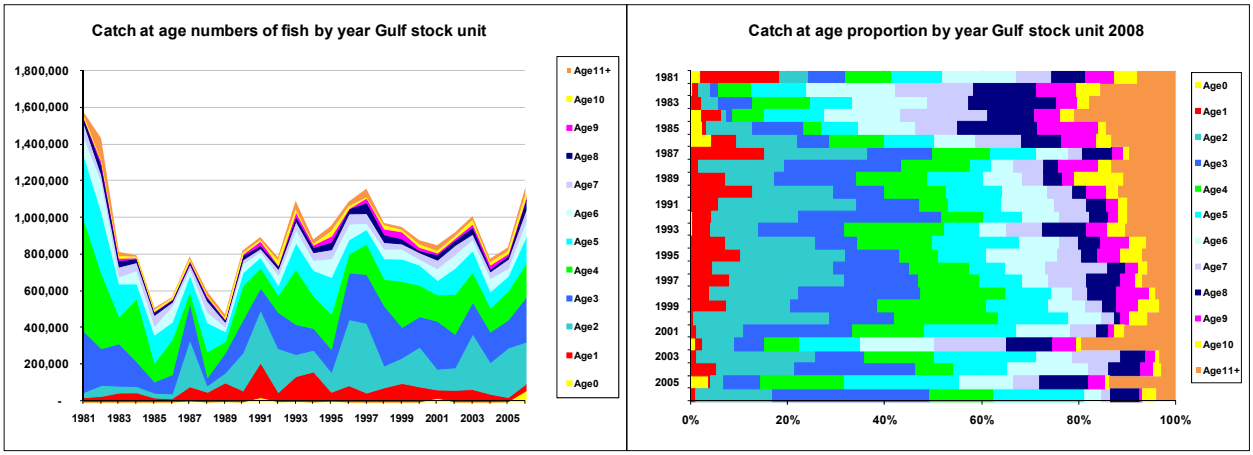


Figure 22. Estimated catch at age for Gulf of Mexico king 1981-2007. Numbers of fish (right) and proportion of catch at age (left).

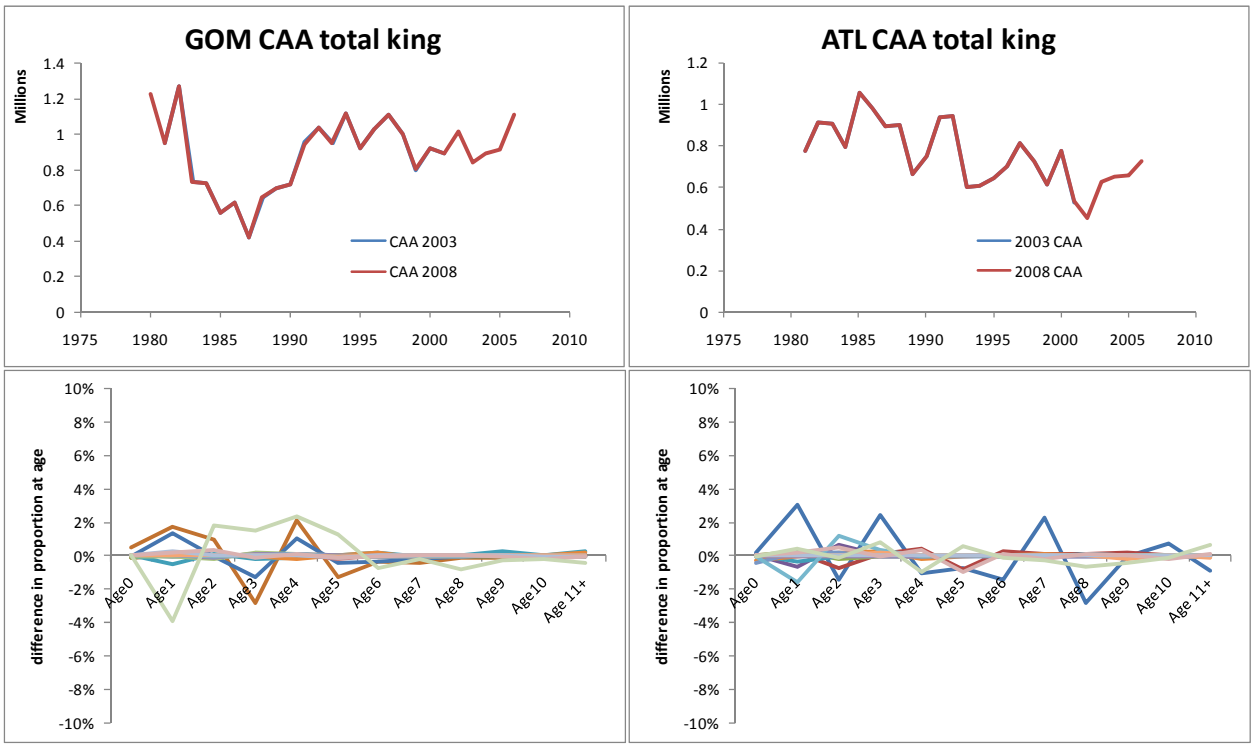
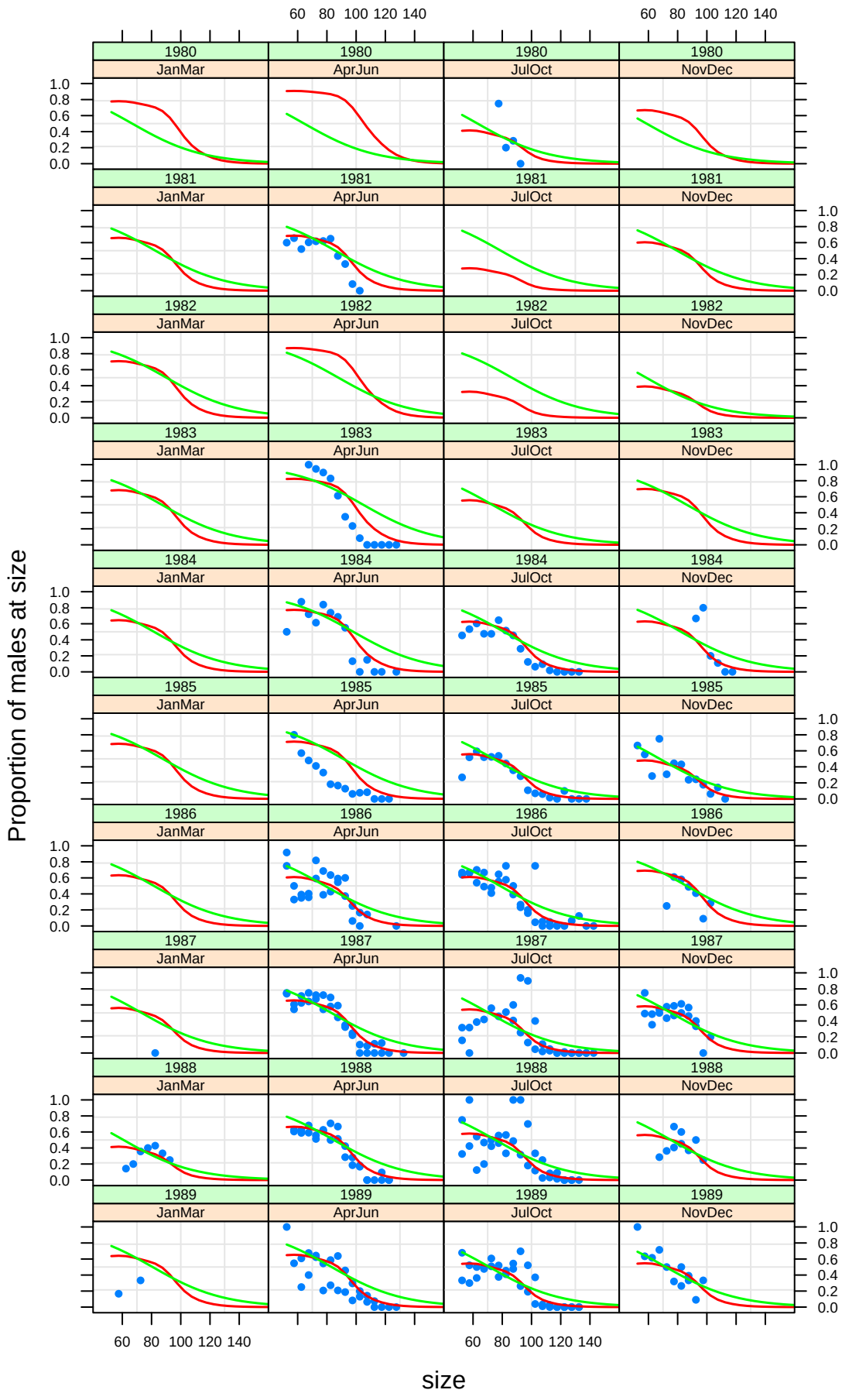
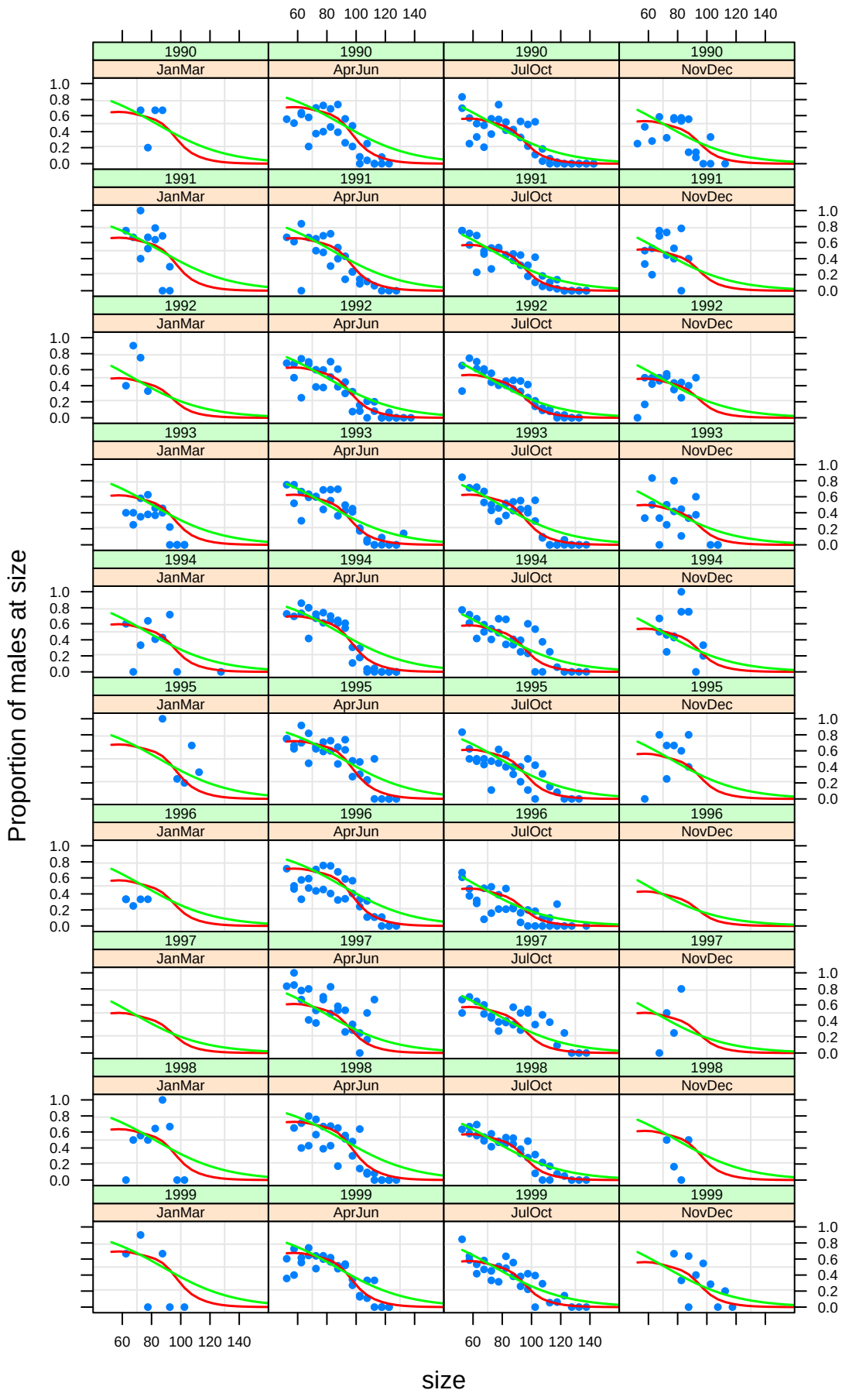


Figure 23. Comparison of estimated CAA for Atlantic (right) and Gulf (left) king mackerel, and proportion of catch at age (bottom row) between 2008 and 2003 assessment evaluations.

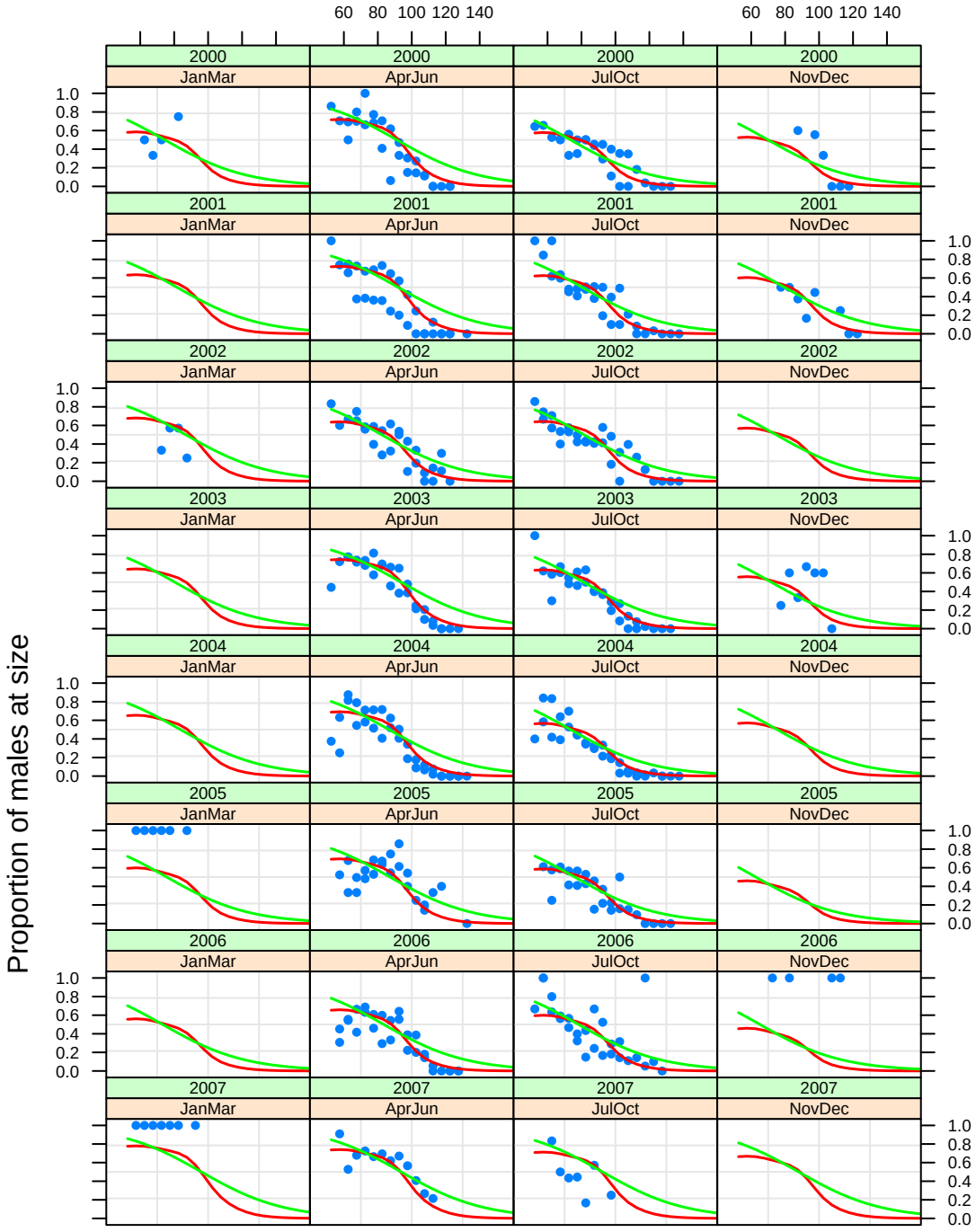
Appendix list

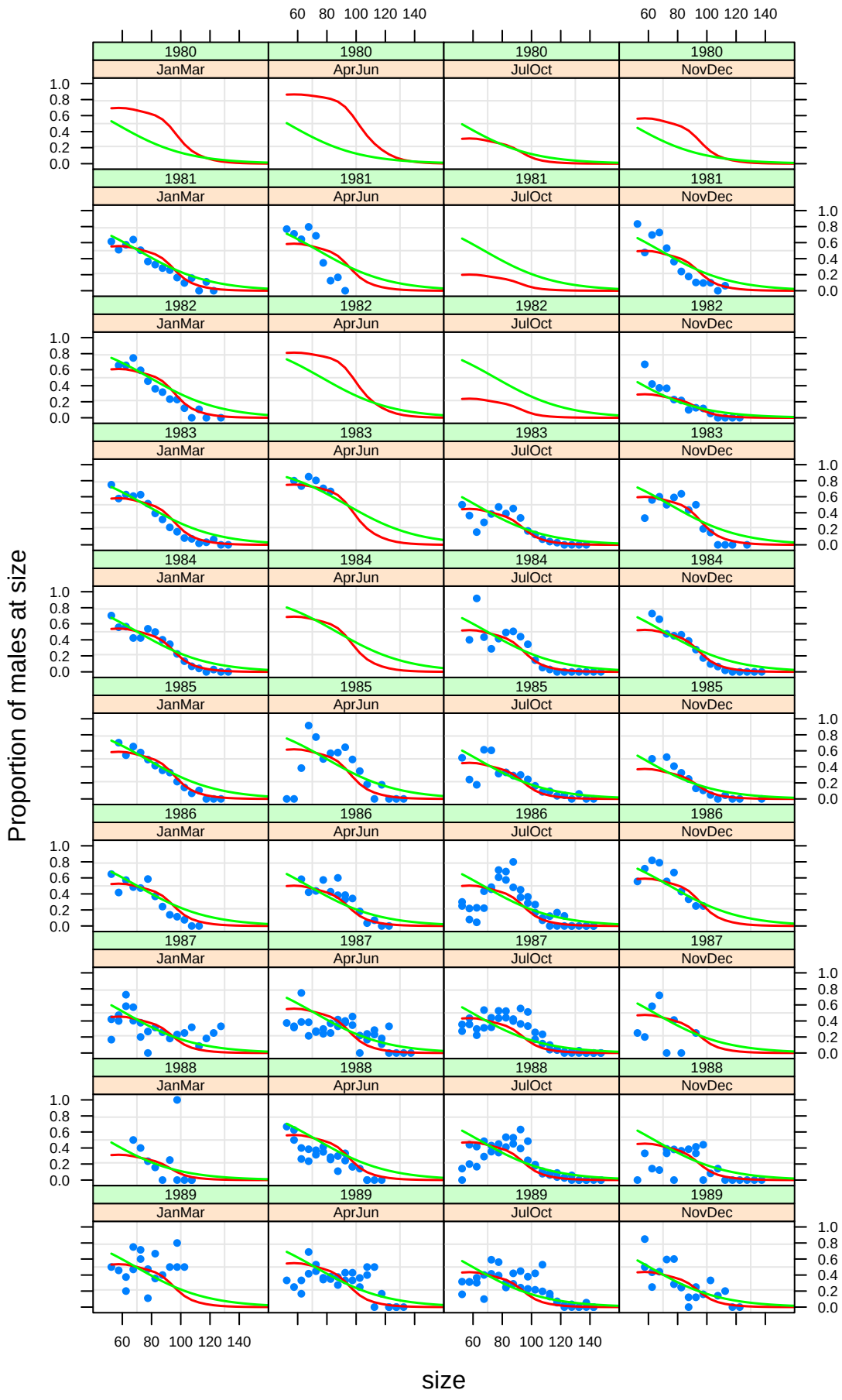
1. Plot of sex ratios at size by stock unit, year and season. Observer male ratio at size (5 cm bin FL) (blue points), predicted GAM model proportions of males (red line), and predicted GLM model proportions of males (green line). Pages 1 to 6
2. Density distribution histograms of catch at size CAS by sex (red= males, blue=females), region and sector. Pages 1 to 18 estimates of CAS using sex ratios 1984-1996. Pages 19 to 36 estimates of CAS using updated sex ratios 1984-2006.
3. Distribution of aged samples by size bin (5 cm FL) for Age Length Key by stock unit and year. Shade cells code: yellow 1 to 4 samples per cell, red 5 to 10 samples per cell, black >10 samples per cell. Pages 1 and 2.

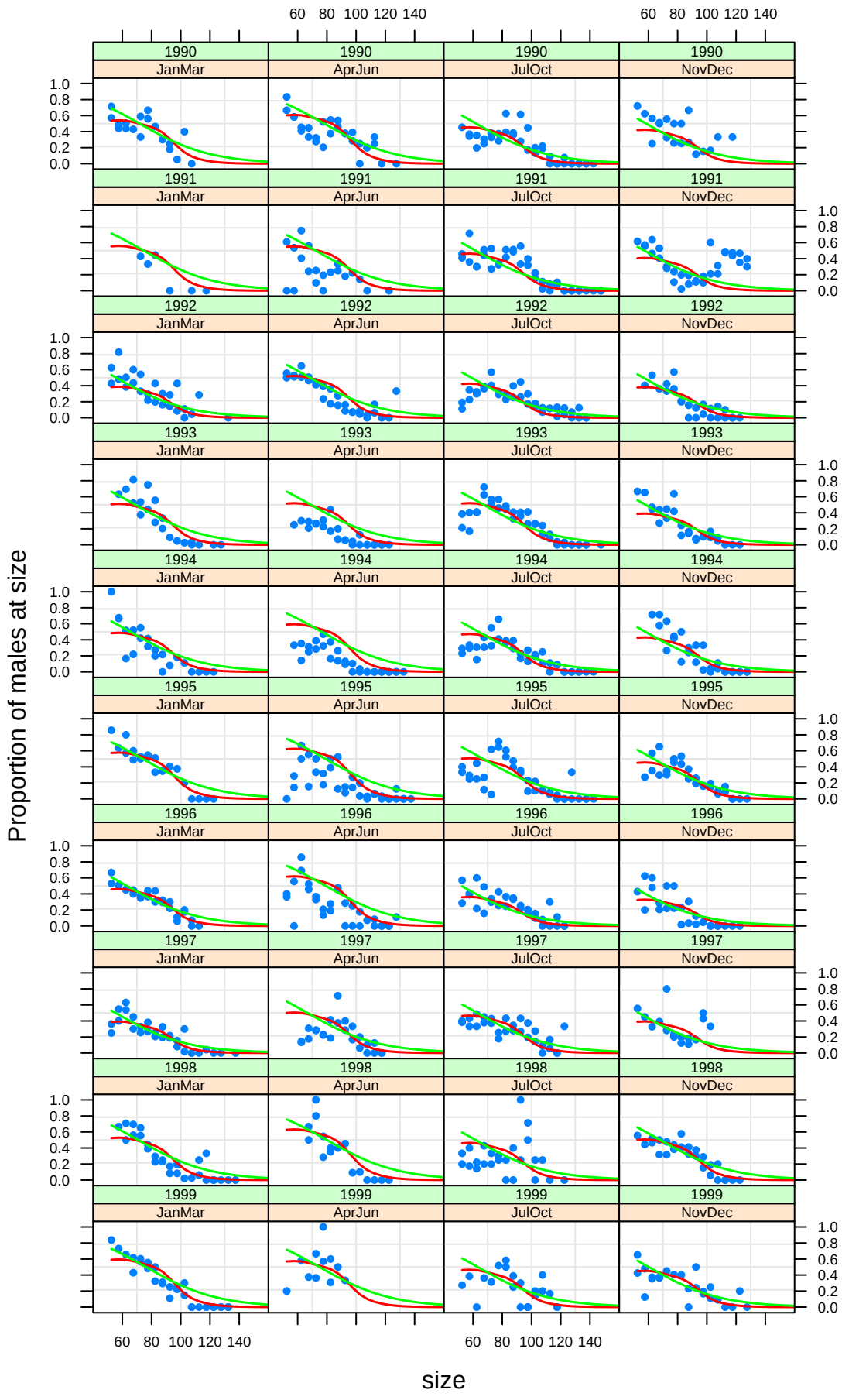

Sex ratio at size ATL stock unit year
Proportion of males at size
size
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
JanMar
AprJun
JulOct
NovDec
60 80 100 120 140
0.0 0.2 0.4 0.6 0.8 1.0


Sex ratio at size ATL stock unit year
Proportion of males at size
size
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
JanMar
AprJun
JulOct
NovDec
60 80 100 120 140
0.0 0.2 0.4 0.6 0.8 1.0

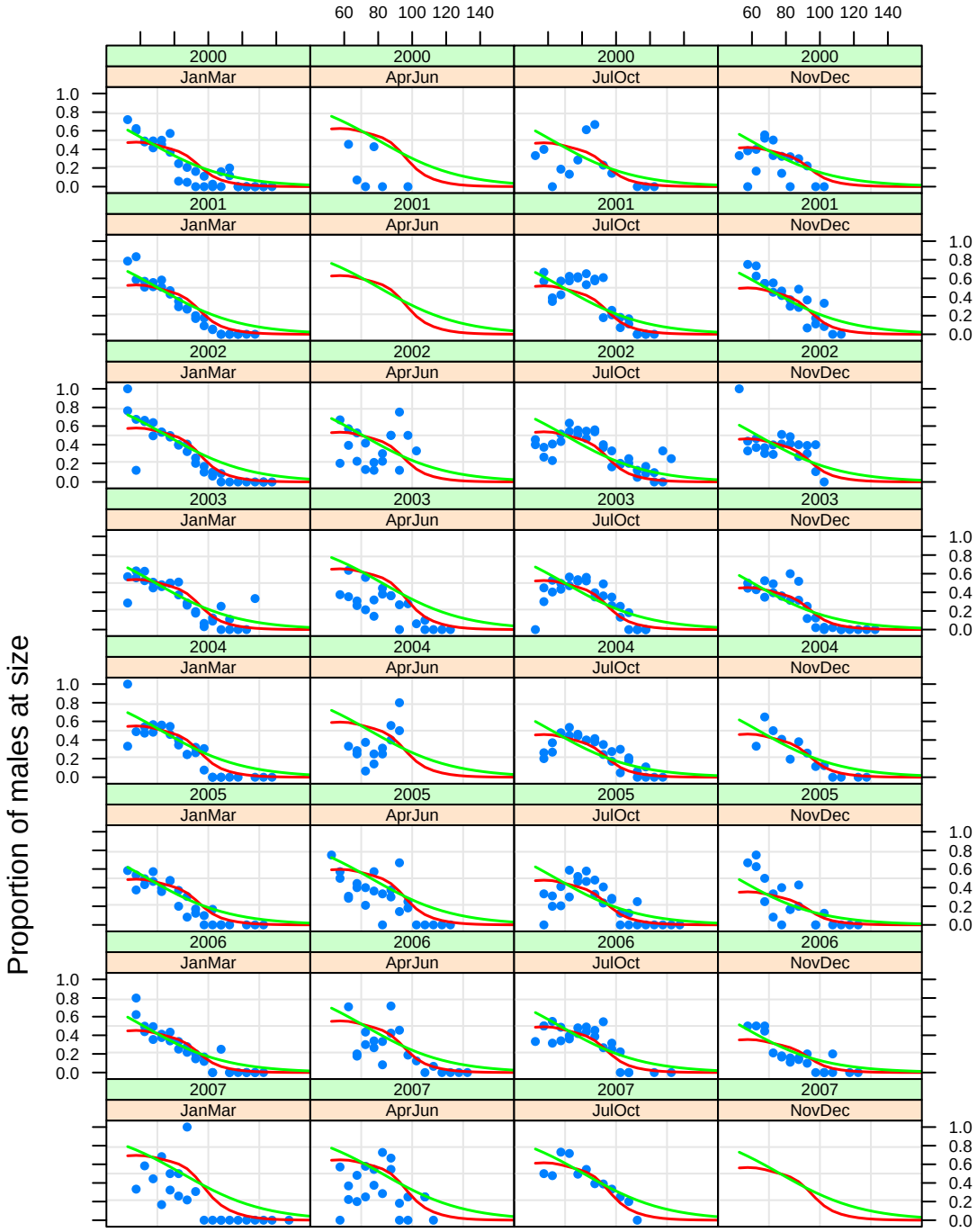
Sex ratio at size ATL stock unit year



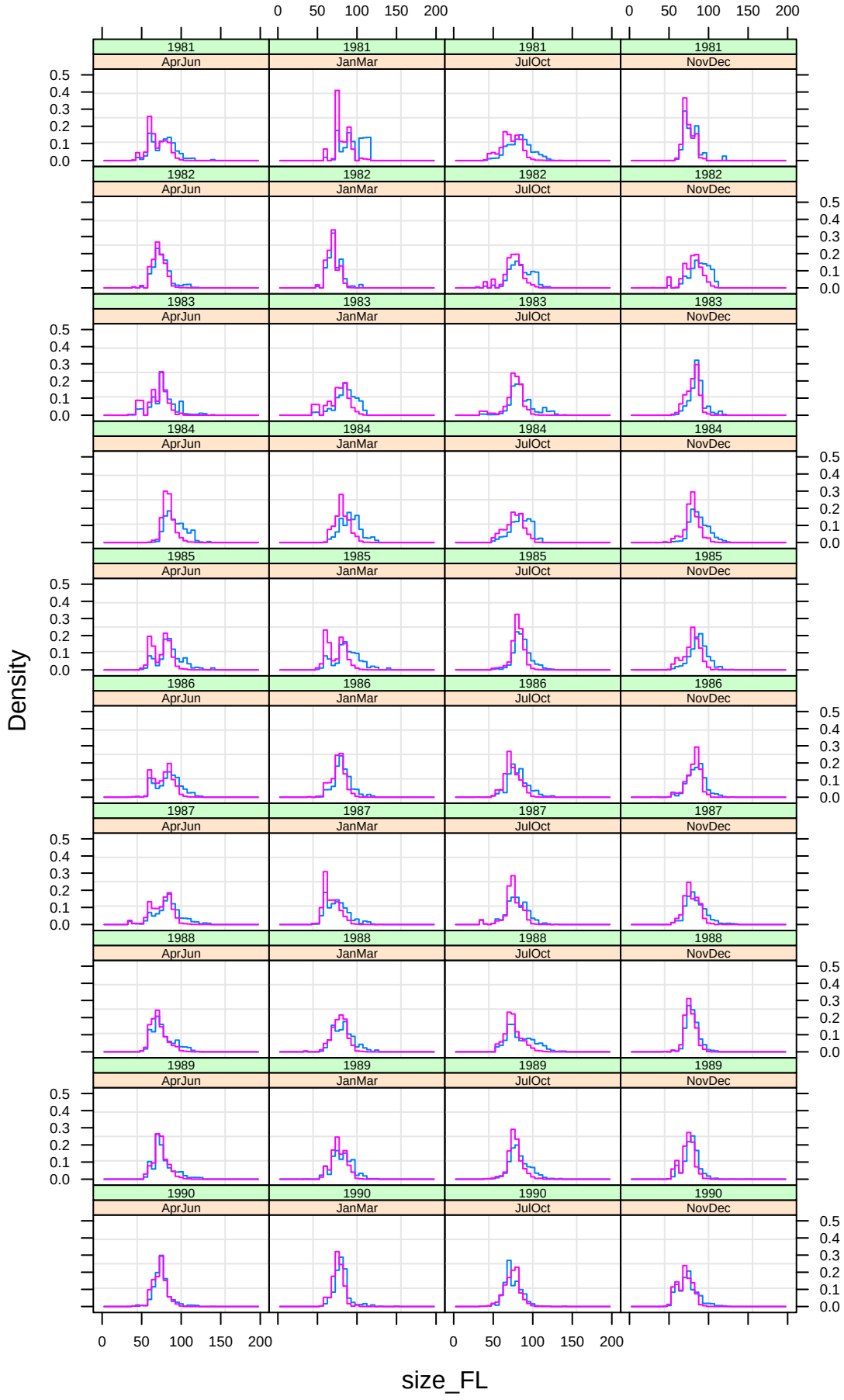

Sex ratio at size GLF stock unit year
Proportion of males at size
size
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
JanMar
AprJun
JulOct
NovDec
0.0
0.2
0.4
0.6
0.8
1.0
60
80
100
120
140


Sex ratio at size GLF stock unit year
Proportion of males at size
size
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
JanMar
AprJun
JulOct
NovDec
60 80 100 120 140
0.0 0.2 0.4 0.6 0.8 1.0

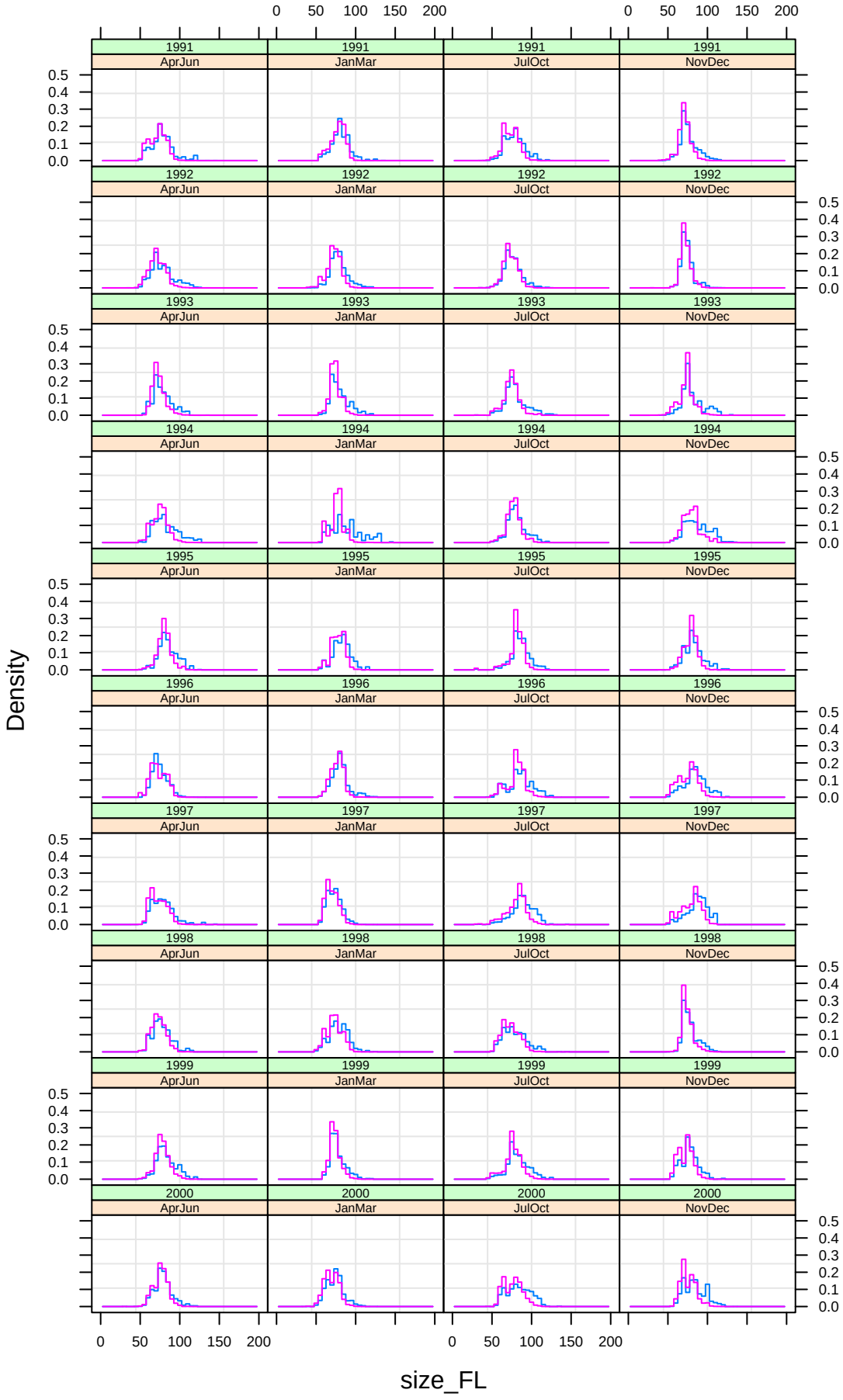
Sex ratio at size GLF stock unit year



CAS by Sex ATL Com



CAS by Sex ATL Com



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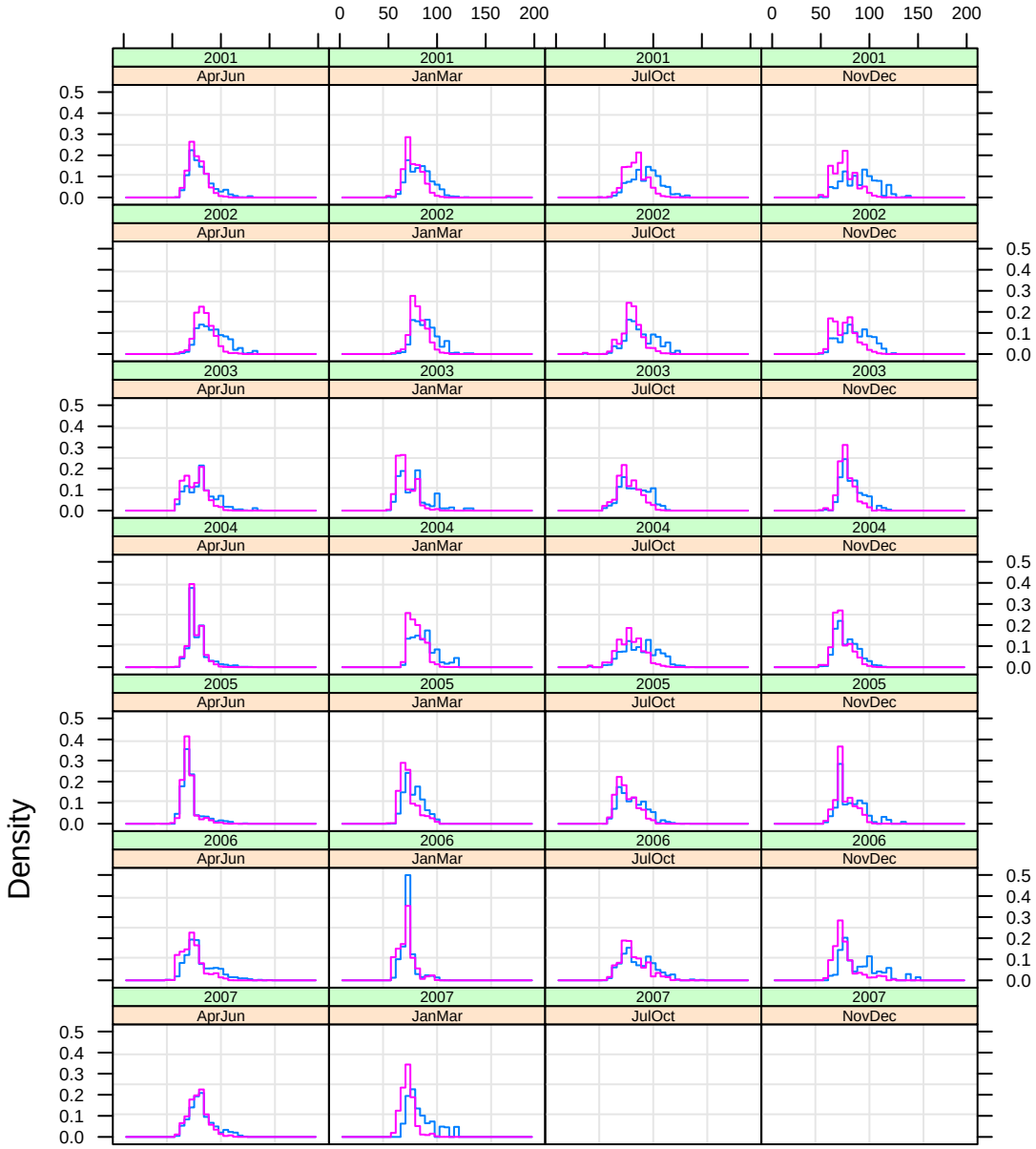
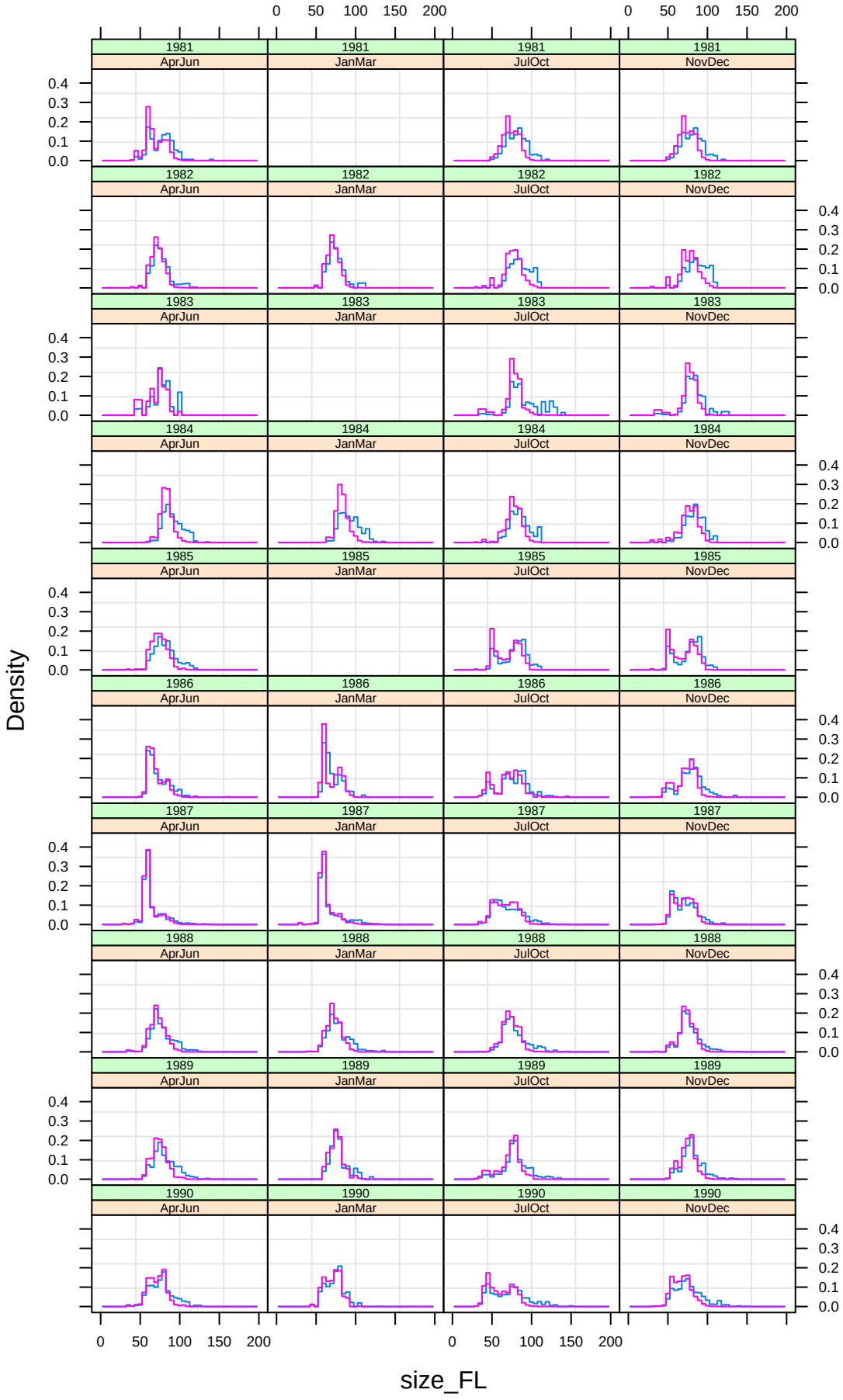


size_FL

CAS by Sex ATL Rec



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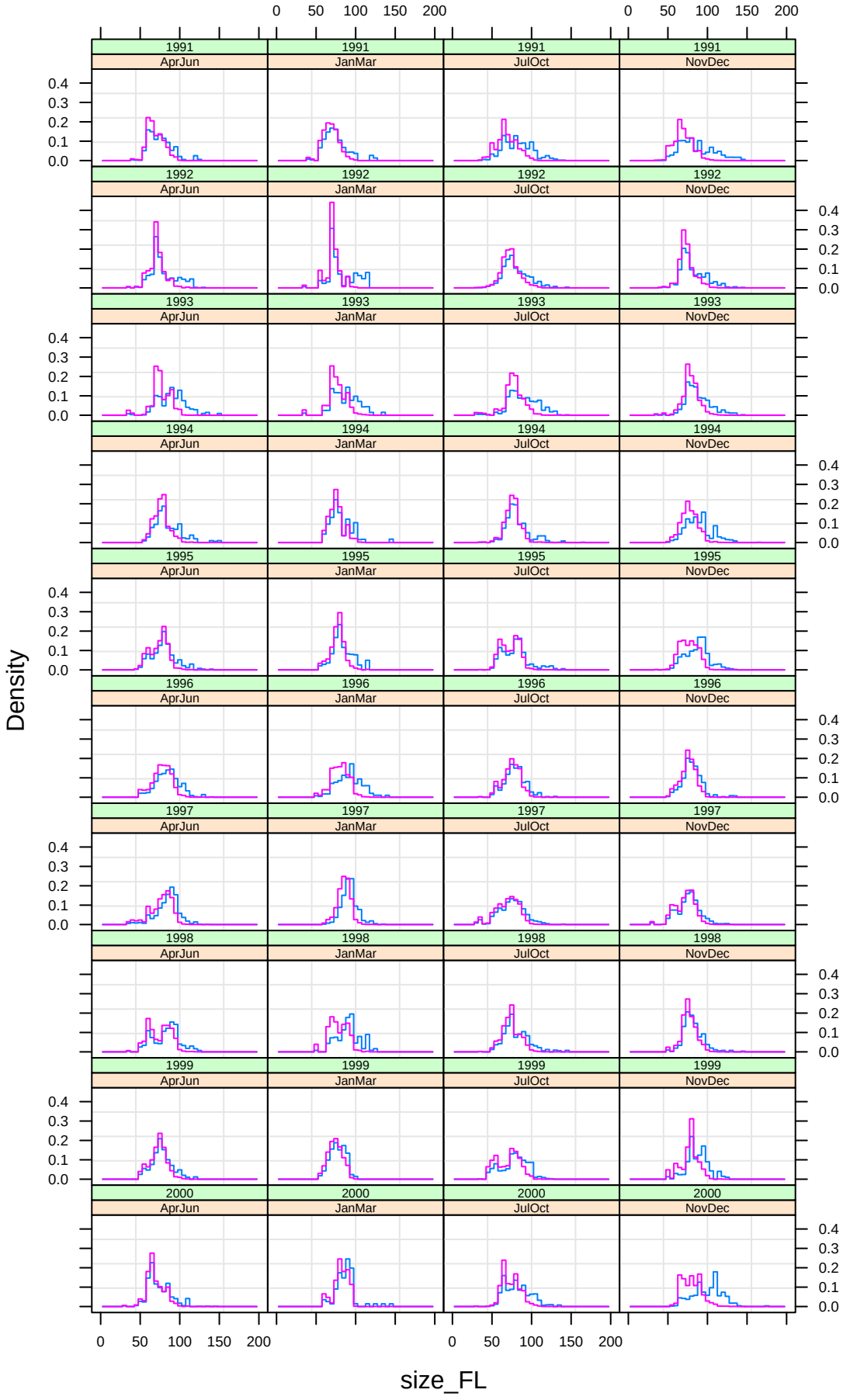

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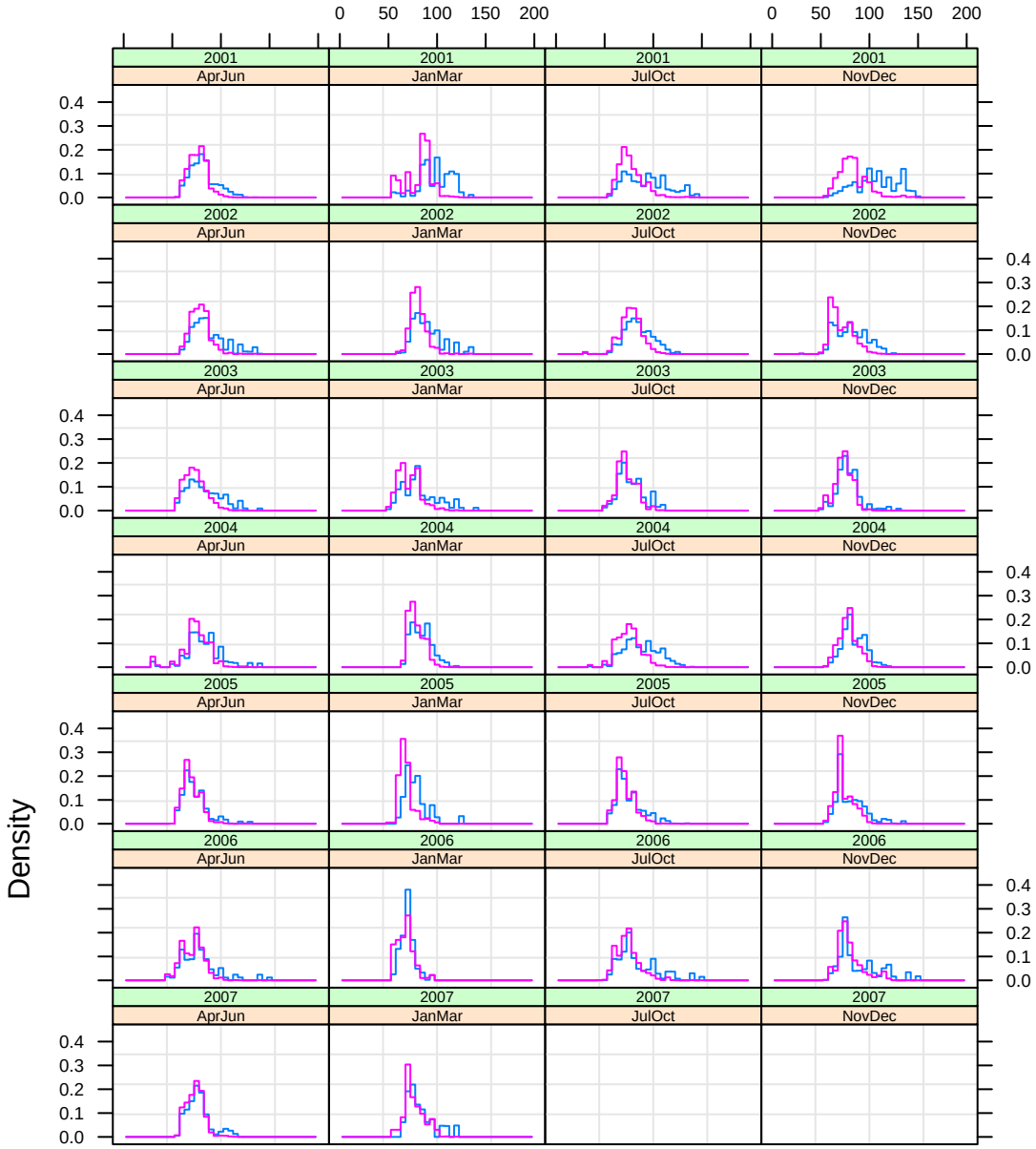

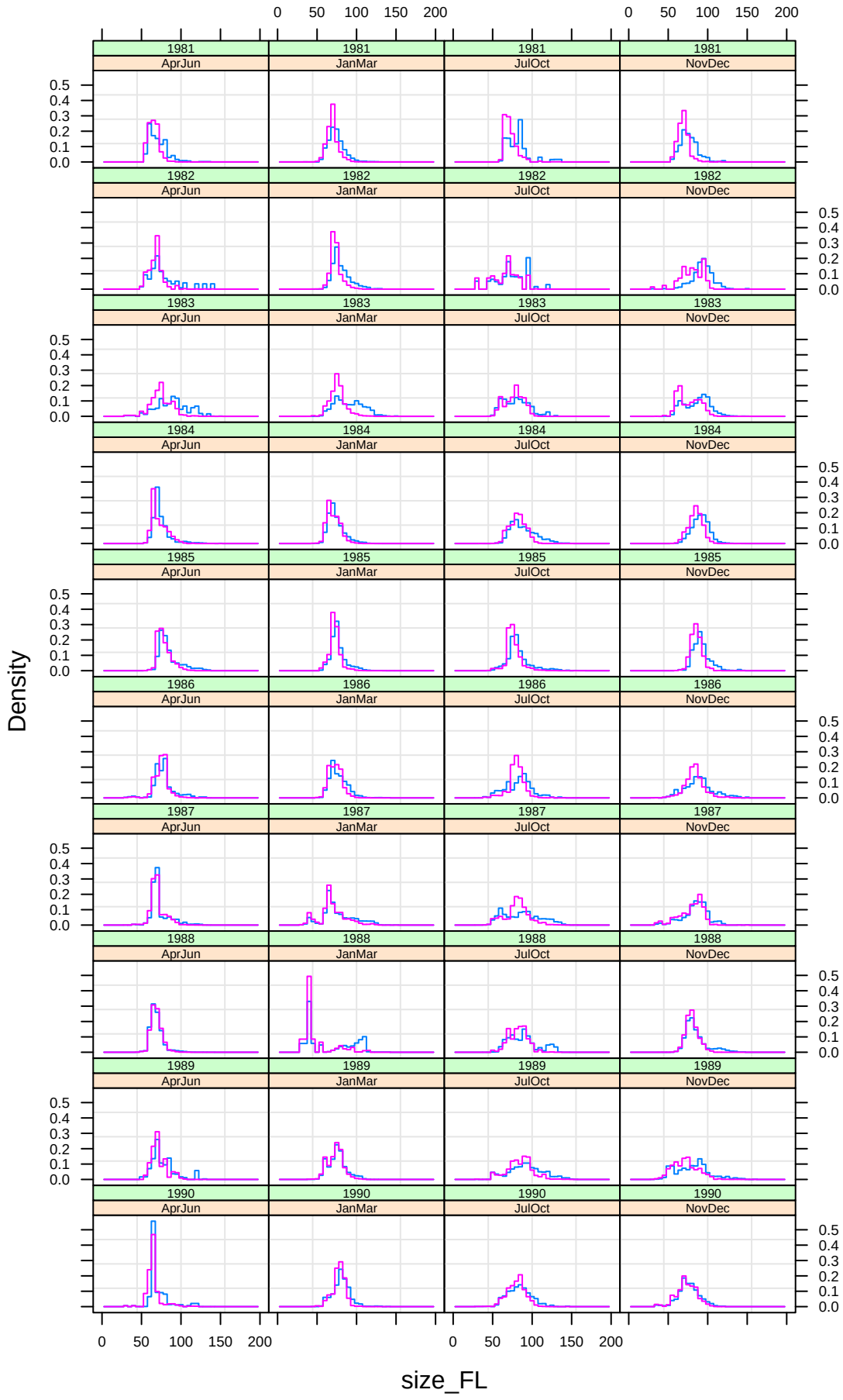
CAS by Sex GOM Com
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1981 JanMar
1981 JulOct
1981 NovDec
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1989 AprJun
1989 JanMar
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1989 NovDec
1990 AprJun
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size_FL

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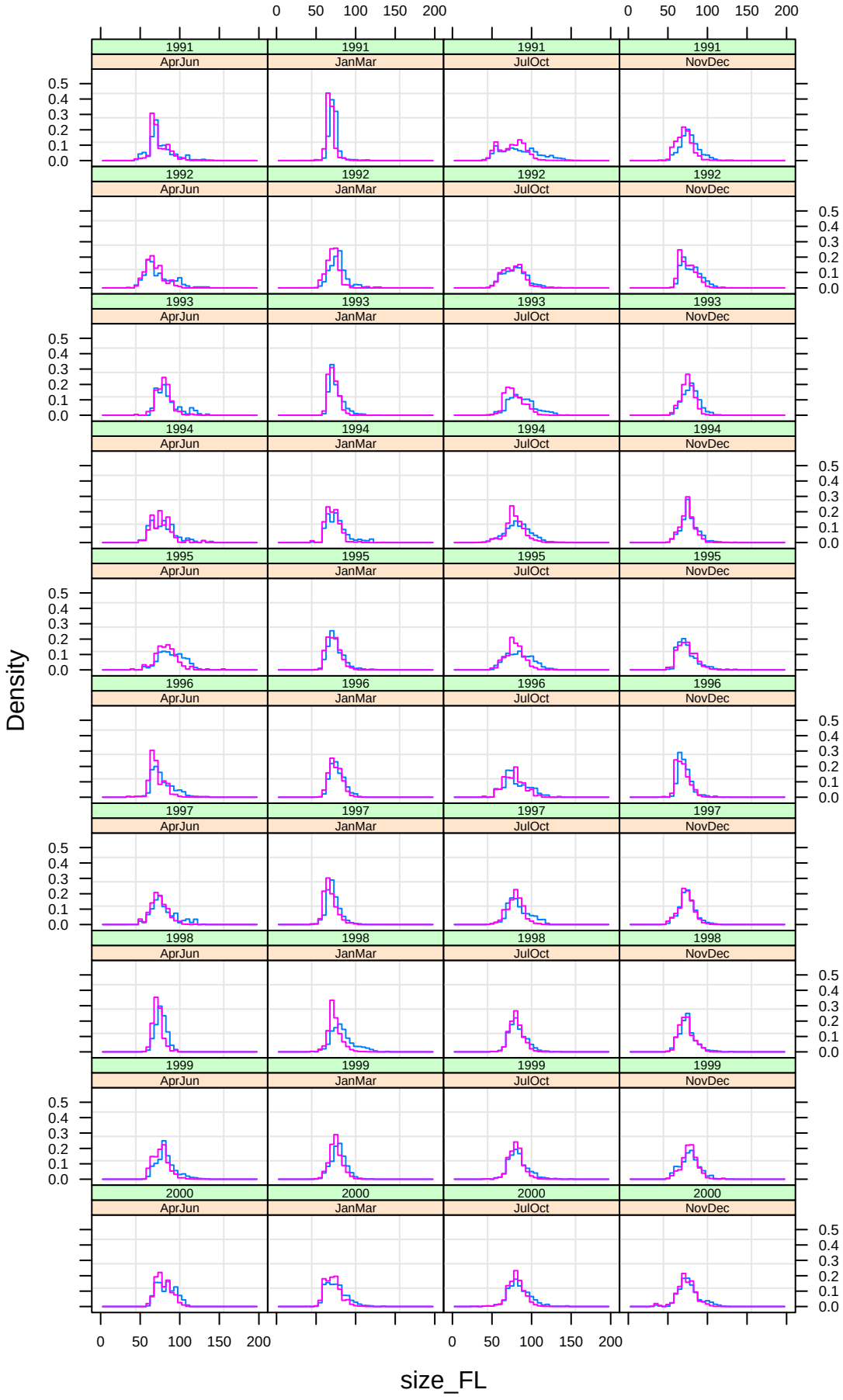

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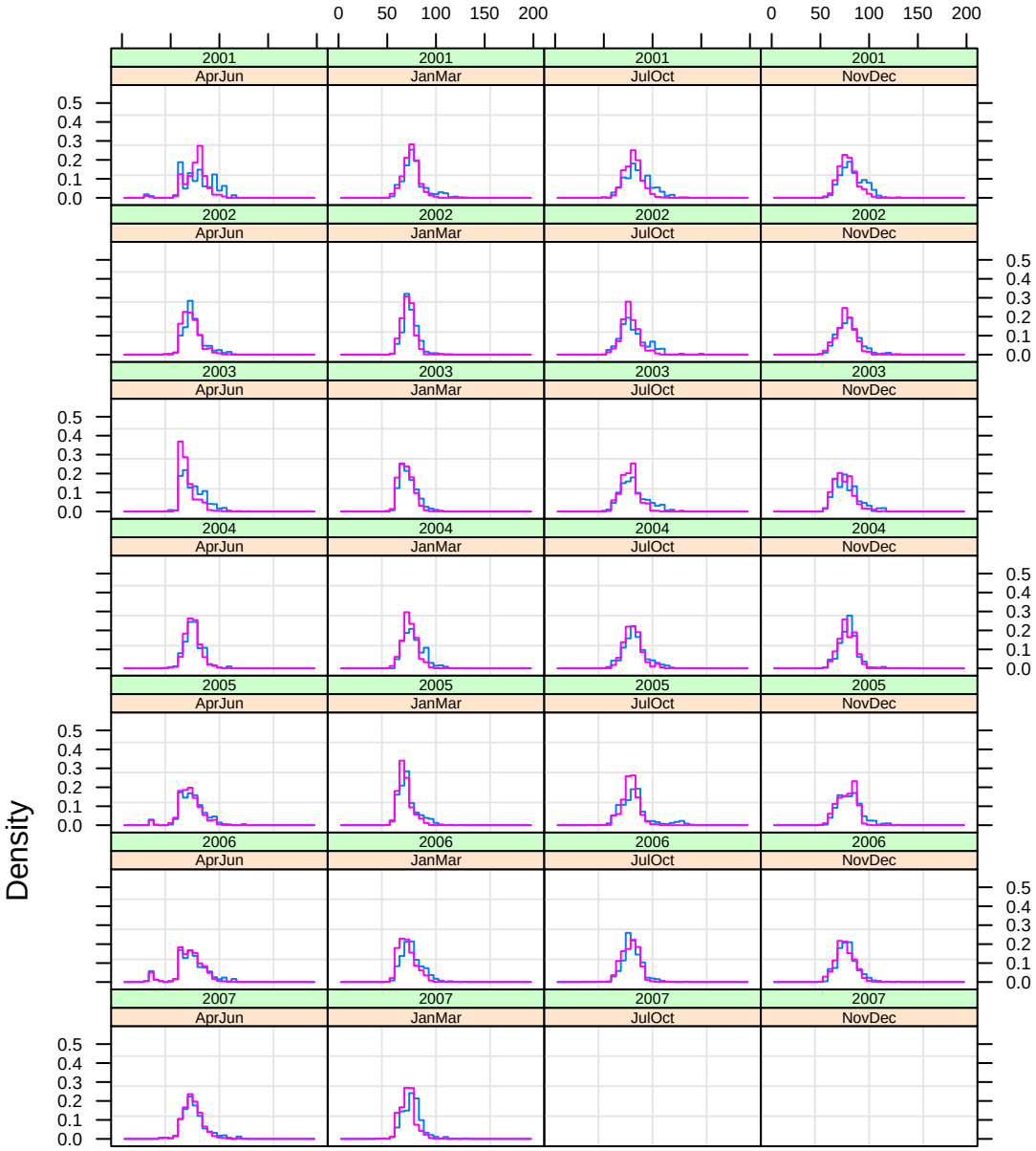

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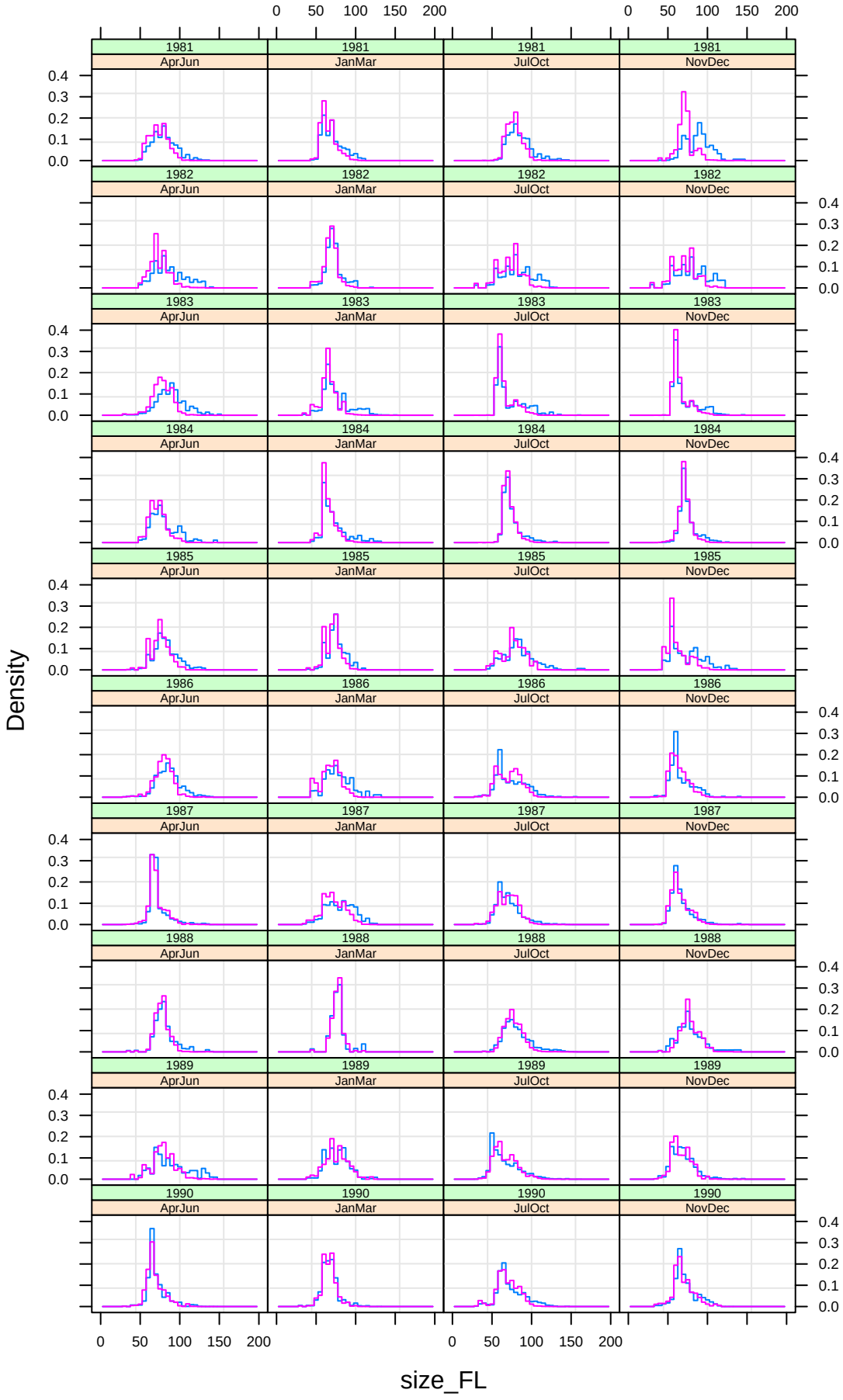

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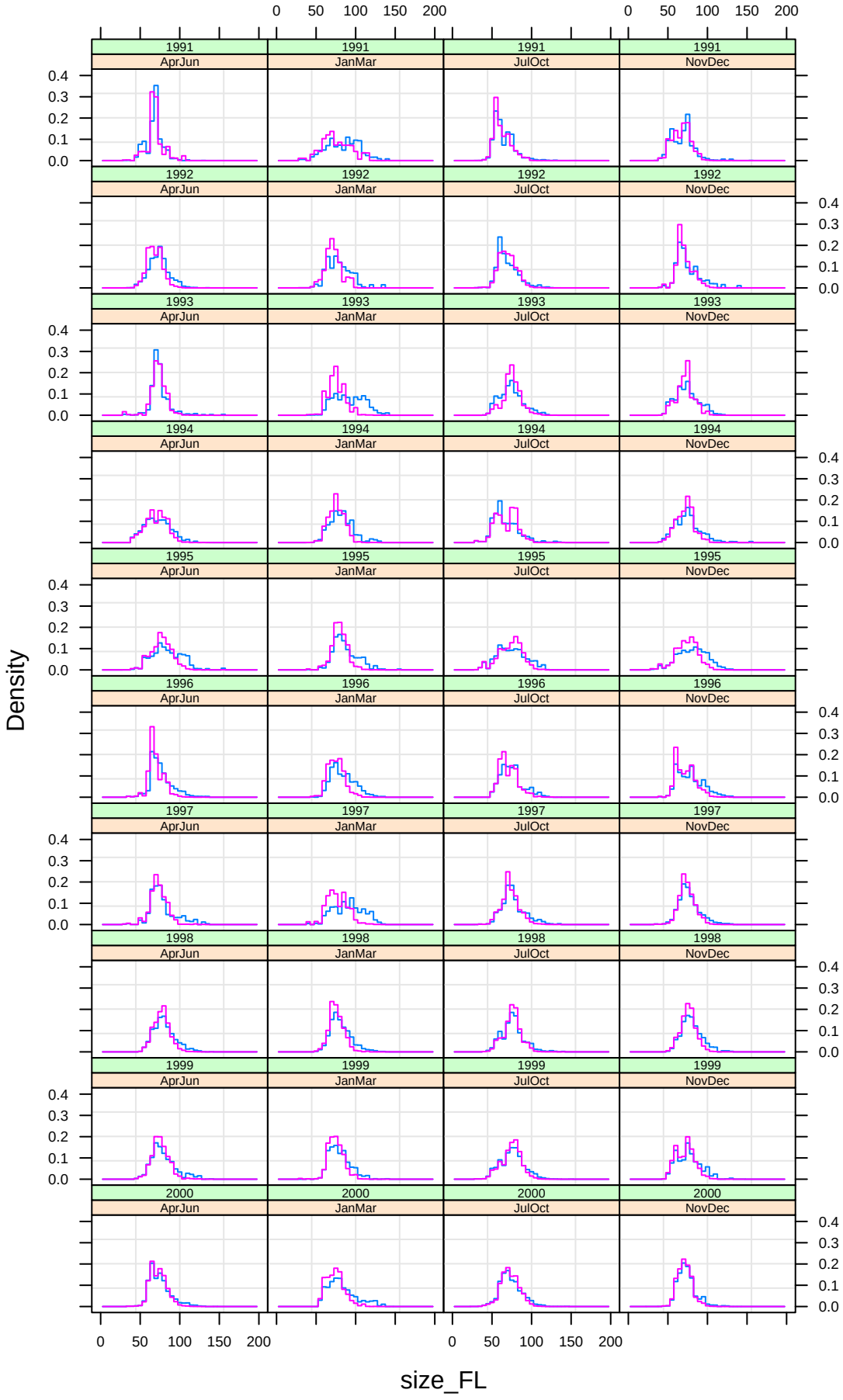

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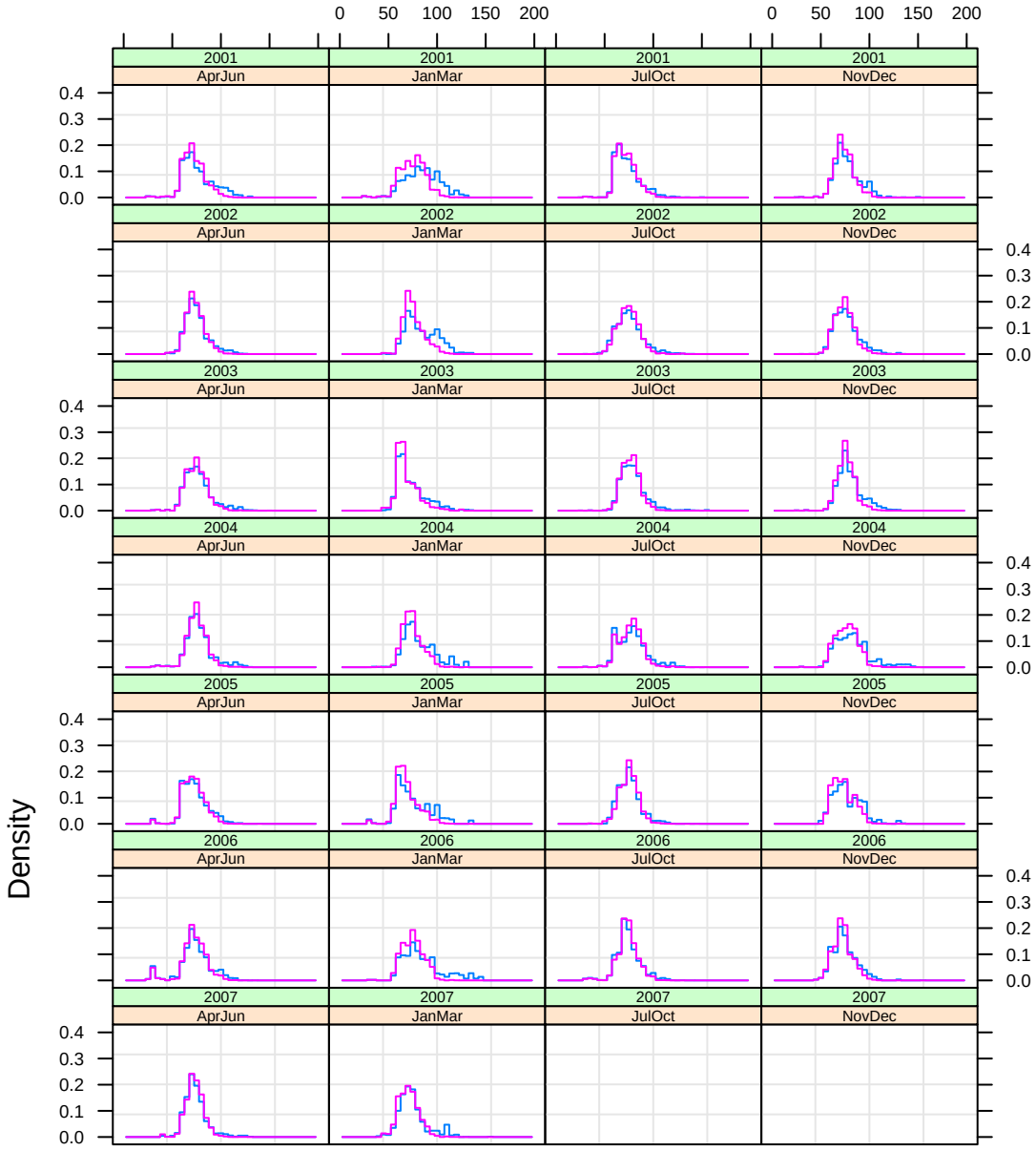
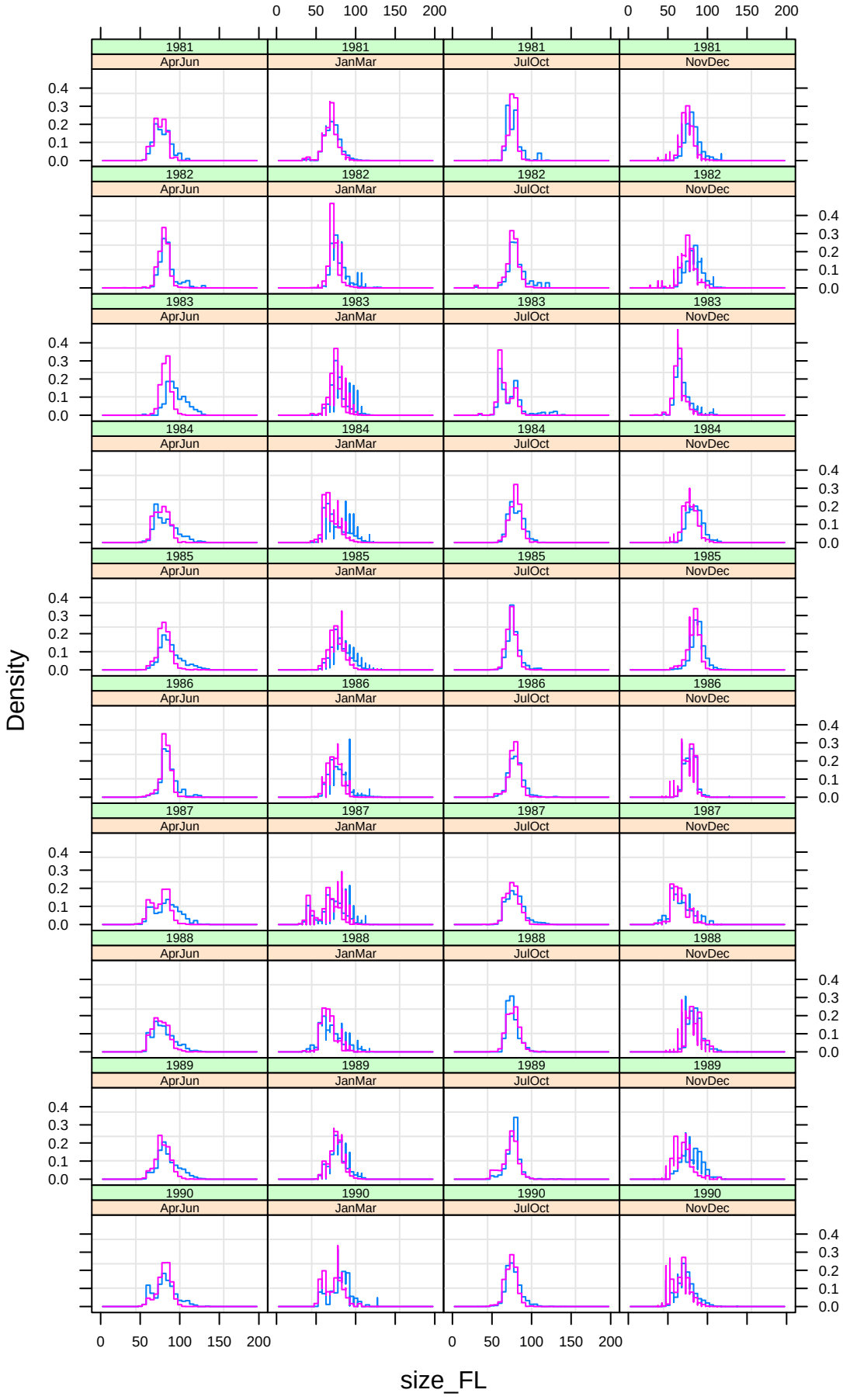


CAS by Sex MixZone Com



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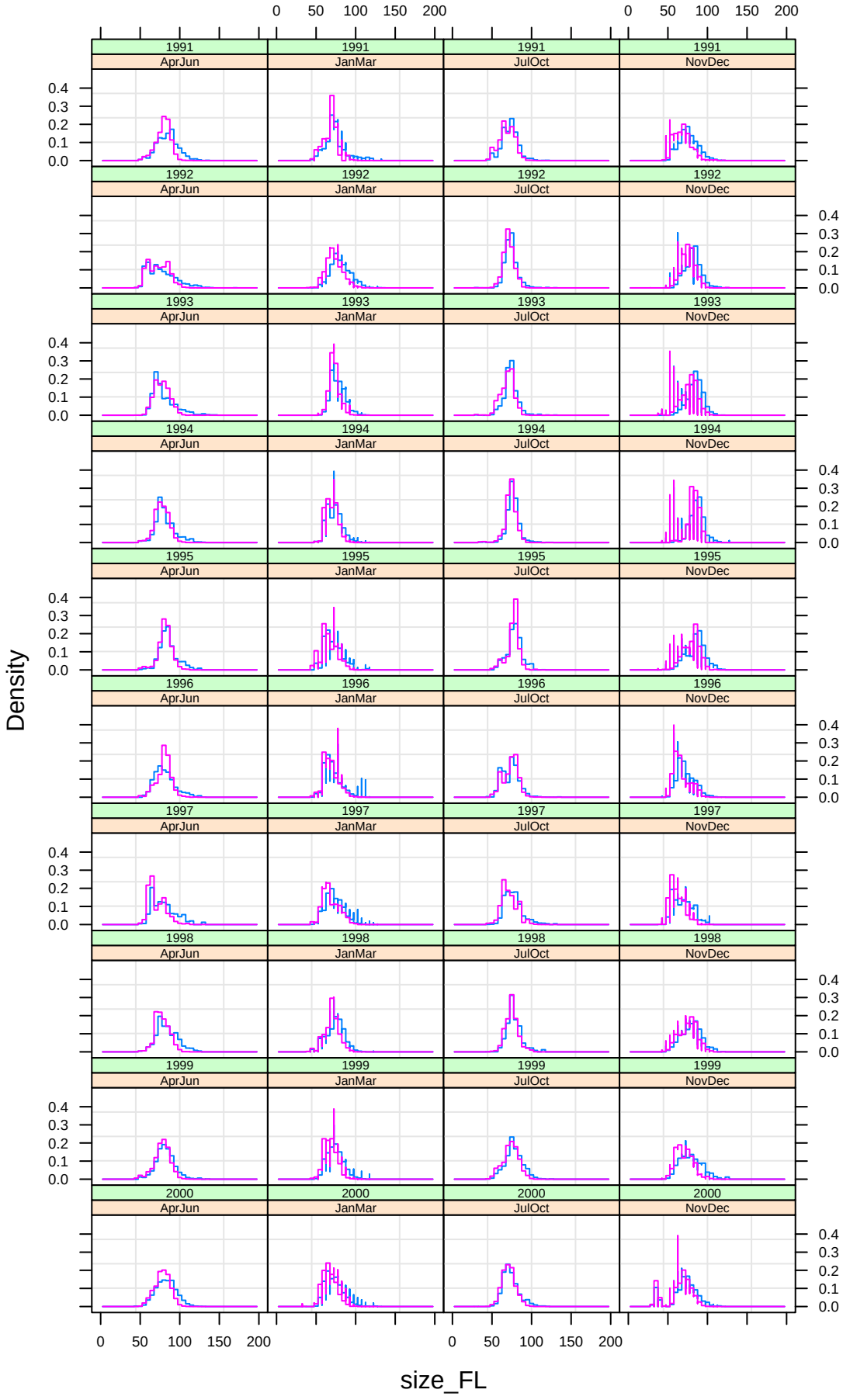

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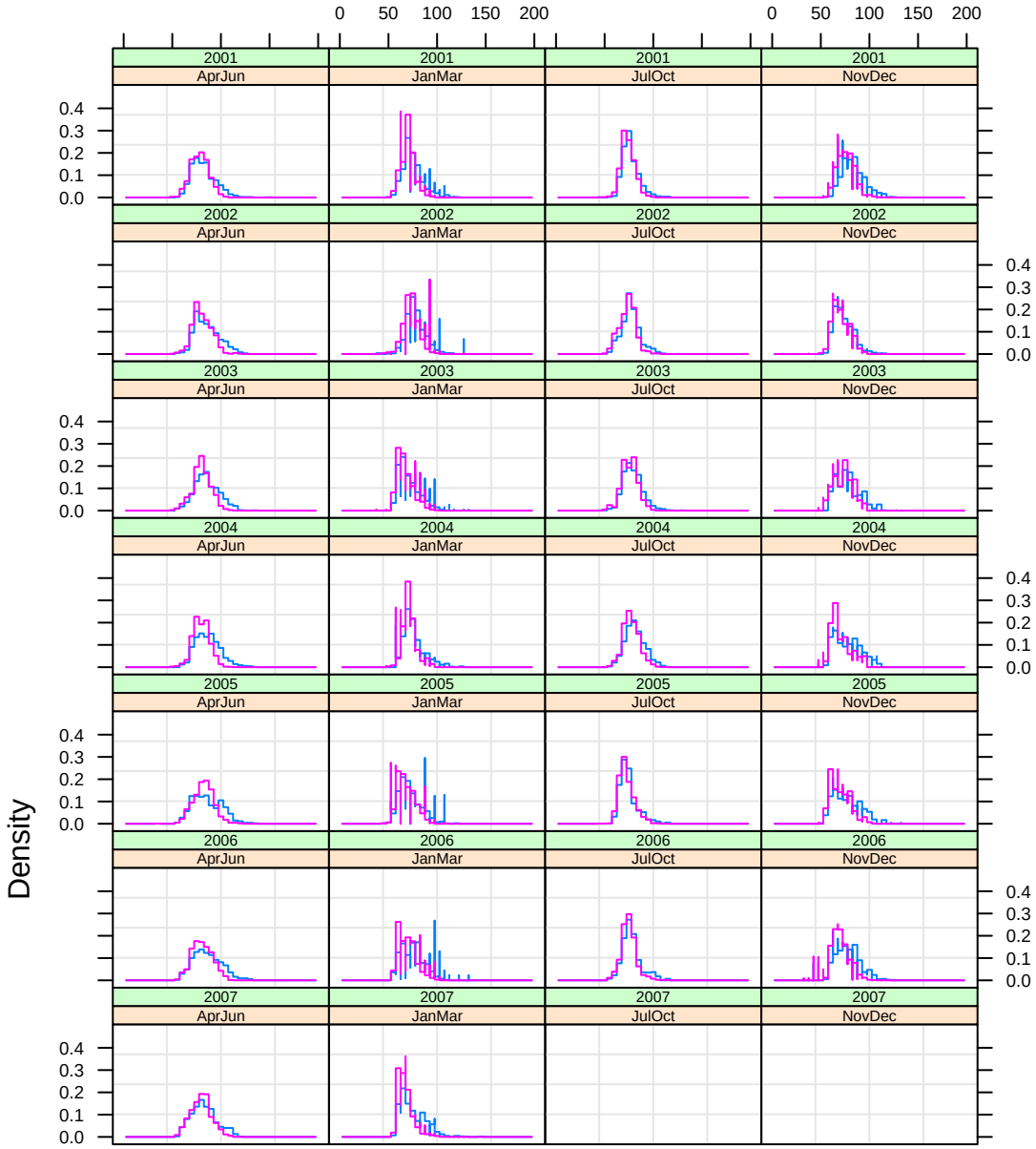

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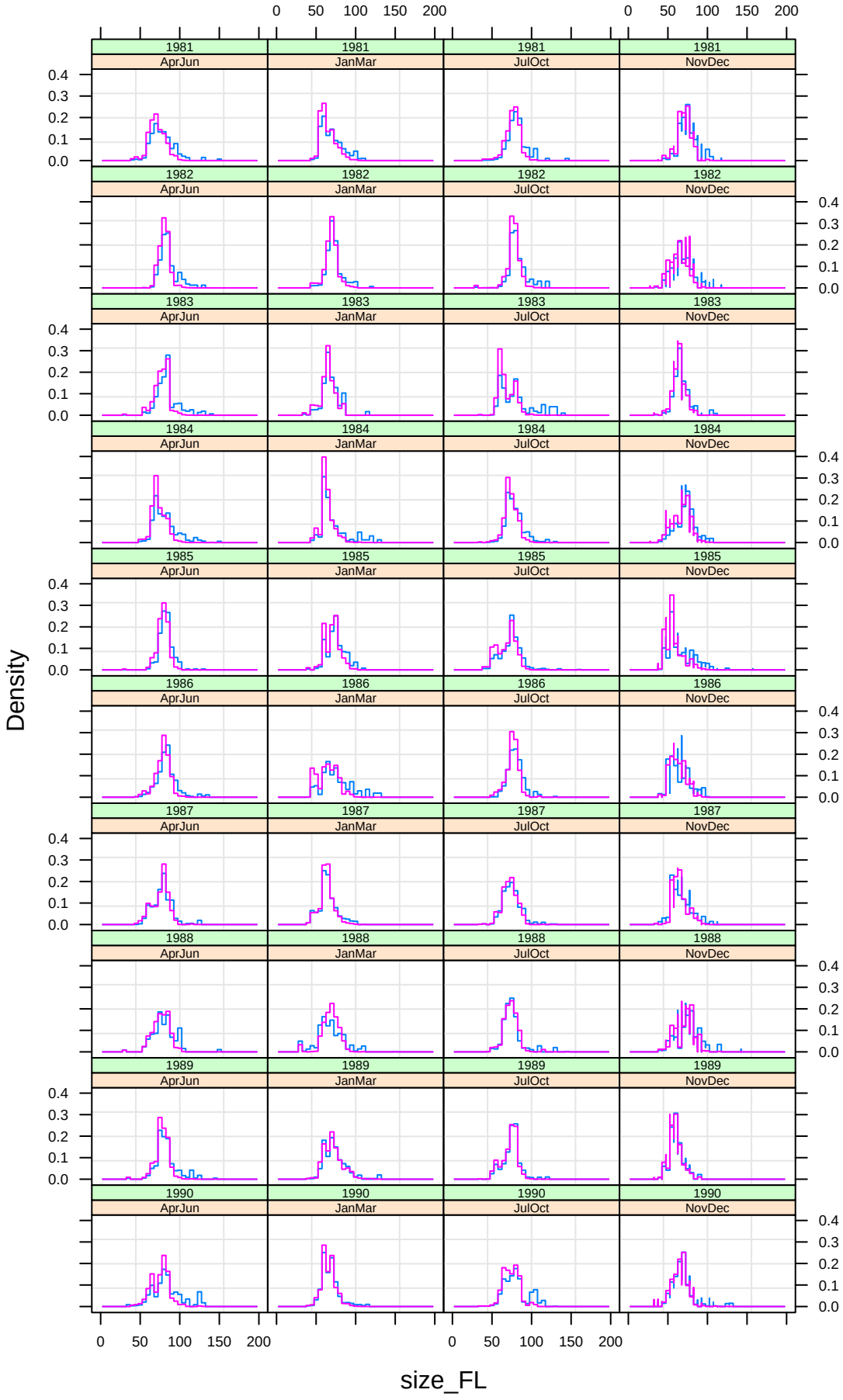

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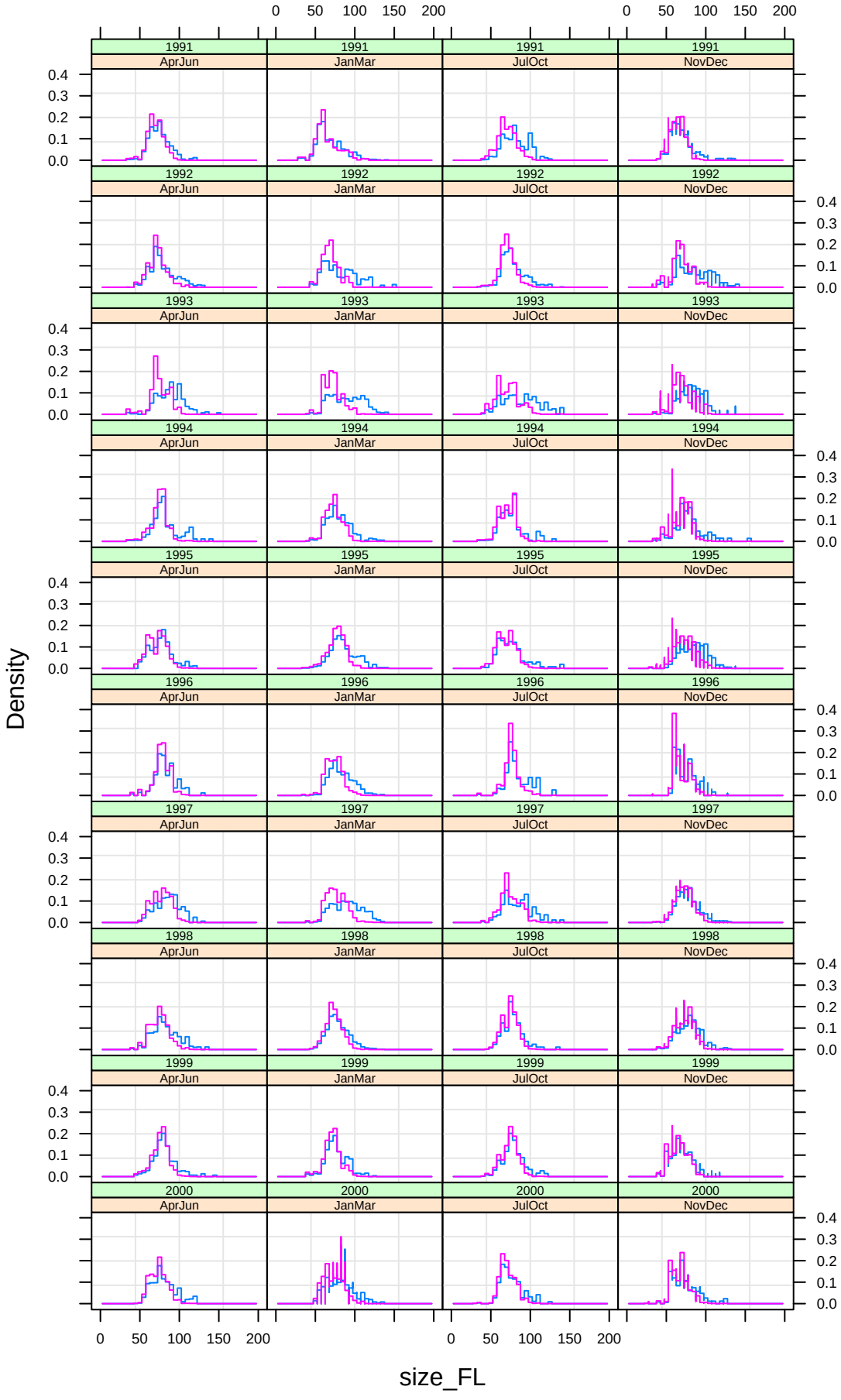

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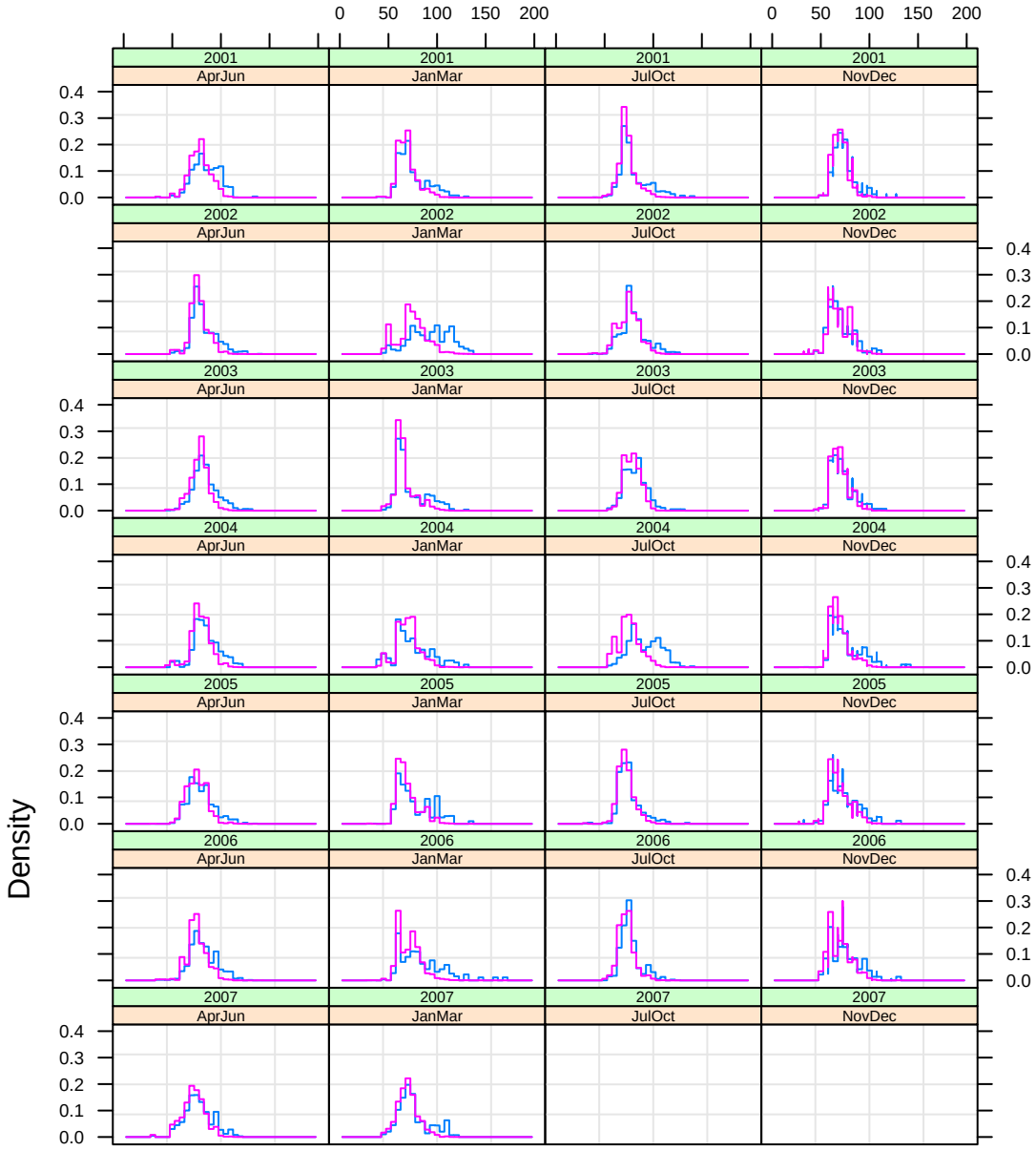

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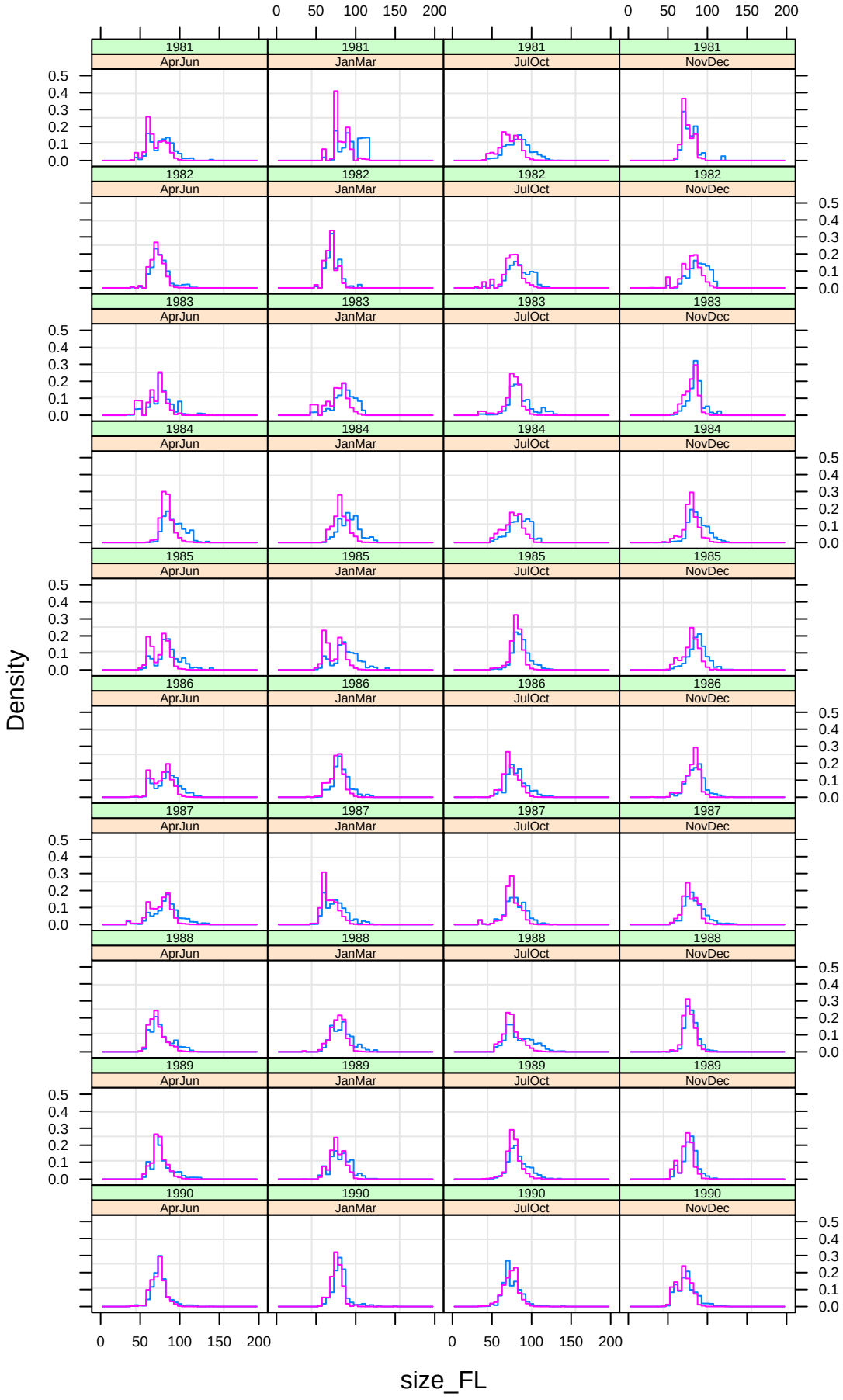
CAS by Sex SR08 ATL Com



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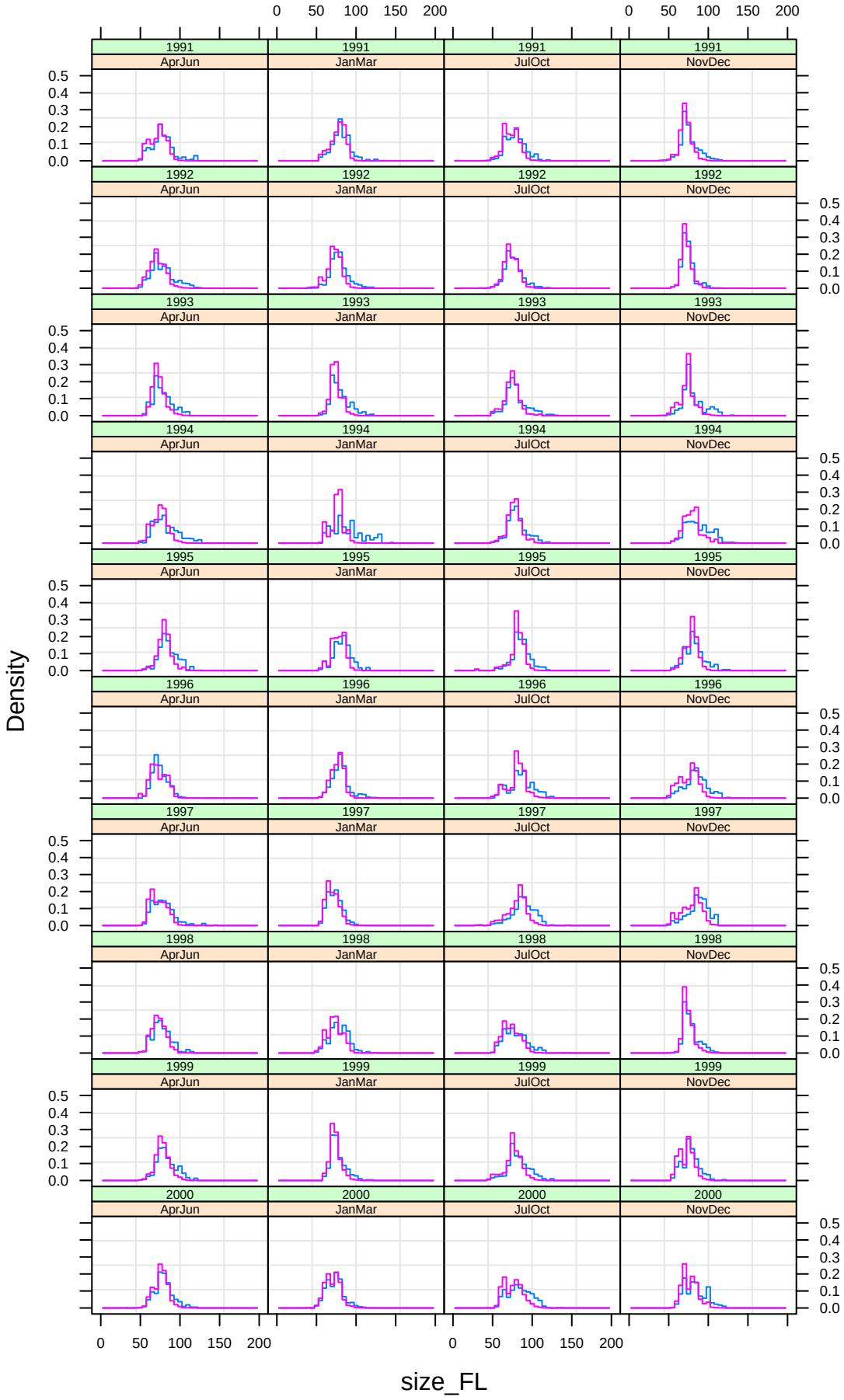

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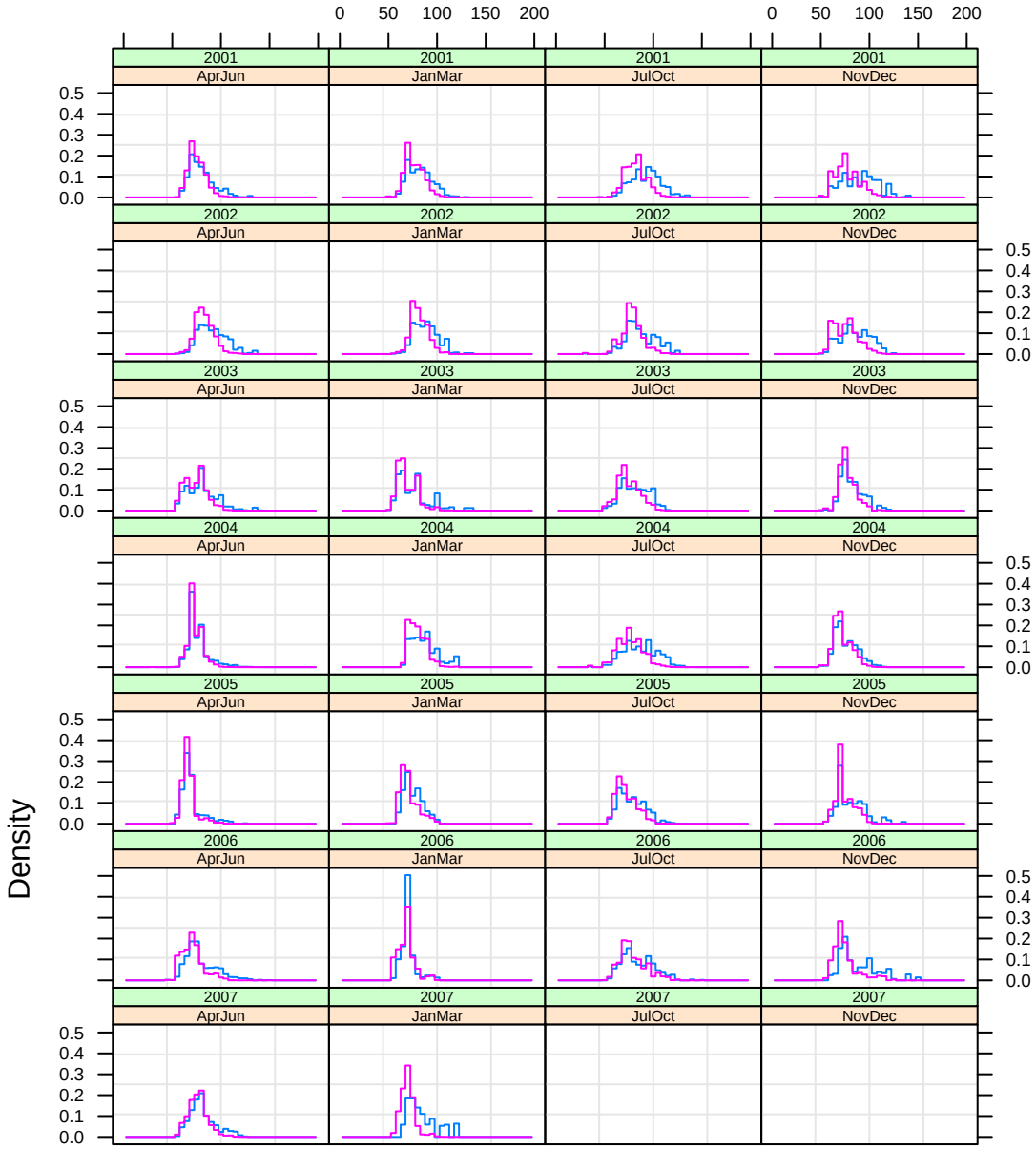

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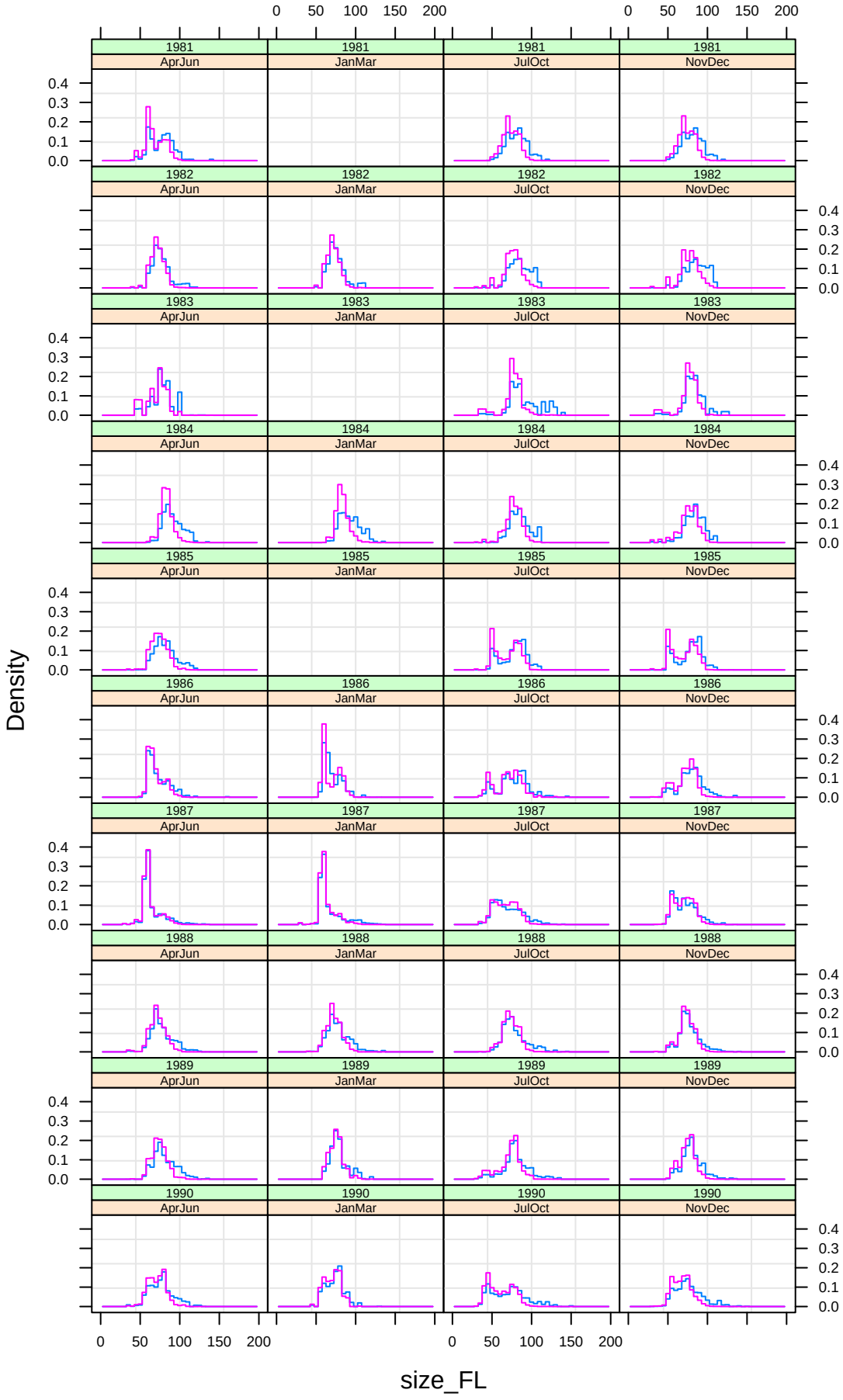

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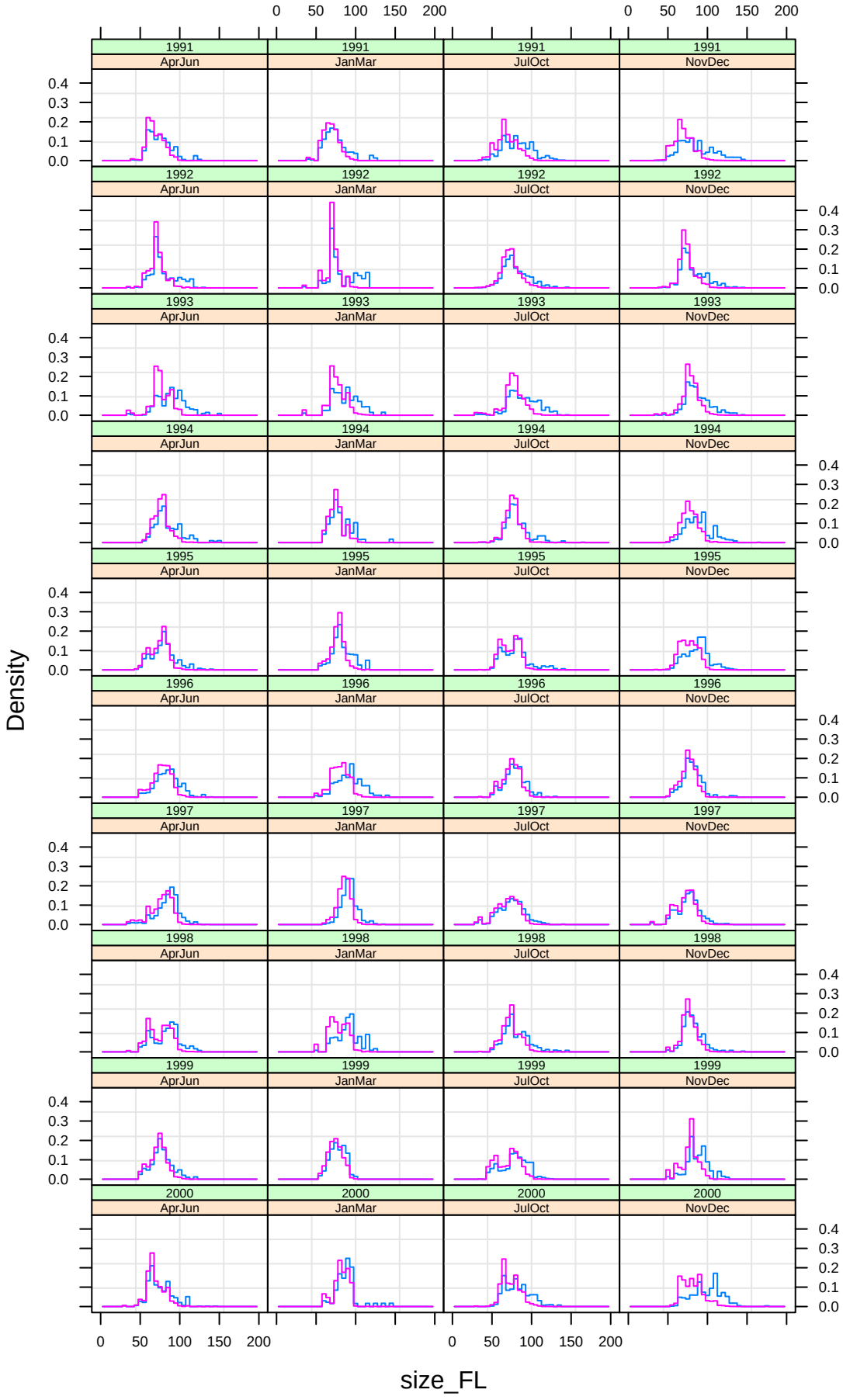

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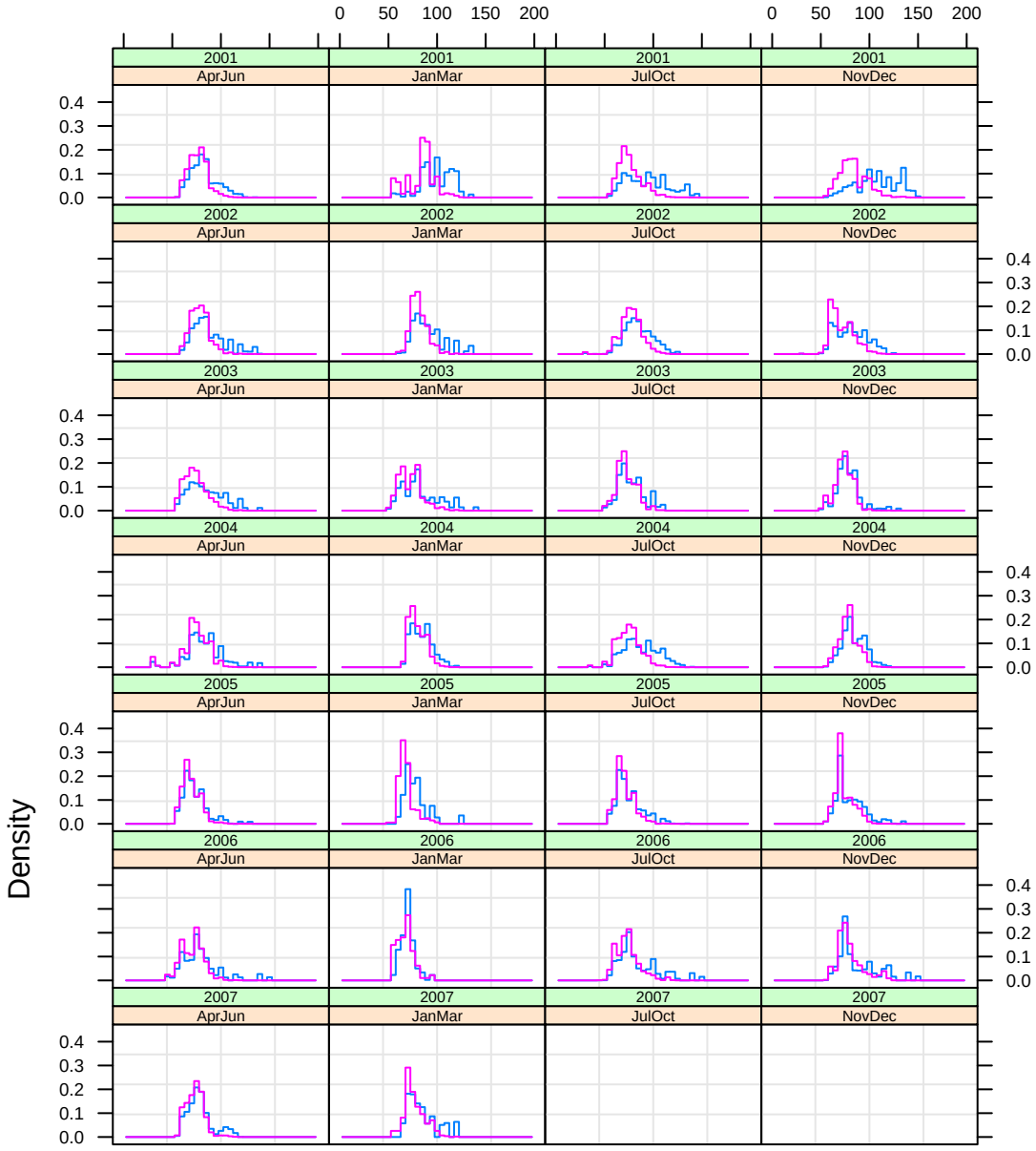

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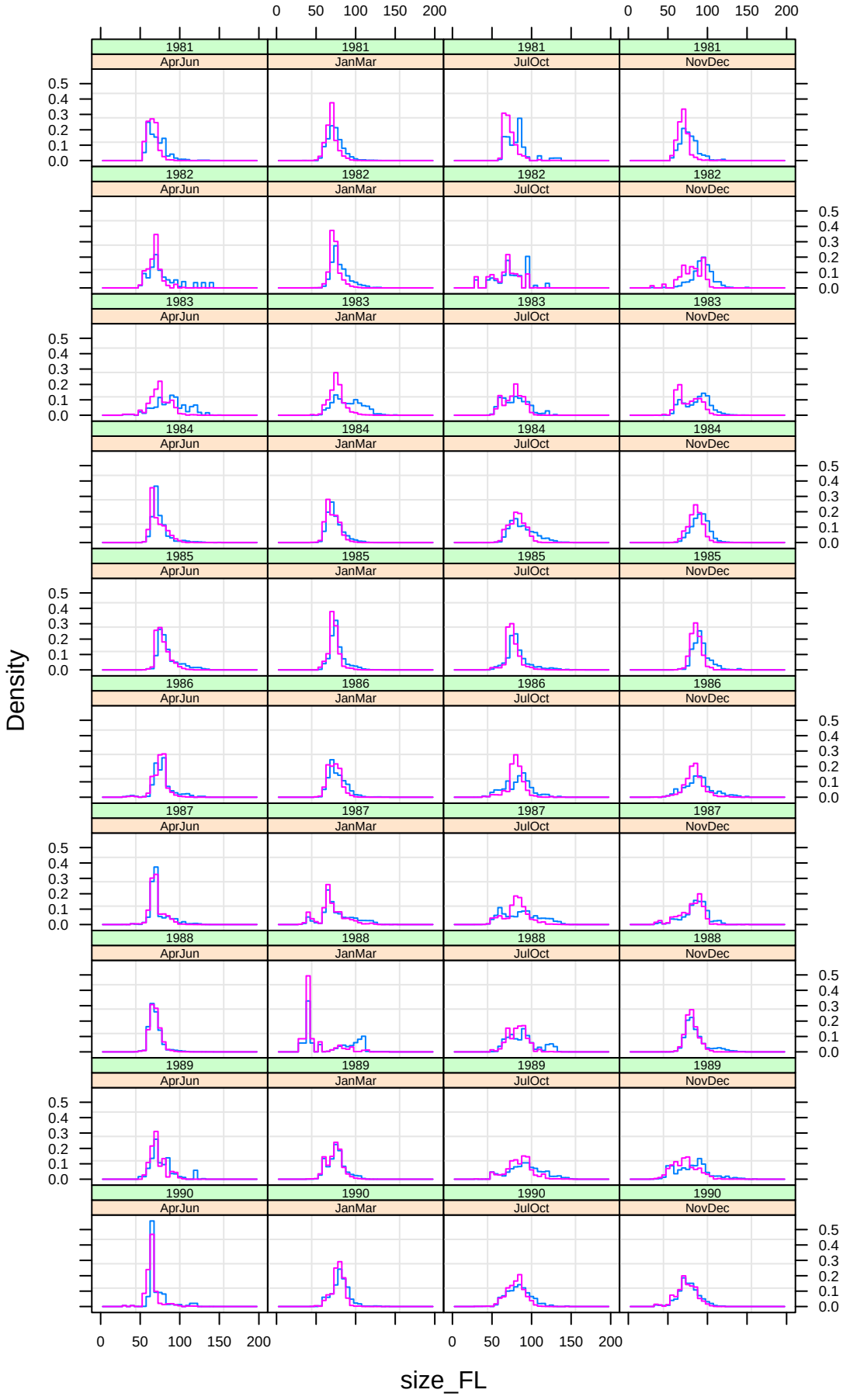

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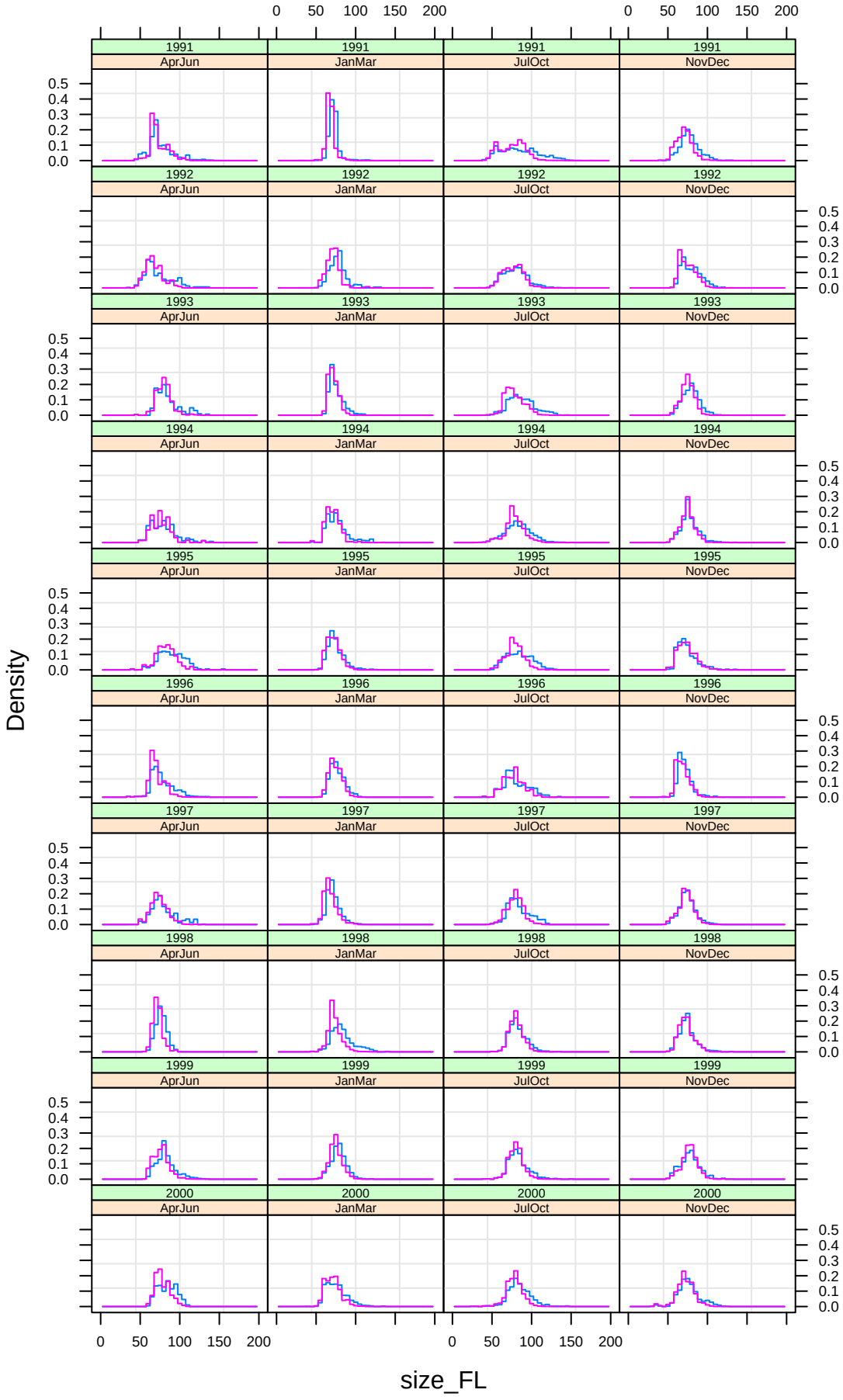

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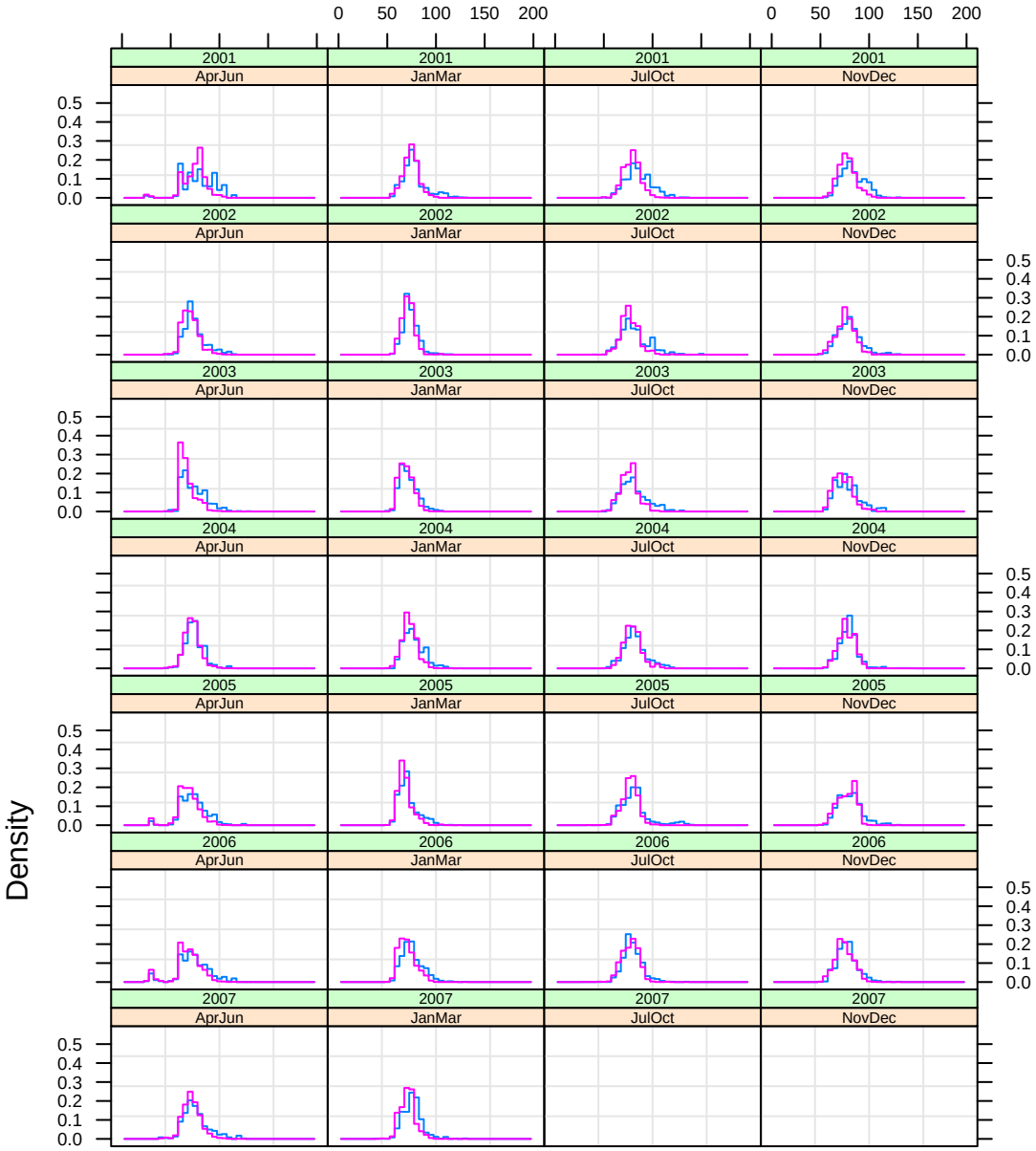

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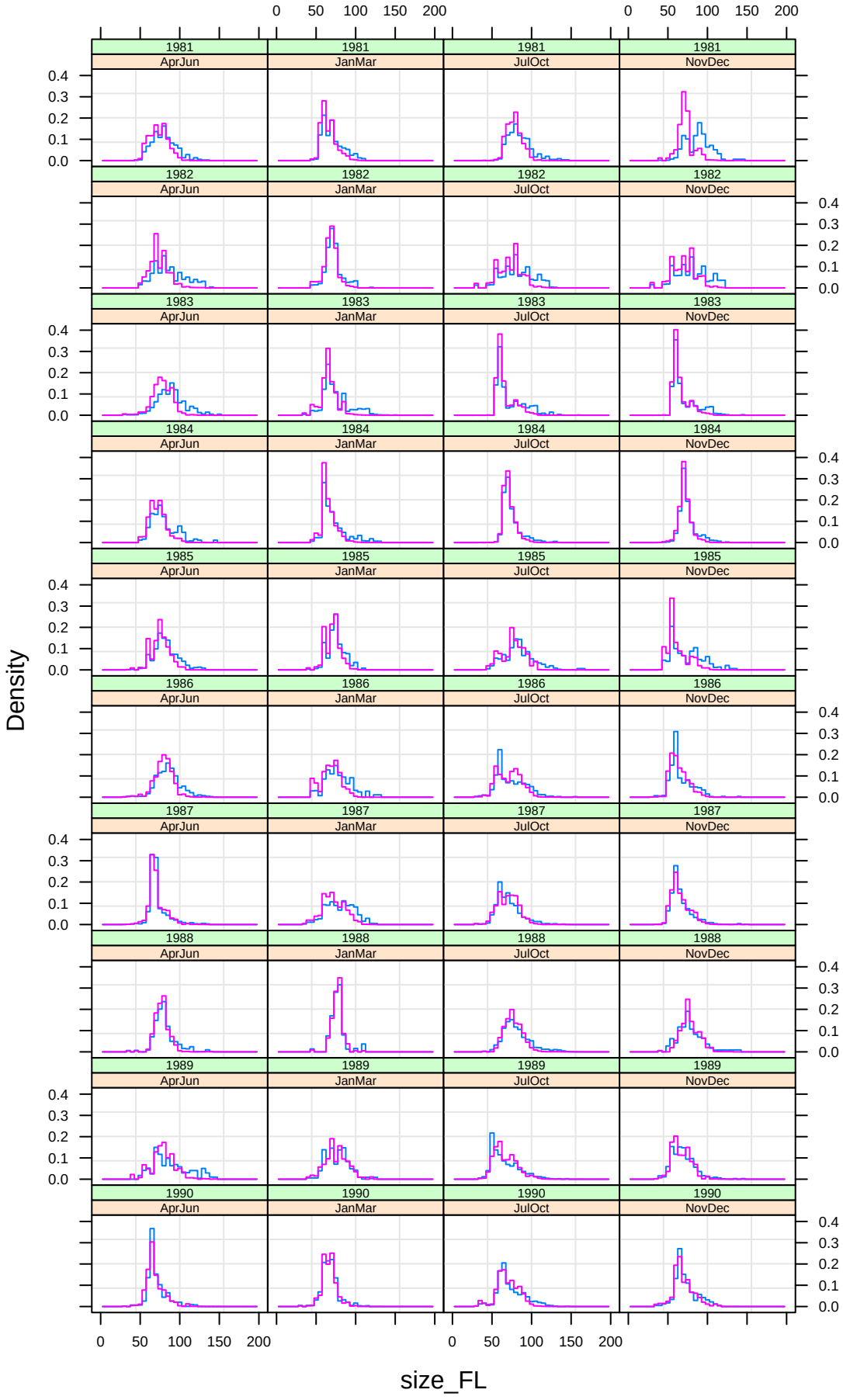

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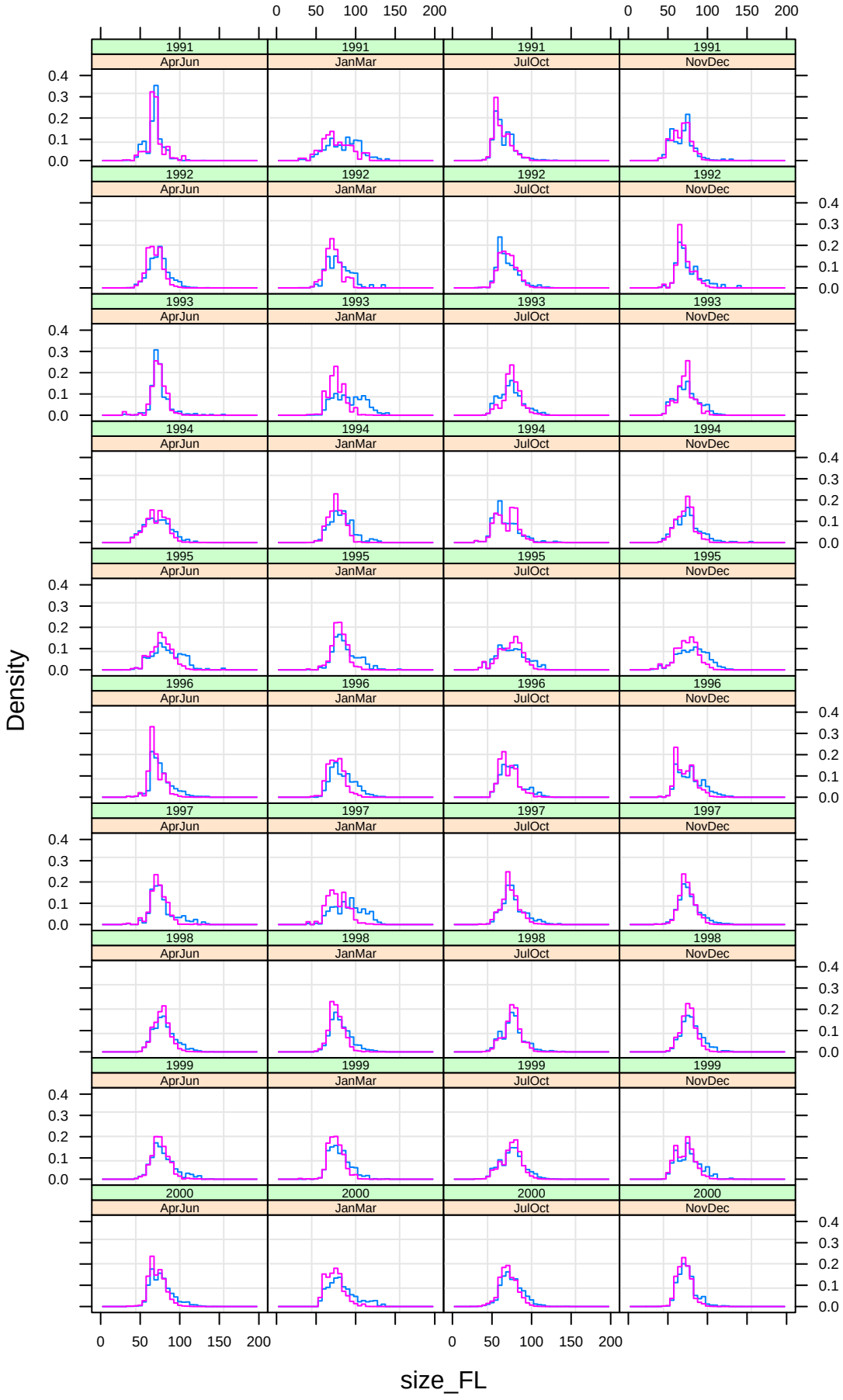

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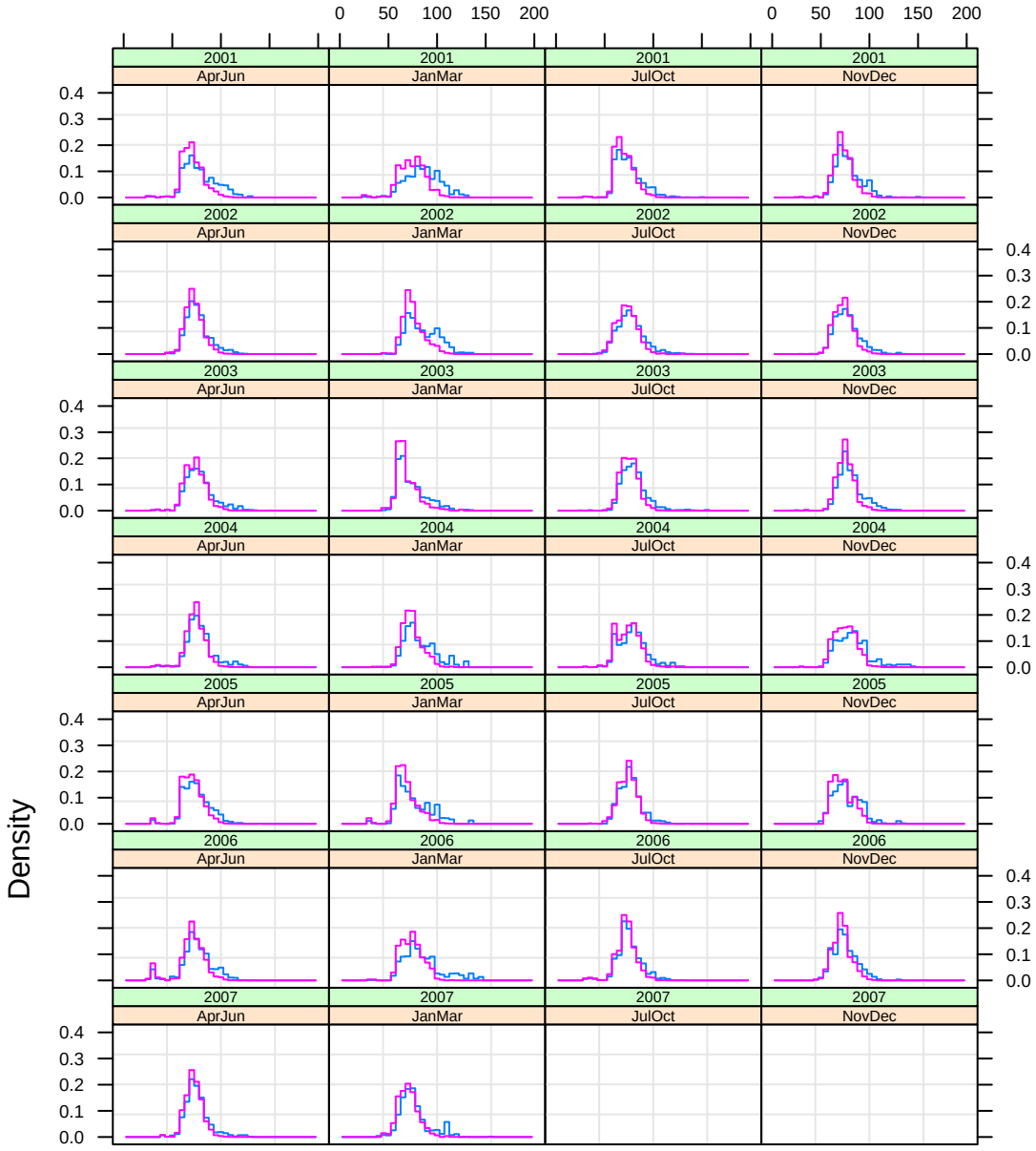

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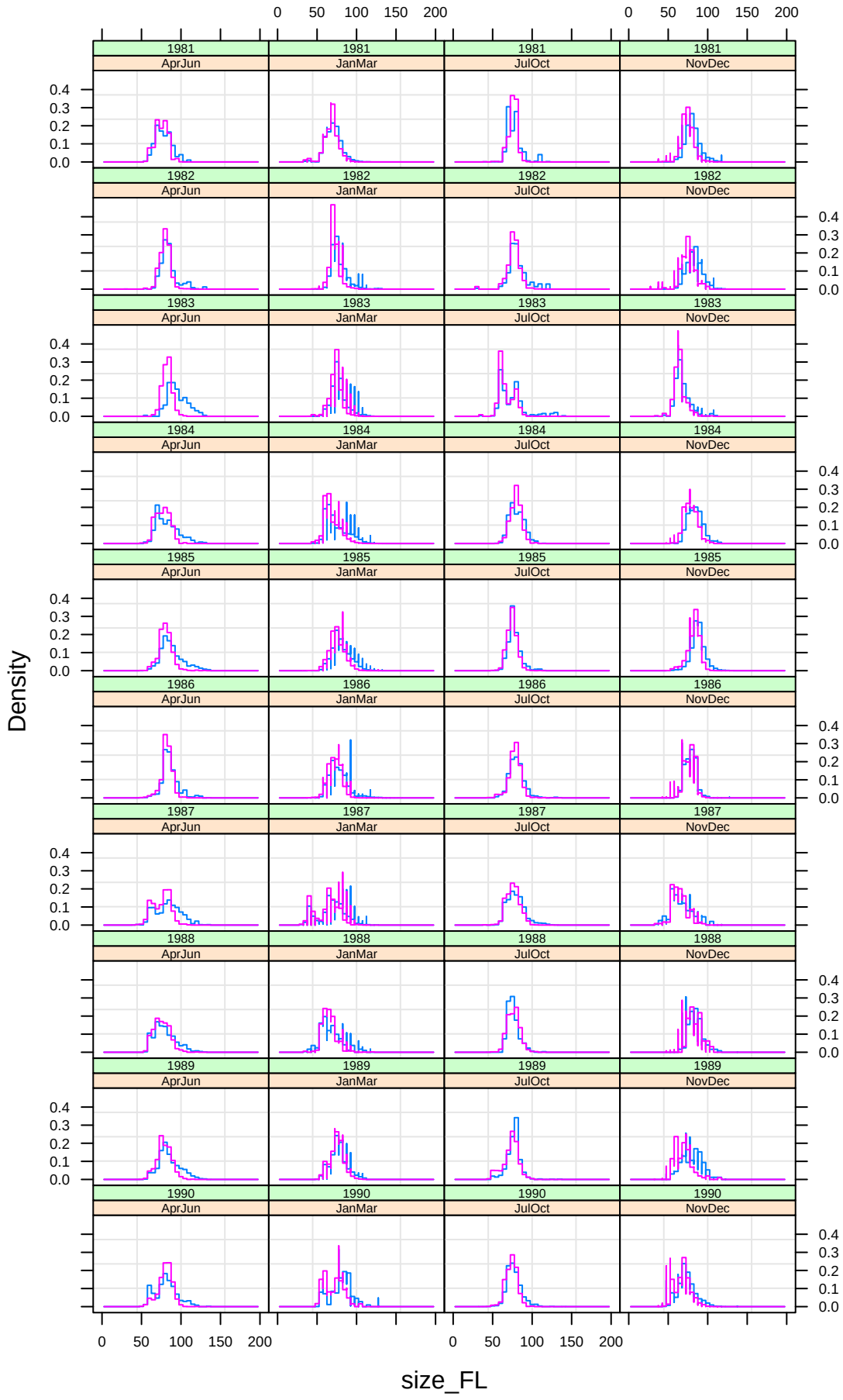
CAS by Sex SR08 MixZone Com
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1989 NovDec
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1990 JanMar
1990 JulOct
1990 NovDec
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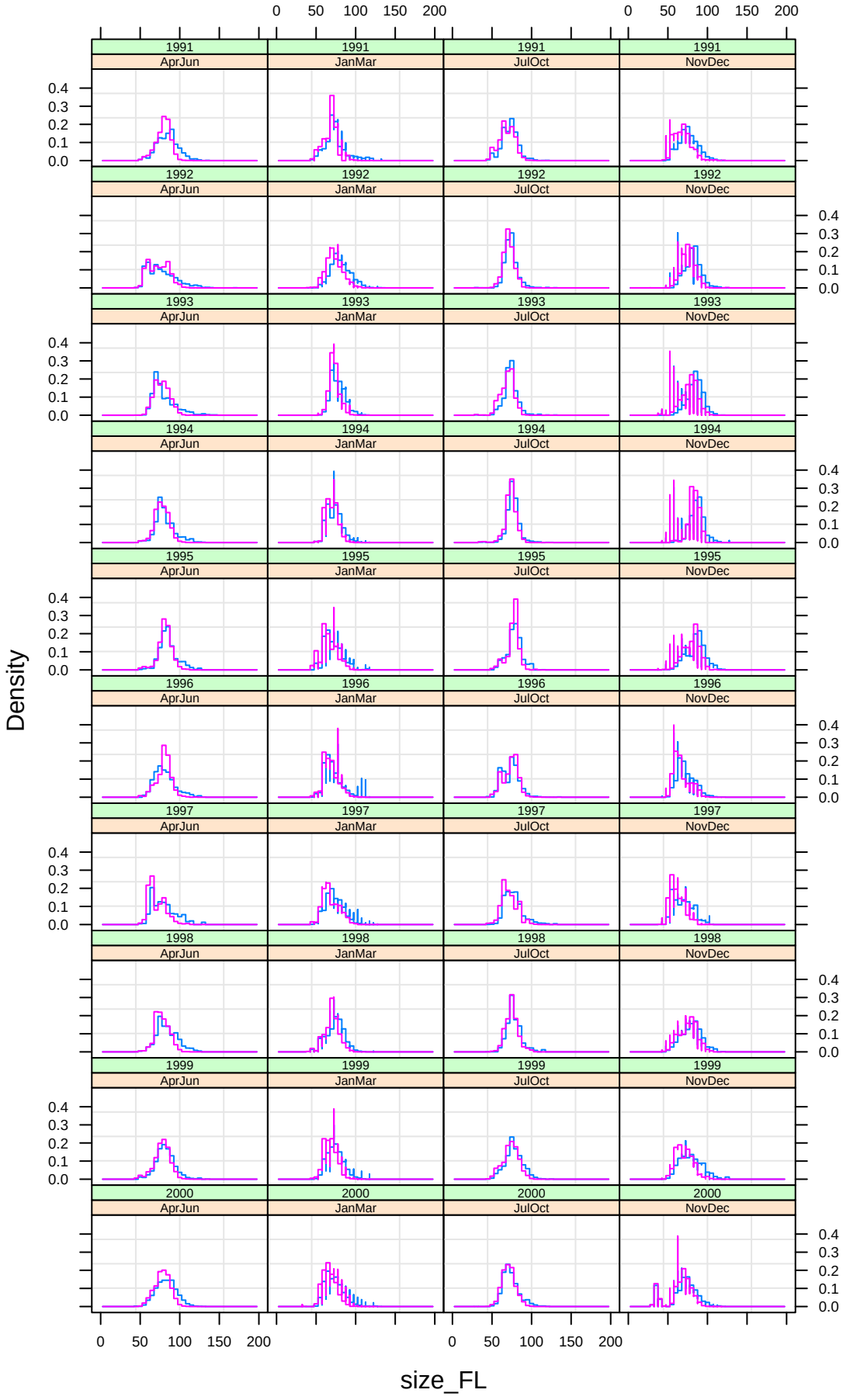

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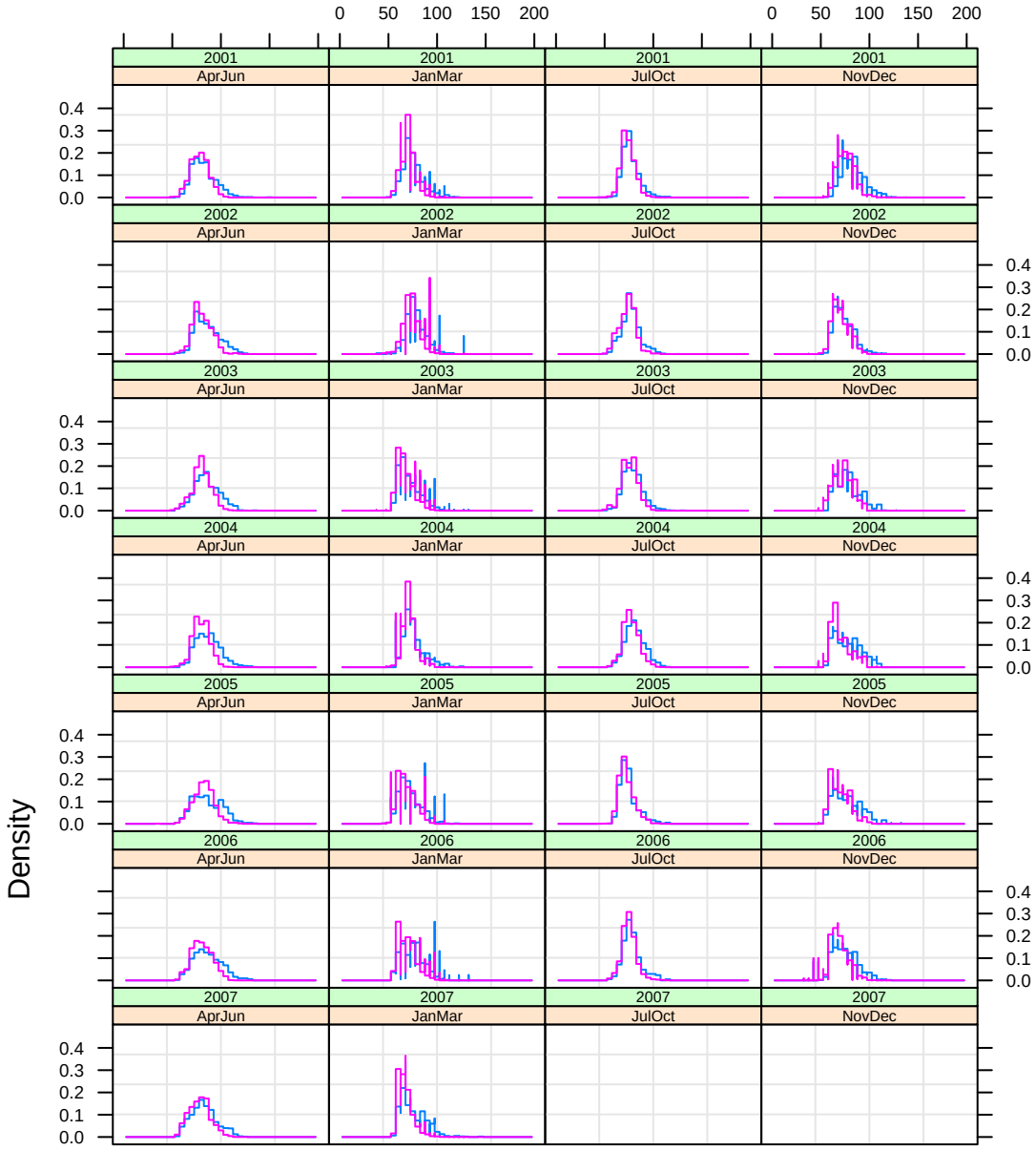

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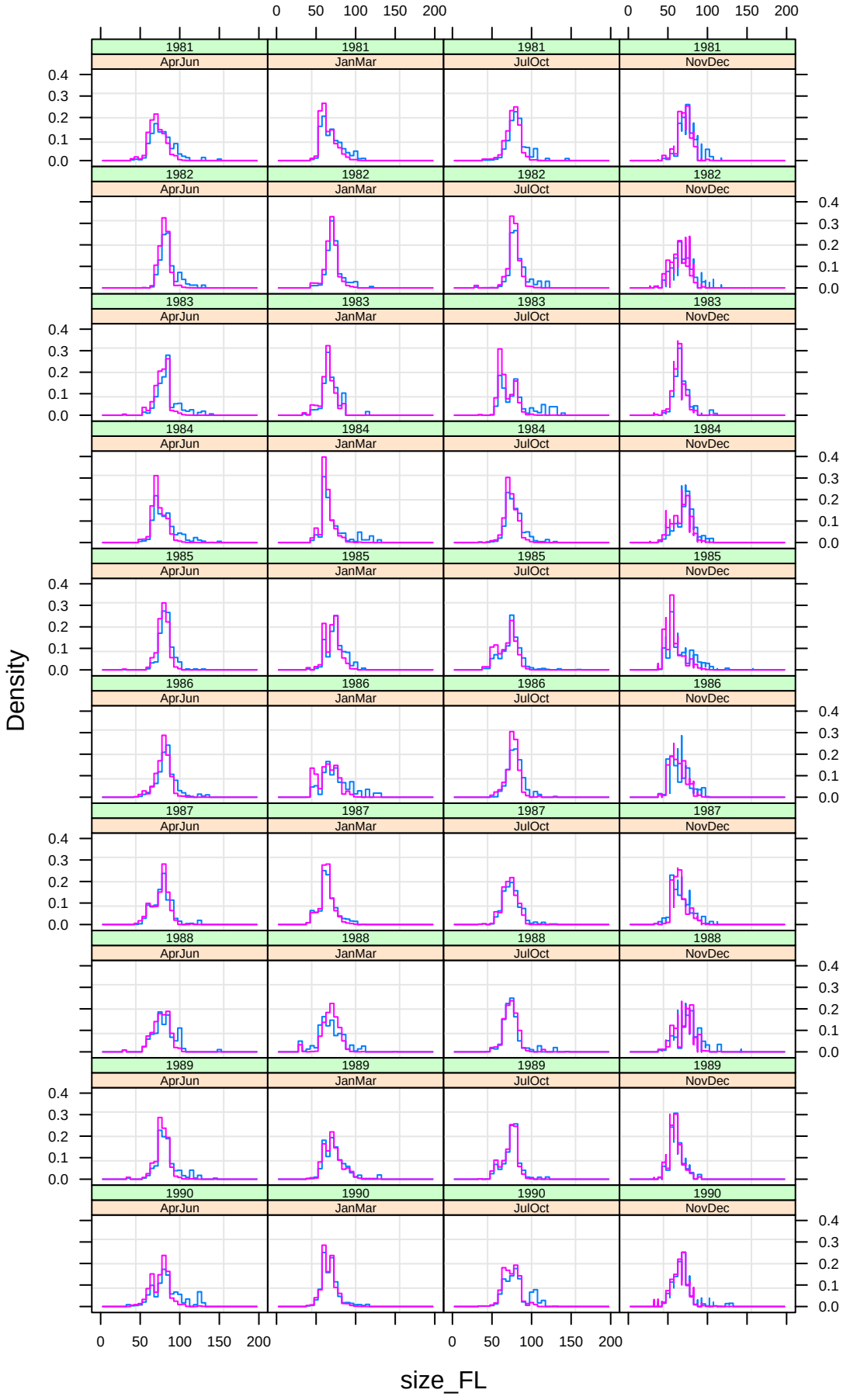
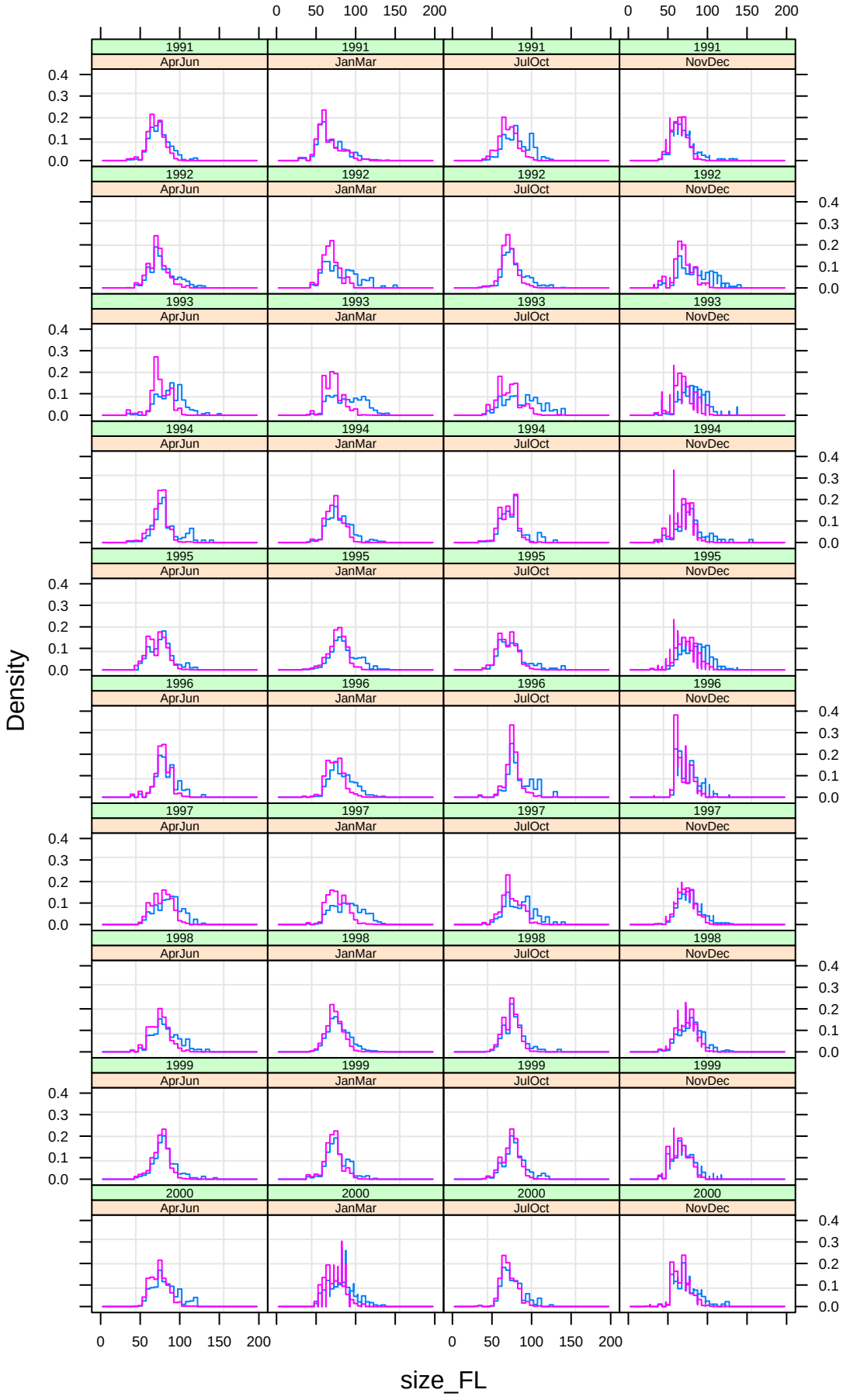
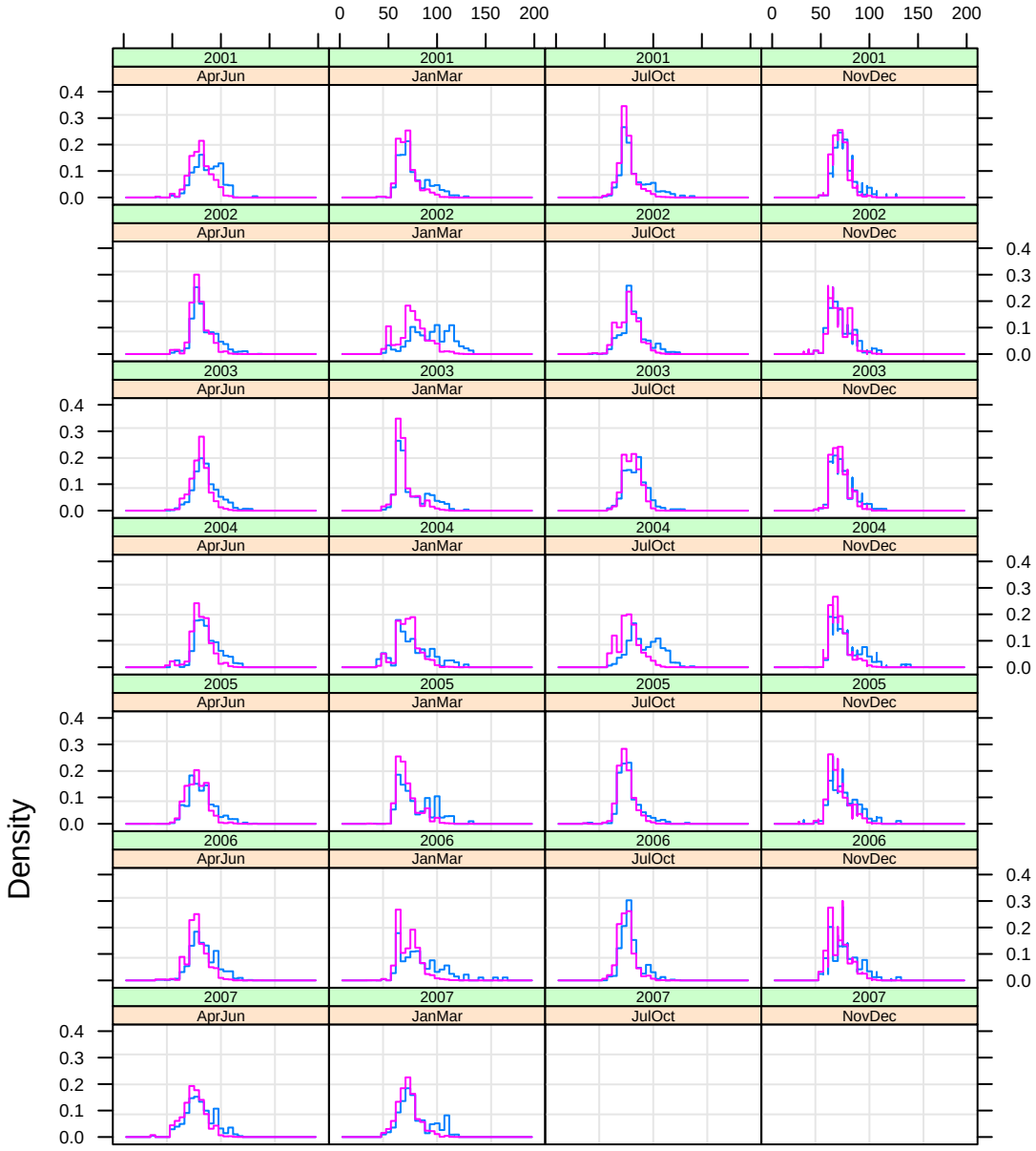


CAS by Sex SR08 MixZone Rec

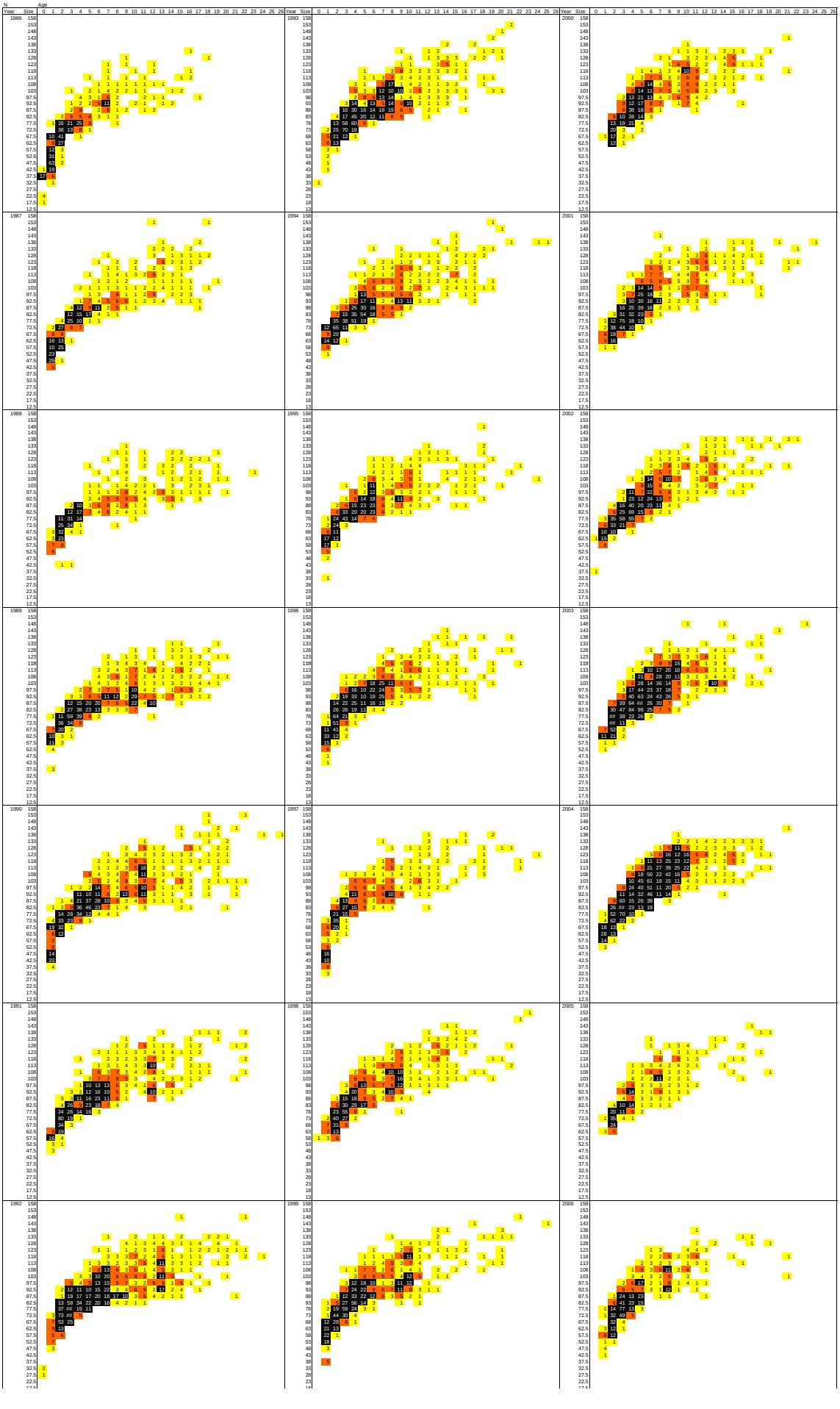


CAS by Sex SR08 MixZone Rec



size_FL

MigGrp ATL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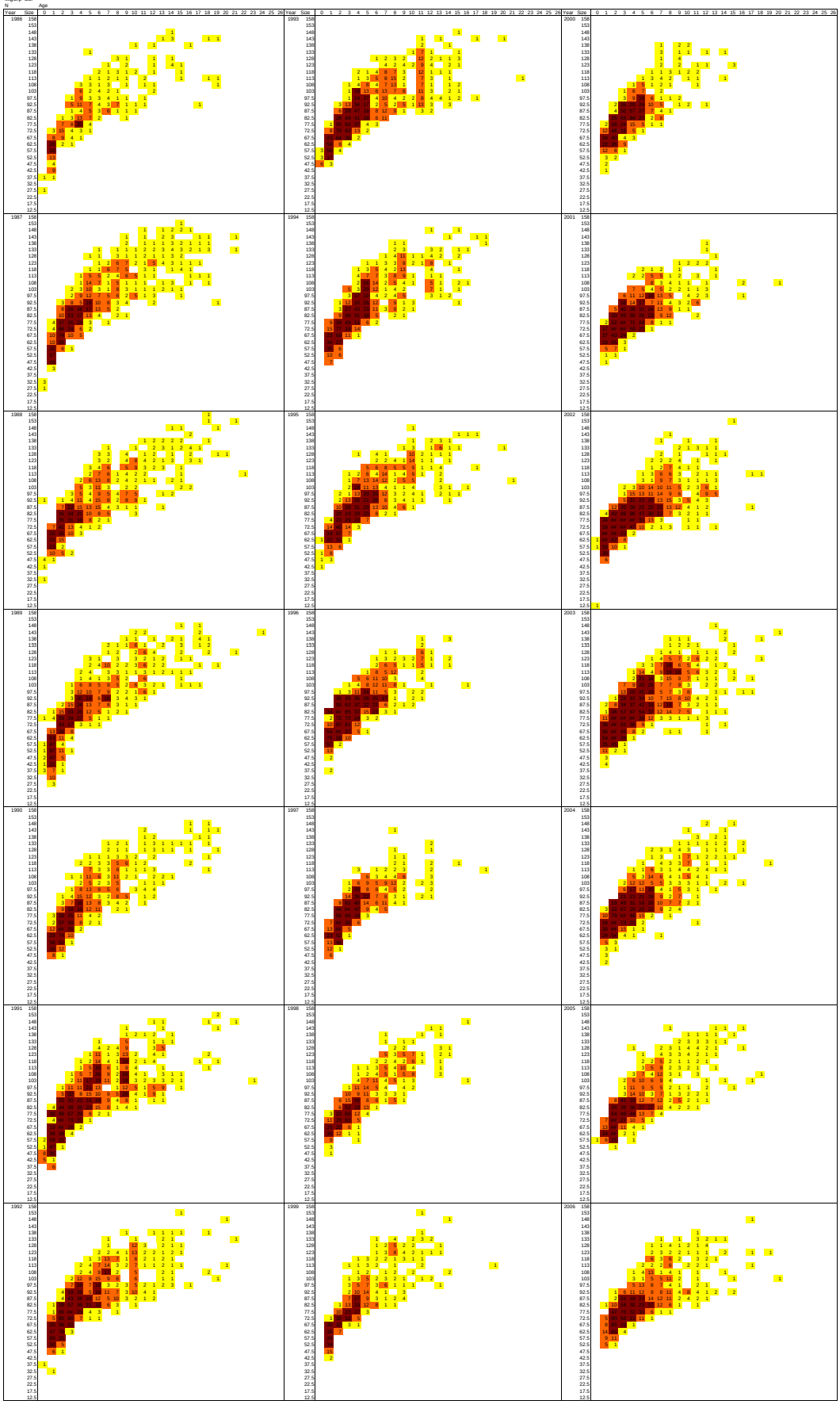
MigGrp GLF
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Age
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