

Sizes of tag-recaptured red drum that were released alive by recreational anglers

Introduction

Estimating the size composition of fish released alive by recreational anglers (B2 fish) has been a long-standing problem in stock assessments of red drum. The issue arises because, unlike harvested fish, no samples are available for creek clerks to measure during angler intercepts. The B2 length (and age) composition is especially important with respect to red drum due to the high B2 component of the fishery (~80%). An estimated 8-16% of released fish die due to hook injuries and these mortalities need to be accounted for in assessment models.

Information on the length composition of B2 fish were available from tagged red drum that had been recaptured, measured, released alive and reported by recreational anglers. When anglers reported their recaptures, they are asked for details of: (i) fish length, (ii) fishing location, and (iii) fish disposition (harvested, released alive, released dead).

South Carolina tagging data

Lengths of tagged red drum that had been recaptured + measured + released alive + reported by recreational anglers in South Carolina were available from three tagging programs run by the South Carolina Department of Natural Resources: (i) tags applied by volunteer anglers, (ii) tags applied by the SCDNR fishery-independent surveys of estuarine sub-adult red drum (primarily the stop net, electrofishing and trammel net surveys), and (iii) tags applied by SCDNR longline surveys of coastal adult red drum.

B2 length measurements were available from 5,097 fish that had been tagged by the volunteer angler program (angler recaptures occurred from 1988-2013), 7,813 fish that were tagged by sub-adult surveys (recaptured during 1987-2013) and 169 fish that were tagged by longline surveys (recaptured during 1997-2013) (see **Table 1**).

Most of the B2 length data ($n = 12,018$) were from inland fishing areas (by MRIP definition), with less data from areas ≤ 3 miles ($n = 1,081$), and very few from federal waters (> 3 miles, $n = 33$) (see **Table 2**).

Potential biases

The size composition of the tag/recapture B2 fish was influenced by (i) size composition of fish that were initially tagged, (ii) growth of the fish between tagging and recapture, and (iii) size selectivity of the recreational fishery.

From 1993 – 2011, the volunteer angler tagging program instructed anglers to only tag red drum greater than 18 inches (457 mm) total length. Similarly, the sub-adult surveys usually only tagged fish that were 350 mm TL or greater. Therefore, B2 fish that were smaller than these size cut-offs were underrepresented (see **Fig. 1**).

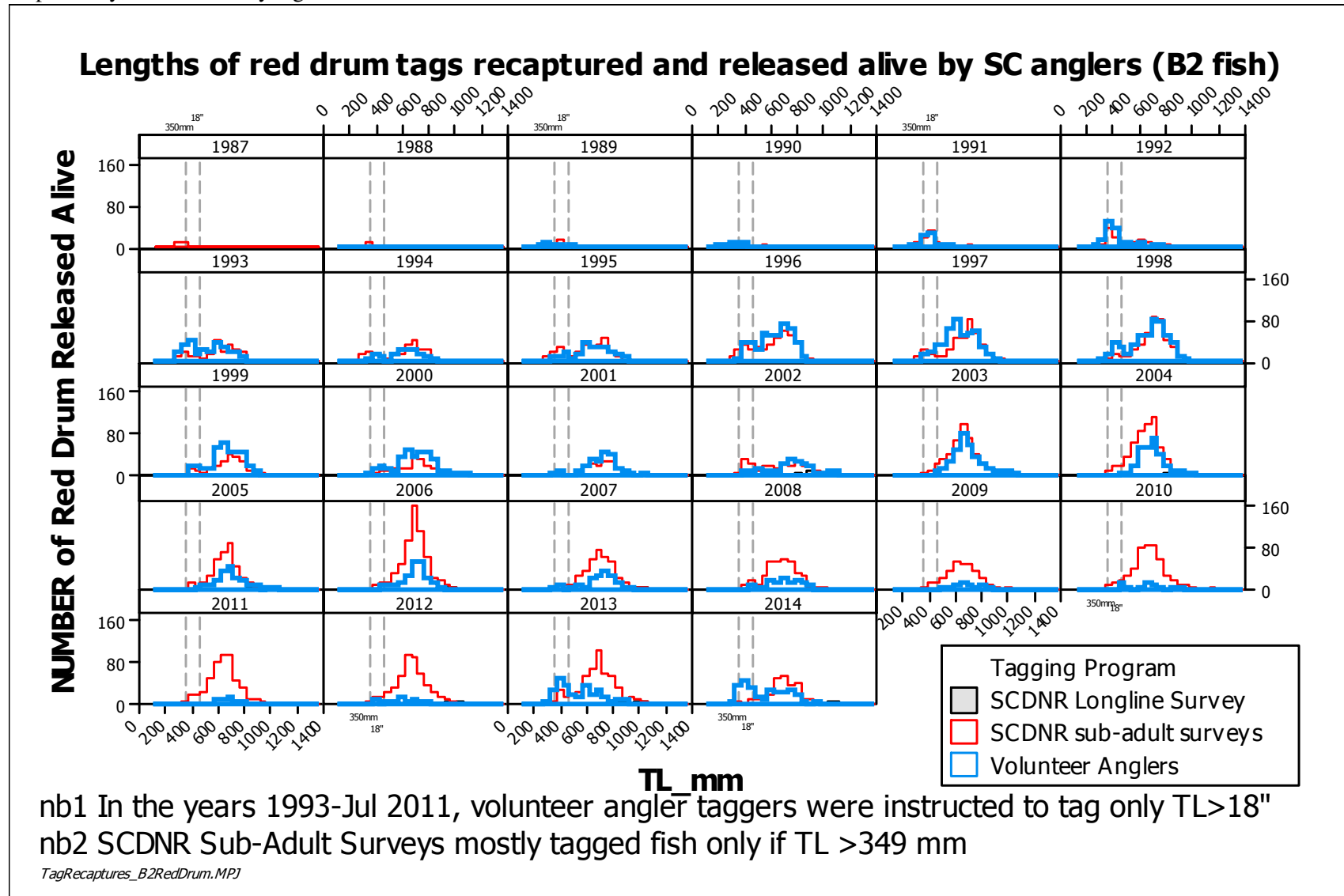
Table 1 Numbers of tagged red drum that were recaptured + measured + released alive + reported by recreational anglers in South Carolina.

Year	SCDNR Longline SURVEY	SCDNR sub-adult surveys	SC angler tagging program	TOTAL
1987		20		20
1988		16	2	18
1989		18	36	54
1990		16	36	52
1991		80	73	153
1992		113	143	256
1993		201	235	436
1994		208	128	336
1995		264	213	477
1996		367	430	797
1997	1	357	433	791
1998	2	392	457	851
1999		213	331	544
2000		172	303	475
2001	4	157	222	383
2002	23	235	214	472
2003	14	441	336	791
2004	21	557	298	876
2005	13	378	181	572
2006	16	600	220	836
2007	13	386	168	567
2008	8	367	127	502
2009	5	324	69	398
2010	7	484	57	548
2011	8	489	50	547
2012	15	467	65	547
2013	19	491	270	780
TOTAL	169	7,813	5,097	13,079

Table 2 Size composition and fishing area of tagged red drum that were recaptured + measured + released alive + reported by recreational anglers in South Carolina.

TL, mm (floored bins)	FISHING AREA			TOTAL
	Inland	<=3NM	Federal	
150	1			1
200	6			6
225	12			12
250	26			26
275	52			52
300	87	5		92
325	171			171
350	262	9		271
375	372	18		390
400	327	4		331
425	259	2		261
450	306	1		307
475	261	2		263
500	272	1		273
525	376	3		379
550	525	8		533
575	629	15		644
600	902	18		920
625	870	18		888
650	931	34	2	967
675	1,002	47		1,049
700	1,066	77	2	1,145
725	877	59	2	938
750	656	77	1	734
775	536	69	3	608
800	421	101	5	527
825	252	74	1	327
850	178	58	4	240
875	112	46	1	159
900	75	66	2	143
925	39	42	6	87
950	45	41		86
975	22	33		55
1000	21	30	1	52
1025	21	22	1	44
1050	17	19	1	37
1075	10	6		16
1100	9	10		19
1125	3	11		14
1150	3	1		4
1200	4	1		5
1250	1			1
1275		1		1
1350	1			1
Grand Total	12,018	1,029	32	13,079

Fig. 1 Annual size composition of tagged red drum that were recaptured + measured + released alive + reported by recreational anglers in South Carolina. The gray dash lines show 350 mm and 457 mm (18 inch) TL limits, below which the sub-adult surveys and volunteer angler programs, respectively, did *not* usually tag red drum.



North Carolina tagging data

Lengths of tagged red drum that had been recaptured + measured + released alive + reported by recreational anglers in North Carolina were available from two tagging programs run by the North Carolina Division of Marine Fisheries: (i) tags applied by volunteer anglers and (ii) tags applied by the NCDMF fishery-independent surveys. Additional lengths were available in cases where a multiple recaptures occurred subsequent to the release of a tagged fish from either a commercial or recreational entity not associated with the NCDMF tagging programs.

B2 length measurements were available from 753 fish that had been tagged by the volunteer angler program (angler recaptures occurred from 1987-2013), 1,438 fish that were tagged by NCDMF surveys (recaptured during 1986-2013) and 116 fish that were recaptured subsequent to a prior capture and release by either a recreational or commercial entity (recaptured during 1986-2013; **Table 3**).

Most of the B2 length data ($n = 1,818$) were from inland (estuarine) fishing areas (by MRIP definition), with less recreational releases reported from ocean waters ($n = 571$). Nineteen releases were reported for fish tagged in North Carolina, but recaptured and released in another state (**Table 4**).

Potential biases

The size composition of the tag/recapture B2 fish was influenced by (i) size composition of fish that were initially tagged, (ii) growth of the fish between tagging and recapture, and (iii) size selectivity of the recreational fishery.

The volunteer angler tagging program in North Carolina directs anglers to only tag red drum greater than 27 inches (686 mm) total length. The North Carolina surveys tag red drum of all sizes captured by recreational anglers but most tagging occurs on sub-adult fish (<27 inches in total length) with the exception of fish tagged in the Division's longline survey. Tagging efforts occur across a wide range of areas, however, tagging effort has varied over time and the Division's tagging efforts may underrepresent smaller fish due to decreased effort in some years. The length distribution of the releases by year is provided in **Table 5 and Figure 2**.

Table 3. Numbers of tagged red drum that were recaptured + measured + released alive + reported by recreational anglers in North Carolina.

Year	Division Survey	Volunteer Tagger	Commercial	Recreational	Total
1986	1		5		6
1987	1	1			2
1988		2			2
1989		2			2
1990		1			1
1991	18	3	2	1	24
1992	6	5		1	12
1993	18	11		1	30
1994	161	18	30	8	217
1995	29	4	6	1	40
1996	10	5			15
1997	90	8		5	103
1998	61	25	1	1	88
1999	48	26		2	76
2000	59	38			97
2001	37	24	2	1	64
2002	18	26		1	45
2003	12	17		1	30
2004	13	22			35
2005	29	35		2	66
2006	98	77		8	183
2007	151	87		8	246
2008	227	54		14	295
2009	80	51		2	133
2010	49	58		3	110
2011	47	51		2	100
2012	60	53		3	116
2013	115	49		5	169
Total	1438	753	46	70	2307

Table 4 Size composition and fishing area of tagged red drum that were recaptured + measured + released alive + reported by recreational anglers in North Carolina.

SZCLASS (TL, mm)	Inland (estuary)	Ocean	Outside North Carolina	Total
150	9			9
200	11			11
250	17	1		18
300	112	3		115
350	186	22		208
400	295	69	2	366
450	176	20	3	199
500	126	9		135
550	137	27	2	166
600	119	49	3	171
650	70	40	1	111
700	69	79	1	149
750	33	48	2	83
800	21	34	1	56
850	7	21		28
900	14	14		28
950	18	3	1	22
1000	20	7		27
1050	23	9		32
1100	55	16	1	72
1150	100	27	1	128
1200	117	40	1	158
1250	41	24		65
1300	30	8		38
1350	10	1		11
1400	1			1
1450	1			1
Grand Total	1818	571	19	2408

Table 5. Annual size composition of tagged red drum that were recaptured + measured + released alive + reported by recreational anglers in North Carolina.

SZCLASS (TL, mm)	Year																										Total			
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		2012	2013	
150												9																	9	
200												11																	11	
250								7				7		1								1				1			17	
300	1					4	2		63	1		12	9	3	1				1		4	7	3				2	2	115	
350	1	2		1		4	3	4	71	3	1	19	9	3	6	1	1		1	1	12	39	12	2	1		4	6	207	
400	3					11	6	14	53	17	3	23	15	11	17	5	2	1	7	11	17	48	24	7	11	8	11	32	357	
450	1					3	1	7	10	7	2	7	7	5	5	5	1	3	5	3	14	19	20	11	9	10	16	16	187	
500									4	1		3	8	6	7	3	1	2		7	12	8	34	6	1	2	7	16	128	
550									2	2	2	1	6	7	6	4	1	1	1	6	16	10	53	13	2	4	2	16	155	
600								1			1	1	12	3	11	7		1	2	18	12	51	13	7	8	3	9	160		
650									4			1	1	6	6	5	1	2		3	12	3	20	11	6	5	4	6	96	
700						1			2	1	1	3	1	3	5	3	2	2	4	3	10	12	16	11	16	9	22	11	138	
750								1	1					3	3	4	4	4	1	3	4	8	9	9	7	8	3	7	79	
800												1		4	4	5	3	3		2	3	2	5	2	6	7	1	3	51	
850														2	1	1	3		1	2	4	3		2	3	4		2	28	
900									1			1		1	1	2					1	6	1	1	1	3	4	1	27	
950																	2				2	2	1	1	4	2	5	3	22	
1000					1						1		3	1					2		2	2		2	2	6	1	3	26	
1050												3	1	3	2		2	2	1		3	5	3	1		1	1	4	32	
1100									1	2			3	4	4	4	3		2	4	10	9	5	3	7	3	1	5	70	
1150					1				2				5	4	9	6	6	2	4	5	11	20	10	12	5	6	10	6	124	
1200									2	1	1	3	1	4	3	5	6	8	1	4	11	22	14	17	17	8	7	11	9	155
1250			1								1		3	2	2		4	1	2	1	5	9	3	7	9	4	4	6	65	
1300			1								1			1	2	3			1	2	1	5	4	2	4	3	3	4	37	
1350													1									2	4						10	
1400																										1			1	
1450																													0	
Total	6	2	2	2	1	24	12	30	217	40	15	103	88	76	97	64	45	30	35	66	183	246	295	133	110	100	116	169	2307	

Figure 2. Annual size composition of tagged red drum that were recaptured + measured + released alive + reported by recreational anglers in North Carolina. Years of 1986 to 1990 not plotted due to small sample size.

