Regional Analysis of Florida's Gulf and Atlantic Stocks of Red Drum

August 2010

Fish and Wildlife Research Institute
Florida Fish and Wildlife Conservation Commission

Introduction

Early research on the population structure of red drum indicated that there were only slight genetic differences between fish in the U.S. Gulf of Mexico and those in the U.S South Atlantic region. The currently accepted meta-population structure is somewhat different and is based on findings from more advanced genetic analyses that appear to complement the findings from tagging studies. Genetic evidence suggests that estuarine-specific populations of red drum can occur and that these show some exchange with neighboring estuarine-specific populations but are increasingly isolated from populations that occur at greater and greater distances from their natal estuary. Most tag/recapture observations for inshore sub-adult red drum support the existence of estuarine-specific populations, showing little movement between or even within estuaries. However, there are infrequent occurrences of long-distance movement of sub-adults over fairly short periods of time and more frequent and extensive movement of adult red drum.

Under this 'isolation by distance' scenario it makes sense to attempt a more regional assessment and many states have conducted assessments for the red drum stocks within their waters. The choice of geographic scale for these assessments is often a compromise between the broad geographic scope of limited data and the desire to determine the population dynamics of red drum within specific estuaries. This potential population structuring has led fisheries stakeholders to take issue with the results of coast-wide assessments in Florida, asking for assessments that reflect a more regional geographic scale. This report includes an analysis of red drum within northern and southern regions on the Atlantic and Gulf coasts of Florida. It should be noted that this reduction in the spatial extent of Florida assessments for this species is counter to the much larger scales used for interstate fisheries management of red drum by the Gulf of Mexico Fisheries Management Council (U.S. Gulf of Mexico) and the Atlantic States Marine Fisheries Commission (South Atlantic Bight stock, SC through FL).

Methods and Materials

This assessment uses a modification of the age-structured population model developed to assess the Atlantic coast stock of red drum during SEDAR 18. Though similar to the statistical catch-at-age model used in previous Florida assessments, there are some modifications incorporated and reviewed by a panel of scientists that provided improvements (SEDAR 18 report). The regions were defined by Florida counties such that the northwest region included waters off Escambia through Pasco counties, the southwest region was Pinellas through Monroe counties; southeast region, Miami-Dade through Volusia counties, and northeast region, Flagler through Nassau counties.

The data necessary for these model runs include region-specific harvest numbers, proportions-at-age in the harvest, and indices of abundance. Within the model structure, the natural-mortality-at-age is assumed known (Murphy and Munyandorero 2009) as is the discard mortality rate for the recreational catch-and-release fishery (8%).

The estimated numbers of red drum landed by the regional commercial fisheries prior to 1989 were based on the coast-wide numbers given in the last assessment (Murphy and Munyandorero 2009). These coast-wide estimates were apportioned into northern and southern region estimates using the 1984-1988 overall ratio of commercial landings weight between regions. Due to a lack of adequate data for red drum ages in the commercial landings, the age composition of the regional commercial fisheries was assumed the same in the northern and southern regions on each coast. As with the coast-wide assessment, there was no attempt to include estimates of discard mortality from the commercial fishery.

The estimates of regional angler catch come from a post-stratification of the Marine Recreational Fisheries Statistics Survey's (MRFSS) coast-wide estimates (Tables 1, 2; Fig. 1). This involves an assumption that the fishing effort estimated for each coast can be apportioned between regions using the relative numbers of angler-intercepts made in each region. We had some trouble post-stratifying the recent year's estimates because of the conflicting design with the modified for-hire survey, though the sum of the regional estimates differed only slightly from the coast-wide totals. The age composition of the recreational harvest (MRFSS Type A+B1) was estimated using the lengths sampled from the angler creel (MRFSS Type A, Table 3) and age-length keys developed for the last assessment. Coast-wide age-length keys were used on length frequencies developed for each region. When insufficient lengths were available (20 per year) to describe the landings in a region x wave x fishing-mode x area-fished cell, the pooling routine used during the last coast-wide assessment was employed. With the smaller numbers of lengths measured in each region, more extensive pooling of length data was required than that needed in the coast-wide assessment. The lengths of live-released fish come from limited data available from the FWC-FWRI volunteer angler logbooks kept by southern region fishers since 2002. The assumptions needed to determine the lengths of live-released red drum prior to this period were the same as used in the last coast-wide assessment.

Indices of abundance were developed for each region using FWC-FWRI's fishery-independent small-seine data (young-of-the-year index, model age 1, Table 4) or large seine data (Table 5, age-specific indices for model ages 2 and 3), and using MRFSS total catch-rates (for age aggregated index, model ages 1-3, Table 6). All data were standardized using a delta lognormal model. Information used from the MRFSS survey included only single-angler targeted trips, defined as those where red drum were caught and/or indicated as a targeted species. The MRFSS data for single-angler trips was used in these regional assessments to increase the length of the time series from 1991-2007 (used in the coast-wide assessment that used complete-trip catch rates) to 1982-2008.

Results

The data fits to the population model were quite close for total catch rates where the coefficient of variations were assumed 10% for the commercial landings and came from the estimated proportional standard errors for the recreational catch (Tables 1,2; Fig. 2).

The observed proportion-at-age in the fisheries' landings was generally in good agreement with the model predictions though some differences were apparent. For instance, in the northwest region, the predicted proportion of age-1 fish in the recreational landings after 1985 were consistently overestimated (Fig. 3). These and other long-term differences between observed and predicted proportions likely occurred because the sample sizes for aged fish was low. The number of length measurements made (Table 3) was low for many years and this sample size is often higher than the number of ages sampled. In general, the proportion at age data point to a rapid drop in the proportion of age-1 red drum in the landings after 1985 and a resultant increase in the proportion of age-2 and age-3 fish in the landings.

The different indices of abundance in a region occasionally corresponded to each other but did show some differences. For instance, in the southwest region, the young-of-the-year (model age 1) indices have been quite low since the beginning of 2006 (Fig. 4, note that this is the fall 2005/winter 2006 spawning season). However, the age-2 and age-3 indices corresponding to these show increases in 2007 and 2008. In both gulf coast regions abundance for ages 1-3 appeared to increase during the late 1980's then decline through 1994 before resuming a slower increase through 2008. Atlantic coast indices were quite variable; especially the pooled MRFSS index (Fig. 5). Without a lot of correspondence among the indices the overall trends in relative abundance were fairly flat, though the MRFSS indices showed increases at least through 2000 in both regions.

Model estimated abundance and exploitation for the age groups included in the estimates of escapement (model ages 1-5) show similar trends on each coast. On the gulf coast, estimated abundance of ages 1-5 increased rapidly during 1982 through 1988 then declined through 1996, showing a slow increase since then (Fig. 6). Exploitation of these age groups dropped dramatically between 1985 and 1987, and was very low during the period 1987 through 1990. Since the mid 1990's, the aggregate exploitation for ages 1-5 on the gulf coast has fluctuated around 10% in the northern region and around a slightly higher value in the southern region. On the Atlantic coast, estimated age 1-5 abundance increased relatively sharply between 1986 and the early to mid 1990's (Fig. 7). Since then abundance has leveled off somewhat. Age 1-5 exploitation rates showed the same trend as seen on the gulf coast with a large reduction during the mid 1980's. In the northeast region, estimates of exploitation have remained very low through 2008 while in the southeast region exploitation has rebounded somewhat, reaching over 20% by 2007.

The regional calculated year-specific escapement rates all reflect the decline in exploitation during the 1980's and reach peak levels during the late 1980's. Escapement in all regions declined after this through at least the early-mid 1990's (Fig. 8). Since then the absolute levels and/or trends have been different in each region. Along the gulf coast, escapement has fluctuated around 40-50% since

2004, with only a small chance that escapement dropped below 30% in 2004, 2005 and 2008. Along the Atlantic coast, the northeast region appears to have maintained a high level of escapement of about 70% since at least 1996. In the southeast region, escapement has fluctuated around a declining trend with better than 50% chance that it dropped below 30% in 2004, 2005, 2007, and 2008.

The regional assessment results indicate that escapement has fared better in the northern two regions of the state than in the southern regions. In the northwest region, escapement has fluctuated around 50% between 2005 and 2008 whereas in the southern region on the gulf coast escapement has averaged about 41% during 2005-2008 (Table 7). On the Atlantic coast, there is a much larger regional difference in escapement where it has averaged about 75% in the northeast region and 28% in the southeast region during 2005-2008. When compared to the results from the last coast-wide assessment it needs to be kept in mind that the assessment model used has been modified and improved somewhat, though the basic population dynamics components are nearly identical. Along the gulf coast, the northwest region escapement rates were consistently higher than those estimated using the coast-wide gulf analysis (Fig. 8). The regional estimates of escapement in the southwest region were quite similar to the coast-wide assessment results except for the higher estimates of escapement seen during the last half of the 1980's. On the Atlantic coast, the regional assessment estimates of escapement were quite similar to the coast-wide assessment results during 1982-1994 but the regional estimates diverged from the regional estimates after this. The northeast region escapement estimates remained high while the coast-wide Atlantic estimates declined. The southeast region estimates of escapement declined even more rapidly than did the coast-wide estimates after the mid 1990's.

Comments

The data available for the statistical catch-at-age model used in the assessment of red drum in Florida have been marginally sufficient for past coast-wide assessments. In particular, there continues to be insufficient sampling of the size and age structure of live-released red drum and too few age-samples collected directly from the fishery landings. While these issues are magnified in these regional assessments, they are not obstacles to completing the analysis if the following assumptions can be accepted: 1) volunteer angler measurements of live-released fish in the southern parts of the state are similar to the lengths of live-released fish in the northern parts, 2) the age-length keys developed mostly from scientific survey sampling are similar to age-length keys that could be derived from samples made from the angler landings. Other problems encountered with the data needs for regional assessments include increased uncertainty about the angler landings and live-release totals at a regional scale, increased across-year pooling of length samples when computing the age-composition information, and the need to share coast-wide age-length keys between regions.

If red drum populations are sufficiently isolated within the designated regions then any differences in population dynamics between adjacent northern and southern regions will be 'smoothed over' in a coast-wide assessment. For example, information on red drum relative abundance trends were collected using surveys that cover small, non-overlapping geographic areas. If the same population of red drum occupied each of these areas then these surveys should all be measuring the

same changes in abundance (within some level of observation error). However, the juvenile surveys on the Atlantic coast, i.e., St. Johns/Nassau Sound and northern Indian River seine surveys, show apparently different trends over time. In the coast-wide assessment, these differences are assumed to be due to observation error and they are either resolved externally using statistical approaches or resolved within the assessment model. Of course, this is not appropriate if each survey was actually measuring the relative abundance of different populations, for which case regional assessments would be more appropriate.

Regional assessments are preferable if red drum populations are region-specific on each coast. It should be noted, however, that current monitoring programs are structured to support coast-wide assessments, and issues associated with data availability arise in stock assessments even at the coast-wide scale. If FWC is to move to a regional assessment framework for red drum, significant investment in regional-specific data will be required to support the assessments. If the necessary regional data are not available, these 'regional' assessments will become diluted with the available coast-wide data needed to complete the analyses and the 'regional' assessment will end up more closely resembling a coast-wide assessment. In addition, data gaps may require a number of assumptions to be made in the regional assessments that, in some cases, could weaken the regional specificity of the analysis. Alternatively, if red drum mix thoroughly along each coast of Florida, the use of regional assessments will unnecessarily restrict some data use and increase the uncertainty in the assessment findings.

Table 1. Region-specific estimates (est) and its proportional standard errors (pse) for the annual number of red drum landed (MRFSS type A+B1) in Florida during 1982-2008.

	NW		SW		SE		NE	
Landings	est	pse	est	pse	est	pse	est	pse
1982	234,791	0.373	390,704	0.191	34,417	0.279	167,279	0.330
1983	141,301	0.544	987,196	0.319	12,234	0.586	328,534	0.199
1984	330,255	0.414	1,013,996	0.255	31,484	0.394	520,013	0.171
1985	303,386	0.314	158,464	0.348	52,262	0.366	213,276	0.260
1986	378,094	0.238	238,681	0.226	14,392	0.666	99,041	0.201
1987	67,009	0.208	56,526	0.225	9,558	0.544	41,781	0.356
1988	18,246	0.516	10,067	0.462	2,970	0.739	6,572	1.000
1989	114,258	0.186	120,208	0.148	21,554	0.308	13,144	0.377
1990	86,622	0.203	55,854	0.188	21,695	0.312	22,563	0.326
1991	123,565	0.212	156,878	0.148	24,495	0.299	78,323	0.183
1992	137,213	0.124	250,101	0.084	29,578	0.189	73,812	0.182
1993	74,475	0.118	122,588	0.092	18,840	0.189	46,267	0.126
1994	112,055	0.092	121,452	0.094	39,295	0.156	81,505	0.125
1995	139,621	0.084	119,482	0.112	37,139	0.149	59,777	0.125
1996	165,644	0.069	129,211	0.083	50,185	0.149	96,845	0.180
1997	112,414	0.093	216,755	0.128	29,939	0.203	45,367	0.165
1998	119,759	0.080	154,186	0.077	50,187	0.139	57,769	0.131
1999	107,203	0.080	121,406	0.074	92,847	0.083	33,674	0.123
2000	184,180	0.071	133,429	0.084	116,205	0.088	73,176	0.105
2001	107,557	0.083	145,811	0.078	101,933	0.085	74,399	0.110
2002	128,290	0.085	151,468	0.073	68,543	0.092	49,766	0.104
2003	124,941	0.089	232,139	0.069	90,159	0.090	62,995	0.109
2004	104,790	0.080	208,579	0.063	107,888	0.095	51,624	0.122
2005	155,421	0.073	291,007	0.113	134,558	0.091	58,639	0.125
2006	178,395	0.090	180,232	0.071	90,917	0.088	51,765	0.118
2007	190,537	0.068	207,688	0.139	147,131	0.093	48,321	0.151
2008	218,541	0.063	227,550	0.067	110,538	0.093	48,125	0.128

Table 2. Region-specific estimates (est) and its proportional standard errors (pse) for the annual number of red drum released alive (MRFSS type B2) in Florida during 1982-2008.

	NW		SW		SE		NE	
Released	est	pse	est	pse	est	pse	est	pse
1982	28,129	0.577	84,588	0.238	8,711	0.763	1,461	1.000
1983	52,931	0.633	675,001	0.351	17,943	0.567	36,778	0.532
1984	118,964	0.378	587,043	0.253	511	1.000	46,835	0.386
1985	181,044	0.462	96,636	0.342	62,072	0.536	131,326	0.348
1986	409,576	0.264	376,827	0.229	4,329	0.834	95,766	0.232
1987	379,888	0.184	1,088,479	0.185	2,910	1.000	375,049	0.215
1988	445,043	0.151	912,256	0.109	100,365	0.285	133,624	0.430
1989	404,909	0.437	677,715	0.143	18,666	0.447	151,566	0.230
1990	109,464	0.278	567,142	0.183	16,066	0.366	52,602	0.209
1991	591,572	0.171	743,105	0.169	43,678	0.485	602,095	0.248
1992	602,857	0.157	1,146,541	0.083	117,746	0.171	167,147	0.151
1993	289,326	0.181	799,896	0.084	71,723	0.199	393,932	0.134
1994	717,676	0.111	679,821	0.088	187,918	0.127	503,344	0.135
1995	820,445	0.082	530,110	0.098	278,806	0.127	404,898	0.125
1996	855,706	0.079	581,489	0.087	250,101	0.132	250,273	0.127
1997	672,423	0.096	781,107	0.090	230,881	0.125	329,678	0.134
1998	768,030	0.095	679,617	0.075	187,259	0.093	293,751	0.124
1999	477,553	0.085	682,978	0.080	283,052	0.083	283,369	0.124
2000	780,081	0.101	600,413	0.086	436,567	0.082	256,585	0.117
2001	713,951	0.093	722,551	0.113	516,860	0.092	333,184	0.105
2002	484,518	0.110	829,604	0.075	336,939	0.119	326,941	0.120
2003	671,165	0.135	1,241,052	0.069	384,904	0.086	341,046	0.140
2004	625,465	0.084	1,491,481	0.063	627,573	0.092	486,993	0.118
2005	1,172,333	0.093	1,396,635	0.064	771,781	0.081	485,562	0.123
2006	1,330,393	0.072	1,483,832	0.060	607,997	0.089	270,521	0.096
2007	958,841	0.069	1,417,737	0.074	647,986	0.081	218,240	0.178
2008	823,635	0.094	1,411,707	0.067	533,564	0.095	276,933	0.114

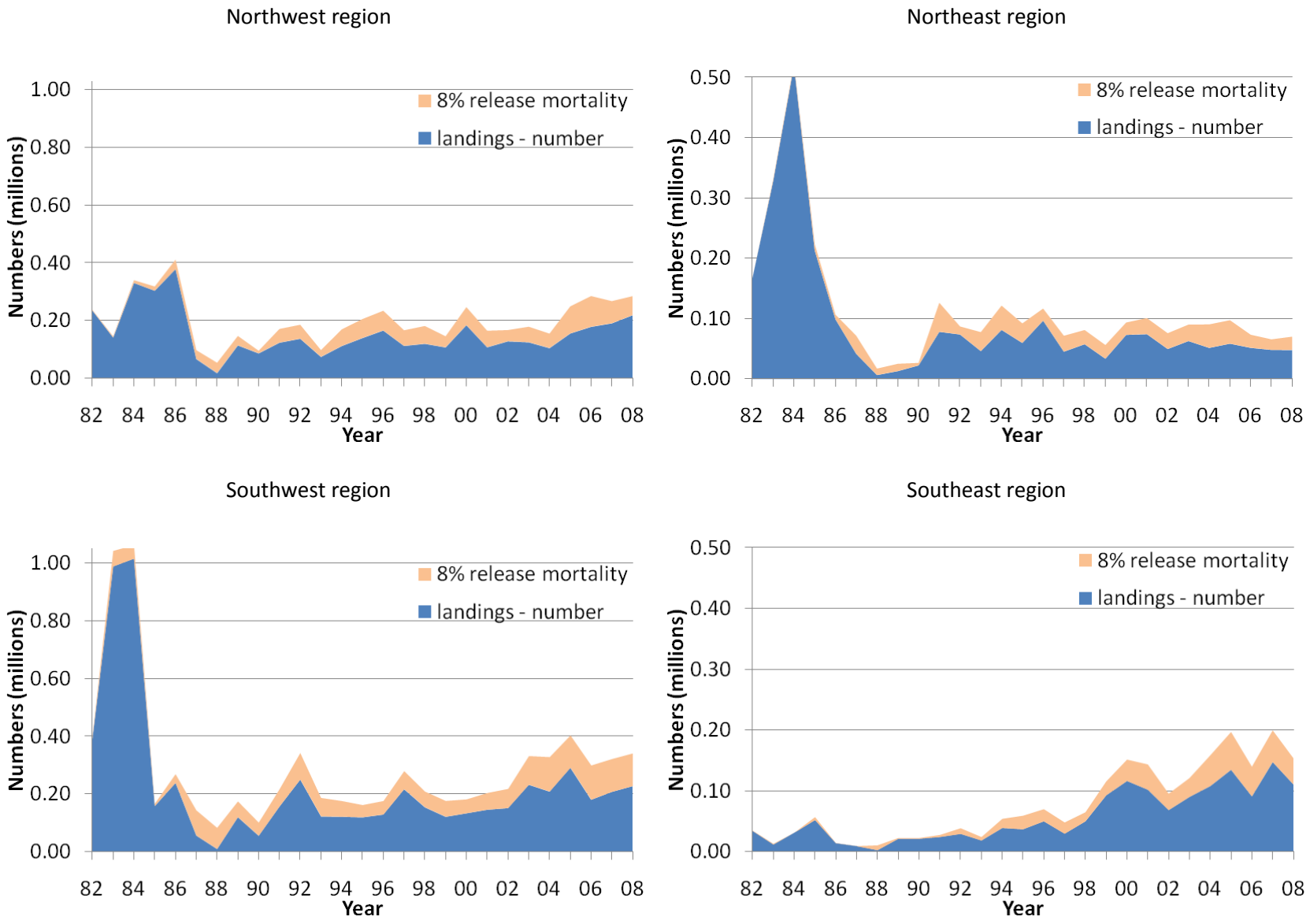

Figure 1. Estimated numbers of red drum landed (dark) or dead after live-release (light) each year in each region of Florida during 1982-2008.

Table 3. Length frequencies and total numbers of red drum sampled and measured from angler creels within each region each year during 1982-2008.

Northeast

TL	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	2	2	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	2	26	15	12	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
12	1	18	30	5	0	0	0	2	1	0	0	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
13	6	23	21	8	3	0	0	1	1	1	6	0	6	1	6	7	1	0	0	1	1	0	0	0	0	1	0
14	15	7	13	13	4	0	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
15	12	15	25	1	3	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
16	9	17	10	2	2	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0
17	1	15	8	1	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	2	1	1	0	1	1	3	2
18	1	1	5	0	3	2	0	0	0	1	2	4	4	2	4	0	4	6	13	5	6	5	1	5	5	3	2
19	1	0	4	1	6	0	0	1	0	2	1	3	4	3	3	1	6	8	7	7	15	9	5	10	7	4	4
20	2	1	0	0	9	0	0	0	0	1	2	4	5	2	5	0	4	10	7	15	4	7	7	9	9	2	6
21	1	1	0	2	3	2	0	0	1	4	4	6	8	5	7	5	10	3	8	8	13	6	8	10	14	5	4
22	0	2	1	0	2	1	0	0	1	2	2	3	2	2	6	5	6	2	10	12	10	5	8	11	5	7	6
23	0	2	2	0	5	0	0	2	1	0	1	4	3	3	5	3	4	9	12	14	13	6	8	5	4	6	2
24	0	1	0	0	2	1	0	0	1	1	1	5	7	4	1	0	2	3	10	9	7	9	9	5	5	5	8
25	0	2	0	0	3	2	0	1	0	3	0	1	2	4	6	0	6	7	13	13	13	10	9	7	13	1	1
26	0	1	0	1	2	1	0	0	1	6	1	4	6	4	1	3	5	4	4	14	13	7	5	3	4	1	6
27	0	2	0	0	3	1	0	1	5	5	2	5	7	7	9	0	2	0	7	7	8	5	3	4	2	2	2
28	0	2	7	1	3	0	0	0	2	8	1	3	5	3	6	1	5	0	2	1	2	1	1	1	1	0	1
29	0	3	1	1	2	1	0	0	0	0	0	3	1	2	0	0	1	0	0	1	0	0	0	0	0	0	0
30	0	2	0	0	0	1	0	0	0	0	0	0	1	1	0	7	0	0	0	0	1	0	0	0	0	0	0
31	0	2	3	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
32	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40+	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	57	148	164	51	57	14	2	8	14	34	27	49	66	45	61	34	59	53	95	109	108	71	64	72	71	40	45

Table 3 (con't). Length frequencies and total numbers of red drum sampled and measured from angler creels within each region each year during 1982-2008.

Southeast

TL	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	10	0	4	4	7	8	0	0	0	0	1	2	5	0	17	3	0	0	0	0	0	0	0	1	0	0	0
14	4	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
15	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0
16	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2	0	0	2	2	0	1	3
17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4	2	2	0	0	1	3	0	0	2
18	1	0	0	2	0	0	0	0	0	0	0	2	1	0	2	0	3	5	3	5	4	4	10	3	8	8	4
19	1	0	0	0	0	0	0	0	0	3	0	3	2	1	0	1	5	14	10	11	5	9	10	12	10	14	13
20	2	1	1	0	0	0	0	3	0	0	1	1	0	7	0	3	4	16	12	20	7	10	22	13	22	14	18
21	0	1	0	0	0	0	0	2	0	3	6	1	1	4	4	1	6	14	18	13	10	19	15	16	15	30	18
22	0	0	0	0	0	0	0	0	0	0	2	2	5	4	1	2	6	23	29	21	12	12	13	18	17	18	15
23	0	0	0	0	0	0	0	0	0	1	3	0	3	4	4	3	8	33	33	26	11	22	9	16	17	16	20
24	3	0	0	0	0	0	0	0	2	2	3	2	4	2	5	4	7	27	25	19	11	21	10	25	21	17	16
25	2	0	1	0	0	0	0	0	0	1	1	1	2	5	4	0	7	19	11	20	12	19	9	16	9	19	14
26	0	0	0	0	0	0	0	0	0	0	5	1	2	4	7	4	6	15	23	11	13	14	10	7	12	16	13
27	0	0	0	0	0	0	0	0	2	2	2	0	6	2	4	1	5	3	6	15	7	9	7	5	8	7	3
28	1	0	0	0	0	0	0	1	0	0	1	2	2	3	2	1	1	0	0	5	3	0	0	2	3	1	0
29	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	2	0	0	0	1	0	0	1	1	0
30	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40+	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	45	3	14	14	7	8	0	7	4	13	29	18	34	36	53	25	60	177	172	170	95	140	118	143	143	163	139

Table 3 (con't). Length frequencies and total numbers of red drum sampled and measured from angler creels within each region each year during 1982-2008.

Southwest

TL	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
11	0	7	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	27	3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
13	3	27	5	0	6	0	0	0	0	0	0	0	0	0	2	6	1	0	0	0	0	0	0	2	0	0	0
14	5	27	19	0	5	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
15	7	9	7	1	2	1	0	0	1	0	1	0	3	0	0	1	0	0	0	0	0	1	1	0	0	1	0
16	7	0	1	2	3	0	1	1	0	0	2	0	0	1	1	2	1	1	0	0	0	0	1	0	2	1	0
17	5	2	5	1	0	1	0	0	1	1	2	1	0	2	3	1	5	3	1	0	5	1	3	5	5	9	3
18	2	0	4	0	8	0	0	2	1	9	17	3	3	8	11	13	11	19	8	7	14	22	23	22	20	16	25
19	2	3	1	4	4	3	0	2	1	8	16	15	6	8	18	12	15	19	21	11	24	21	35	31	29	31	21
20	1	0	3	1	2	2	0	3	5	12	18	10	8	8	17	25	19	30	17	16	30	49	55	47	29	21	35
21	2	0	1	0	1	4	0	6	1	8	24	6	12	7	9	22	27	26	12	19	29	35	45	40	20	24	33
22	0	0	0	1	0	1	0	4	2	9	17	9	14	6	14	10	23	24	10	23	23	38	31	45	16	29	21
23	0	0	0	1	0	1	0	5	2	1	20	6	5	7	7	33	34	30	22	29	22	34	36	56	26	46	28
24	1	1	1	3	0	2	0	2	1	2	23	12	14	7	15	13	36	15	17	25	14	29	34	31	28	26	31
25	1	0	1	0	0	1	0	9	6	0	24	13	11	13	11	7	30	20	16	16	14	30	25	30	17	18	36
26	2	0	2	6	0	1	0	6	8	3	7	13	7	7	5	10	23	17	15	12	21	21	11	28	25	22	34
27	2	2	1	2	0	2	0	6	2	2	4	5	6	8	8	6	12	12	3	12	15	12	7	4	5	7	14
28	0	0	4	4	0	1	0	2	1	1	1	0	7	4	6	7	3	3	6	5	2	3	3	2	4	3	6
29	4	1	2	3	0	1	1	4	0	0	0	2	0	1	0	1	1	1	5	0	0	0	0	0	1	1	1
30	3	0	2	1	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0
31	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
32	0	3	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40+	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	48	110	99	34	31	23	2	53	32	56	179	95	98	89	127	173	241	220	155	176	214	296	311	343	227	255	290

Table 3 (con't). Length frequencies and total numbers of red drum sampled and measured from angler creels within each region each year during 1982-2008.

Northwest

TL	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	1	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	4	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1	0	3	5	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12	8	2	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
13	8	2	0	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	6	0	1	4	0	0	0	1	0	3	1	0	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0
15	6	2	4	6	0	0	0	0	0	2	1	1	1	0	1	1	0	0	0	0	2	0	1	0	0	2	0
16	2	1	0	0	1	0	1	1	0	0	1	0	1	0	0	0	1	1	1	0	0	0	3	0	1	0	2
17	5	1	0	5	0	0	0	0	0	0	4	4	2	5	4	1	2	4	5	0	5	8	10	4	7	17	12
18	2	0	0	1	0	0	1	0	2	3	15	2	6	19	23	9	11	12	18	15	30	18	27	24	17	35	29
19	1	0	0	0	0	2	0	0	0	1	13	5	10	15	16	12	20	13	19	21	26	18	34	26	28	38	31
20	2	1	0	0	5	1	0	0	2	4	21	2	17	17	30	19	17	18	51	18	26	22	42	48	24	39	34
21	1	0	1	0	4	0	0	2	6	4	9	6	11	12	23	12	17	17	31	11	15	22	39	34	26	32	38
22	0	1	0	0	4	0	0	2	3	4	8	8	5	17	14	21	19	27	25	14	24	25	25	31	30	23	35
23	1	0	0	0	0	0	0	1	2	3	12	2	19	14	15	11	20	26	30	14	27	36	20	24	24	30	47
24	1	0	0	0	0	1	0	2	1	4	9	1	8	10	17	6	11	13	21	23	15	23	14	18	16	27	44
25	2	0	0	0	1	6	0	2	2	2	5	0	5	12	15	8	14	16	17	6	12	21	16	20	10	20	18
26	0	0	0	0	0	0	0	2	2	2	9	3	4	6	11	15	11	20	10	20	10	33	15	13	14	21	20
27	0	6	0	0	2	1	0	2	4	1	1	3	5	2	10	9	10	11	13	7	8	14	4	2	8	8	5
28	0	0	0	0	1	0	0	0	4	0	3	2	6	3	3	3	1	6	5	4	0	1	1	0	1	0	0
29	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	1	0	2	0	2	0	0	0	0	0	0
30	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0
31	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
35	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40+	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	50	20	17	26	18	11	4	17	30	35	113	39	106	138	182	127	156	185	250	153	202	242	253	244	206	293	315

Table 4. Standardized annual fishery-independent, small-seine catch rates for young-of-the-year red drum in each region and descriptive statistics. The year indicated represents the year during their initial fall recruitment. In the model, these indices were shifted to January 1 of the next year to align with other calendar years statistics.

Northwest region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1996	0.0301	0.0268	0.0105	0.0198	0.0362	0.0683	168	17
1997	0.0899	0.0824	0.0393	0.0637	0.1078	0.1900	194	33
1998	0.0088	0.0076	0.0026	0.0053	0.0110	0.0224	266	11
1999	0.0282	0.0254	0.0109	0.0192	0.0348	0.0599	266	20
2000	0.0259	0.0232	0.0100	0.0174	0.0322	0.0559	356	20
2001	0.0100	0.0085	0.0031	0.0060	0.0124	0.0259	441	11
2002	0.0524	0.0493	0.0234	0.0384	0.0622	0.1029	456	30
2003	0.0635	0.0602	0.0304	0.0478	0.0760	0.1171	476	42
2004	0.0372	0.0352	0.0175	0.0284	0.0441	0.0662	476	41
2005	0.0424	0.0396	0.0200	0.0314	0.0495	0.0826	476	38
2006	0.0191	0.0177	0.0076	0.0133	0.0227	0.0396	476	20
2007	0.0389	0.0363	0.0186	0.0286	0.0461	0.0730	476	38
2008	0.0243	0.0226	0.0111	0.0177	0.0287	0.0486	272	25

Southwest region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1989	0.0569	0.0528	0.0215	0.0383	0.0694	0.1195	111	17
1990	0.1204	0.1120	0.0508	0.0887	0.1431	0.2310	140	23
1991	0.2005	0.1915	0.1036	0.1550	0.2384	0.3464	137	36
1992	0.1214	0.1153	0.0596	0.0880	0.1428	0.2260	152	30
1993	0.1328	0.1266	0.0638	0.1012	0.1552	0.2455	160	33
1994	0.1661	0.1579	0.0868	0.1265	0.1947	0.2983	200	42
1995	0.4096	0.4036	0.2700	0.3561	0.4595	0.5762	627	155
1996	0.0889	0.0867	0.0575	0.0756	0.0999	0.1297	810	102
1997	0.1243	0.1227	0.0819	0.1067	0.1395	0.1767	671	118
1998	0.0948	0.0924	0.0589	0.0783	0.1084	0.1446	552	81
1999	0.0996	0.0971	0.0624	0.0832	0.1131	0.1540	553	79
2000	0.1016	0.0979	0.0618	0.0838	0.1156	0.1606	552	74
2001	0.1075	0.1049	0.0667	0.0903	0.1217	0.1640	553	78
2002	0.4033	0.3962	0.2726	0.3520	0.4475	0.5680	553	147
2003	0.3701	0.3653	0.2583	0.3213	0.4088	0.5296	777	182
2004	0.1621	0.1584	0.1089	0.1395	0.1814	0.2338	895	120
2005	0.0370	0.0359	0.0223	0.0311	0.0418	0.0596	930	61
2006	0.0538	0.0521	0.0344	0.0456	0.0605	0.0801	931	82
2007	0.0337	0.0327	0.0191	0.0271	0.0389	0.0539	832	51
2008	0.0555	0.0547	0.0327	0.0463	0.0640	0.0862	504	69

Table 4 (con't). Standardized annual fishery-independent, small-seine catch rates for young-of-the-year red drum in each region and descriptive statistics. The year indicated represents the year during their initial fall recruitment. In the model, these indices were shifted to January 1 of the next year to align with other calendar years statistics.

Northeast region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
2001	0.0627	0.0590	0.0234	0.0431	0.0770	0.1241	192	16
2002	0.1473	0.1378	0.0660	0.1068	0.1784	0.2861	192	19
2003	0.1896	0.1773	0.0798	0.1378	0.2258	0.3764	192	17
2004	0.0673	0.0612	0.0274	0.0460	0.0828	0.1402	192	14
2005	0.0120	0.0098	0.0028	0.0065	0.0150	0.0341	288	5
2006	0.1223	0.1180	0.0612	0.0938	0.1454	0.2120	288	27
2007	0.1425	0.1348	0.0749	0.1105	0.1675	0.2523	288	31
2008	0.1021	0.0962	0.0481	0.0752	0.1207	0.1936	192	26

Southeast region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1993	0.0009	0.0005	0.0001	0.0002	0.0010	0.0045	25	1
1994	0.0023	0.0028	0.0002	0.0012	0.0063	0.0396	51	3
1995	0.0015	0.0011	0.0002	0.0006	0.0018	0.0051	89	5
1996	0.0004	0.0002	0.0000	0.0001	0.0004	0.0016	98	1
1997	0.0011	0.0008	0.0002	0.0005	0.0013	0.0034	140	7
1998	0.0041	0.0038	0.0019	0.0031	0.0048	0.0075	196	32
1999	0.0013	0.0013	0.0006	0.0010	0.0016	0.0028	196	25
2000	0.0017	0.0016	0.0008	0.0013	0.0020	0.0034	214	31
2001	0.0022	0.0021	0.0010	0.0016	0.0026	0.0041	234	30
2002	0.0054	0.0052	0.0029	0.0043	0.0062	0.0089	240	51
2003	0.0043	0.0042	0.0022	0.0034	0.0051	0.0075	241	46
2004	0.0117	0.0114	0.0073	0.0098	0.0134	0.0176	294	89
2005	0.0025	0.0024	0.0014	0.0020	0.0029	0.0040	296	52
2006	0.0032	0.0031	0.0018	0.0026	0.0038	0.0057	306	47
2007	0.0020	0.0020	0.0010	0.0016	0.0024	0.0037	323	37
2008	0.0074	0.0070	0.0038	0.0057	0.0087	0.0129	184	41

Table 5. Standardized annual fishery-independent, large-seine catch rates for red drum in each region and descriptive statistics. These indices were distributed across age using percentages observed in random samples of red drum processed for age determination.

Northwest region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1997	0.0154	0.0147	0.0085	0.0120	0.0182	0.0254	95	32
1998	0.0187	0.0185	0.0136	0.0165	0.0207	0.0246	283	101
1999	0.0199	0.0197	0.0154	0.0183	0.0214	0.0251	480	167
2000	0.0149	0.0148	0.0116	0.0136	0.0160	0.0192	513	144
2001	0.0178	0.0177	0.0137	0.0162	0.0192	0.0231	468	136
2002	0.0157	0.0155	0.0119	0.0142	0.0171	0.0202	408	135
2003	0.0214	0.0212	0.0163	0.0194	0.0231	0.0279	408	143
2004	0.0151	0.0149	0.0114	0.0135	0.0164	0.0198	408	115
2005	0.0133	0.0132	0.0100	0.0120	0.0145	0.0173	407	114
2006	0.0123	0.0121	0.0092	0.0110	0.0134	0.0160	408	105
2007	0.0213	0.0211	0.0163	0.0195	0.0232	0.0272	408	136
2008	0.0162	0.0161	0.0123	0.0147	0.0177	0.0209	408	124

Southwest region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1996	0.0033	0.0033	0.0020	0.0028	0.0038	0.0050	305	102
1997	0.0028	0.0028	0.0019	0.0024	0.0031	0.0040	741	118
1998	0.0041	0.0040	0.0029	0.0036	0.0045	0.0057	794	81
1999	0.0027	0.0027	0.0018	0.0023	0.0030	0.0039	934	79
2000	0.0027	0.0026	0.0019	0.0024	0.0030	0.0038	929	74
2001	0.0022	0.0022	0.0015	0.0019	0.0024	0.0030	934	78
2002	0.0024	0.0023	0.0016	0.0021	0.0027	0.0034	934	147
2003	0.0039	0.0038	0.0028	0.0034	0.0043	0.0053	936	182
2004	0.0032	0.0032	0.0023	0.0028	0.0036	0.0045	946	120
2005	0.0068	0.0067	0.0048	0.0060	0.0075	0.0094	516	61
2006	0.0052	0.0051	0.0036	0.0046	0.0057	0.0073	516	82
2007	0.0056	0.0055	0.0039	0.0048	0.0062	0.0078	516	51
2008	0.0064	0.0063	0.0046	0.0056	0.0071	0.0092	516	69

Table 5 (con't). Standardized annual fishery-independent, large-seine catch rates for red drum in each region and descriptive statistics. These indices were distributed across age using percentages observed in random samples of red drum processed for age determination.

Northeast region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
2001	0.0057	0.0054	0.0030	0.0044	0.0067	0.0106	122	17
2002	0.0074	0.0071	0.0046	0.0061	0.0086	0.0118	181	30
2003	0.0045	0.0044	0.0026	0.0037	0.0052	0.0072	192	26
2004	0.0068	0.0067	0.0040	0.0056	0.0078	0.0105	192	34
2005	0.0070	0.0067	0.0043	0.0057	0.0080	0.0115	192	35
2006	0.0057	0.0055	0.0032	0.0047	0.0066	0.0090	192	27
2007	0.0046	0.0044	0.0026	0.0037	0.0053	0.0075	192	29
2008	0.0035	0.0033	0.0018	0.0027	0.0040	0.0059	192	20

Southeast region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1997	0.0064	0.0064	0.0045	0.0057	0.0071	0.0089	364	73
1998	0.0073	0.0072	0.0053	0.0065	0.0080	0.0099	434	91
1999	0.0065	0.0064	0.0047	0.0058	0.0071	0.0084	420	100
2000	0.0076	0.0075	0.0055	0.0067	0.0083	0.0102	420	106
2001	0.0056	0.0056	0.0040	0.0050	0.0062	0.0076	417	80
2002	0.0068	0.0067	0.0050	0.0061	0.0075	0.0095	421	104
2003	0.0065	0.0064	0.0047	0.0058	0.0072	0.0089	421	86
2004	0.0069	0.0068	0.0050	0.0061	0.0075	0.0092	422	103
2005	0.0074	0.0074	0.0055	0.0066	0.0081	0.0099	418	105
2006	0.0072	0.0071	0.0053	0.0063	0.0079	0.0098	419	87
2007	0.0094	0.0093	0.0071	0.0084	0.0103	0.0122	422	115
2008	0.0086	0.0085	0.0063	0.0077	0.0094	0.0115	400	109

Table 6. Standardized annual fishery-dependent, angler total-catch rates for red drum in each region and descriptive statistics. These indices were used as an age-aggregated index of the abundance of age-1 to age-3 red drum each year.

Northwest region

			Percentiles				Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1982	0.1087	0.1022	0.0540	0.0814	0.1301	0.1993	69	23
1983	0.1104	0.0888	0.0262	0.0594	0.1380	0.3171	27	7
1984	0.2349	0.2180	0.1004	0.1671	0.2850	0.4611	61	18
1985	0.2114	0.2051	0.1139	0.1635	0.2475	0.3555	79	34
1986	0.1893	0.1855	0.1202	0.1577	0.2162	0.2865	123	60
1987	0.1752	0.1725	0.1163	0.1498	0.1962	0.2500	165	83
1988	0.3739	0.3528	0.1775	0.2734	0.4456	0.7190	126	110
1989	0.1685	0.1649	0.1002	0.1390	0.1928	0.2599	124	78
1990	0.1668	0.1604	0.0926	0.1333	0.1954	0.2786	90	59
1991	0.2856	0.2537	0.0987	0.1839	0.3457	0.6840	39	28
1992	0.1780	0.1715	0.0957	0.1403	0.2074	0.2960	94	36
1993	0.2028	0.1941	0.1048	0.1563	0.2400	0.3535	90	27
1994	0.1662	0.1615	0.1093	0.1414	0.1851	0.2489	186	63
1995	0.1387	0.1357	0.0917	0.1197	0.1546	0.1982	209	71
1996	0.1468	0.1441	0.0989	0.1265	0.1635	0.2147	227	62
1997	0.1803	0.1782	0.1167	0.1556	0.2042	0.2541	190	60
1998	0.1624	0.1580	0.1047	0.1372	0.1823	0.2452	169	50
1999	0.1810	0.1788	0.1234	0.1589	0.2015	0.2467	221	85
2000	0.2376	0.2332	0.1515	0.2033	0.2673	0.3463	163	79
2001	0.1470	0.1443	0.1018	0.1297	0.1624	0.2032	240	80
2002	0.1386	0.1356	0.0862	0.1183	0.1563	0.2075	183	60
2003	0.2121	0.2073	0.1467	0.1813	0.2389	0.3017	200	77
2004	0.1598	0.1565	0.1113	0.1386	0.1768	0.2262	230	81
2005	0.2097	0.2066	0.1458	0.1827	0.2349	0.2872	222	92
2006	0.2731	0.2663	0.1926	0.2402	0.3028	0.3719	237	127
2007	0.1956	0.1944	0.1392	0.1726	0.2169	0.2700	249	110
2008	0.1384	0.1373	0.1010	0.1237	0.1520	0.1856	312	110

Table 6 (con't). Standardized annual fishery-dependent, angler total-catch rates for red drum in each region and descriptive statistics. These indices were used as an age-aggregated index of the abundance of age-1 to age-3 red drum each year.

Southwest region

				Percentiles			Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1982	0.1457	0.1444	0.0986	0.1266	0.1616	0.2085	226	71
1983	0.1770	0.1745	0.1219	0.1524	0.1975	0.2511	208	75
1984	0.2418	0.2371	0.1619	0.2086	0.2704	0.3478	190	62
1985	0.1271	0.1240	0.0744	0.1046	0.1470	0.1985	184	35
1986	0.1672	0.1650	0.1201	0.1465	0.1847	0.2283	238	132
1987	0.2956	0.2897	0.1966	0.2598	0.3264	0.4183	233	154
1988	0.4128	0.3985	0.2489	0.3361	0.4711	0.6577	237	203
1989	0.1755	0.1727	0.1275	0.1558	0.1950	0.2366	272	112
1990	0.1549	0.1533	0.1097	0.1375	0.1706	0.2072	271	106
1991	0.1556	0.1502	0.0870	0.1251	0.1814	0.2521	87	34
1992	0.2127	0.2092	0.1448	0.1851	0.2365	0.3001	196	87
1993	0.2446	0.2411	0.1678	0.2118	0.2732	0.3429	205	92
1994	0.2408	0.2369	0.1708	0.2136	0.2665	0.3252	272	115
1995	0.1521	0.1492	0.1118	0.1345	0.1676	0.2054	315	93
1996	0.1433	0.1419	0.1055	0.1289	0.1561	0.1928	316	107
1997	0.1237	0.1228	0.0938	0.1122	0.1339	0.1603	458	129
1998	0.1442	0.1429	0.1098	0.1297	0.1566	0.1859	400	133
1999	0.1621	0.1612	0.1286	0.1492	0.1746	0.2026	492	189
2000	0.1629	0.1615	0.1165	0.1434	0.1813	0.2206	244	106
2001	0.1738	0.1730	0.1334	0.1564	0.1890	0.2271	356	153
2002	0.1362	0.1353	0.1031	0.1233	0.1475	0.1784	375	132
2003	0.1739	0.1726	0.1350	0.1590	0.1864	0.2225	437	178
2004	0.2064	0.2055	0.1611	0.1896	0.2211	0.2587	505	213
2005	0.2030	0.2015	0.1601	0.1863	0.2182	0.2544	563	231
2006	0.2587	0.2569	0.1958	0.2342	0.2812	0.3295	387	213
2007	0.2183	0.2156	0.1625	0.1980	0.2359	0.2843	383	181
2008	0.1826	0.1809	0.1420	0.1656	0.1972	0.2349	406	171

Table 6 (con't). Standardized annual fishery-dependent, angler total-catch rates for red drum in each region and descriptive statistics. These indices were used as an age-aggregated index of the abundance of age-1 to age-3 red drum each year.

Northeast region

			Percentiles				Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1982	0.1774	0.1625	0.0723	0.1238	0.2159	0.3650	41	22
1983	0.0961	0.0929	0.0581	0.0795	0.1101	0.1509	204	35
1984	0.1157	0.1128	0.0757	0.0997	0.1289	0.1664	185	67
1985	0.1058	0.1013	0.0536	0.0818	0.1251	0.1913	103	23
1986	0.0486	0.0475	0.0306	0.0408	0.0553	0.0718	177	50
1987	0.2016	0.1902	0.0946	0.1505	0.2378	0.3752	77	59
1988	0.6631	0.2819	0.0149	0.1101	0.7130	3.3104	28	27
1989	0.1101	0.1065	0.0654	0.0901	0.1273	0.1710	96	43
1990	0.0635	0.0610	0.0360	0.0505	0.0743	0.1039	92	40
1991	0.4496	0.3735	0.1057	0.2517	0.5682	1.1929	23	15
1992	0.3853	0.3451	0.1550	0.2683	0.4683	0.7983	42	23
1993	0.4170	0.3799	0.1529	0.2800	0.5068	0.8631	43	28
1994	0.2337	0.2237	0.1344	0.1892	0.2680	0.3813	108	50
1995	0.3120	0.3030	0.1798	0.2513	0.3594	0.5062	101	59
1996	0.2298	0.2213	0.1397	0.1873	0.2626	0.3749	112	60
1997	0.3027	0.2910	0.1657	0.2366	0.3514	0.5200	89	48
1998	0.2549	0.2427	0.1382	0.2000	0.2949	0.4386	91	39
1999	0.1846	0.1770	0.1104	0.1507	0.2105	0.2901	125	52
2000	0.1687	0.1662	0.1071	0.1410	0.1915	0.2556	137	65
2001	0.2509	0.2449	0.1574	0.2107	0.2868	0.3826	136	73
2002	0.1451	0.1413	0.0961	0.1251	0.1618	0.2143	178	70
2003	0.2897	0.2808	0.1827	0.2411	0.3297	0.4423	134	66
2004	0.2850	0.2764	0.1863	0.2408	0.3196	0.4304	140	73
2005	0.2049	0.1980	0.1171	0.1642	0.2359	0.3207	95	43
2006	0.2023	0.1996	0.1268	0.1710	0.2293	0.2990	150	81
2007	0.1180	0.1145	0.0697	0.0973	0.1359	0.1823	123	46
2008	0.1420	0.1387	0.0858	0.1193	0.1612	0.2148	149	53

Table 6 (con't). Standardized annual fishery-dependent, angler total-catch rates for red drum in each region and descriptive statistics. These indices were used as an age-aggregated index of the abundance of age-1 to age-3 red drum each year.

Southeast region

			Percentiles				Number	Number
Year	Mean	Median	2.5th	25th	75th	97.5th	of sets	positive
1982	0.1086	0.1044	0.0567	0.0857	0.1281	0.1816	81	27
1983	0.1074	0.0919	0.0288	0.0643	0.1353	0.2766	27	8
1984	0.2161	0.1842	0.0666	0.1306	0.2765	0.5343	26	11
1985	0.1974	0.1795	0.0853	0.1396	0.2390	0.4069	42	17
1986	0.1013	0.0782	0.0166	0.0493	0.1213	0.3373	15	6
1987	0.2576	0.1668	0.0263	0.0974	0.3164	1.0535	9	5
1988	0.4016	0.2425	0.0267	0.1169	0.4934	1.7347	34	32
1989	0.0919	0.0855	0.0383	0.0663	0.1112	0.1768	50	16
1990	0.1488	0.1380	0.0593	0.1062	0.1794	0.2975	41	21
1991	0.3213	0.2428	0.0518	0.1496	0.4055	0.9901	13	6
1992	0.1917	0.1745	0.0725	0.1252	0.2356	0.4097	32	15
1993	0.1652	0.1512	0.0680	0.1163	0.1955	0.3409	51	14
1994	0.1862	0.1835	0.1324	0.1632	0.2068	0.2569	235	92
1995	0.1807	0.1783	0.1262	0.1594	0.2004	0.2432	229	102
1996	0.2326	0.2261	0.1391	0.1928	0.2663	0.3580	117	58
1997	0.1992	0.1949	0.1223	0.1660	0.2256	0.3089	123	59
1998	0.1654	0.1626	0.1153	0.1441	0.1836	0.2338	211	75
1999	0.1685	0.1672	0.1306	0.1537	0.1818	0.2140	382	153
2000	0.1150	0.1143	0.0867	0.1038	0.1248	0.1488	363	125
2001	0.1598	0.1584	0.1211	0.1456	0.1720	0.2043	365	142
2002	0.1336	0.1324	0.0937	0.1171	0.1481	0.1871	222	87
2003	0.1468	0.1442	0.1045	0.1298	0.1623	0.2003	244	88
2004	0.1460	0.1444	0.1081	0.1301	0.1599	0.1924	271	122
2005	0.1823	0.1800	0.1365	0.1637	0.1985	0.2409	311	143
2006	0.1624	0.1609	0.1215	0.1458	0.1772	0.2118	324	139
2007	0.1507	0.1488	0.1119	0.1349	0.1653	0.1999	279	116
2008	0.1403	0.1389	0.1027	0.1254	0.1531	0.1868	290	118

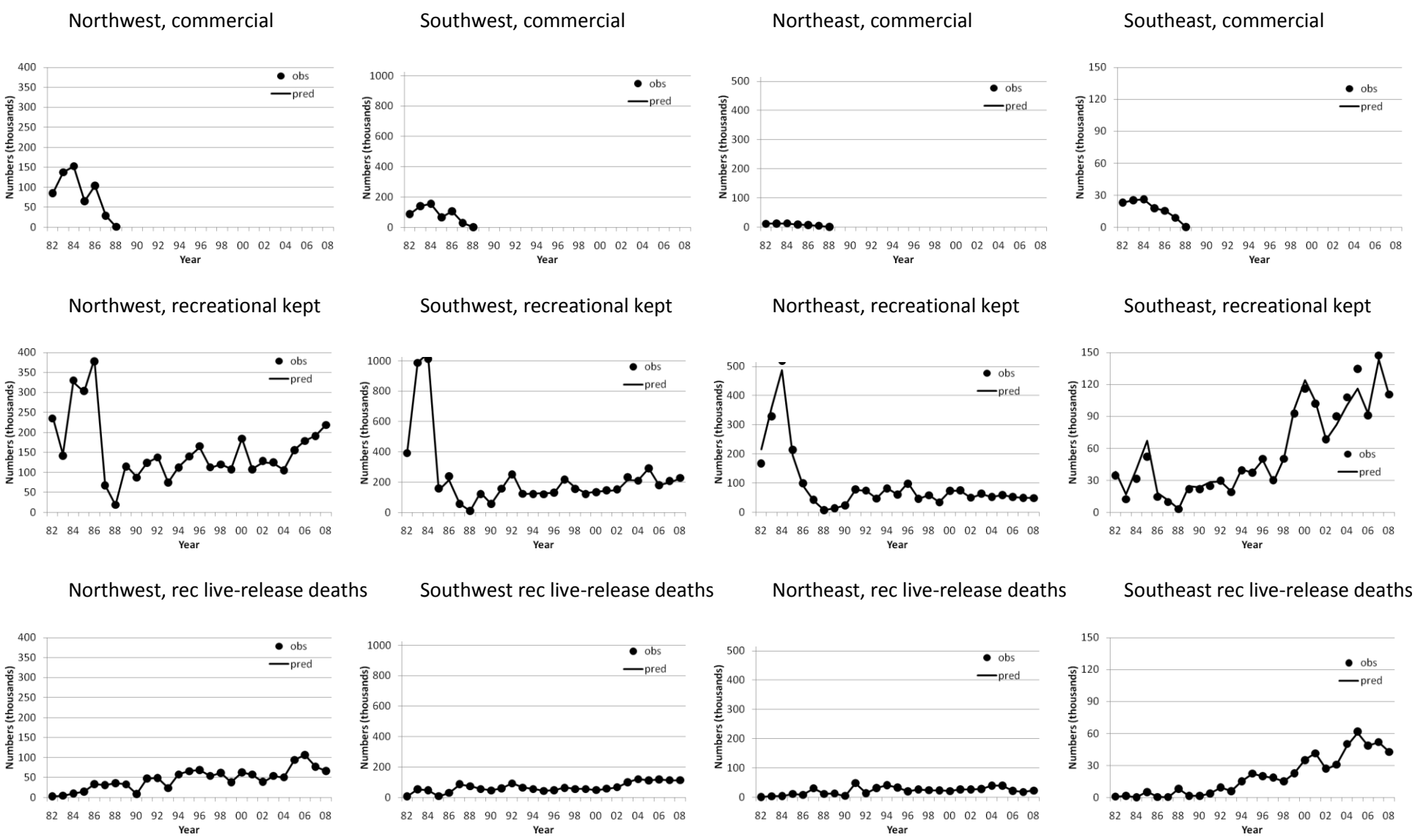

Figure. 2. Observed and predicted annual commecial and recreational landings and live-release discard deaths for red drum in each of the four regions.

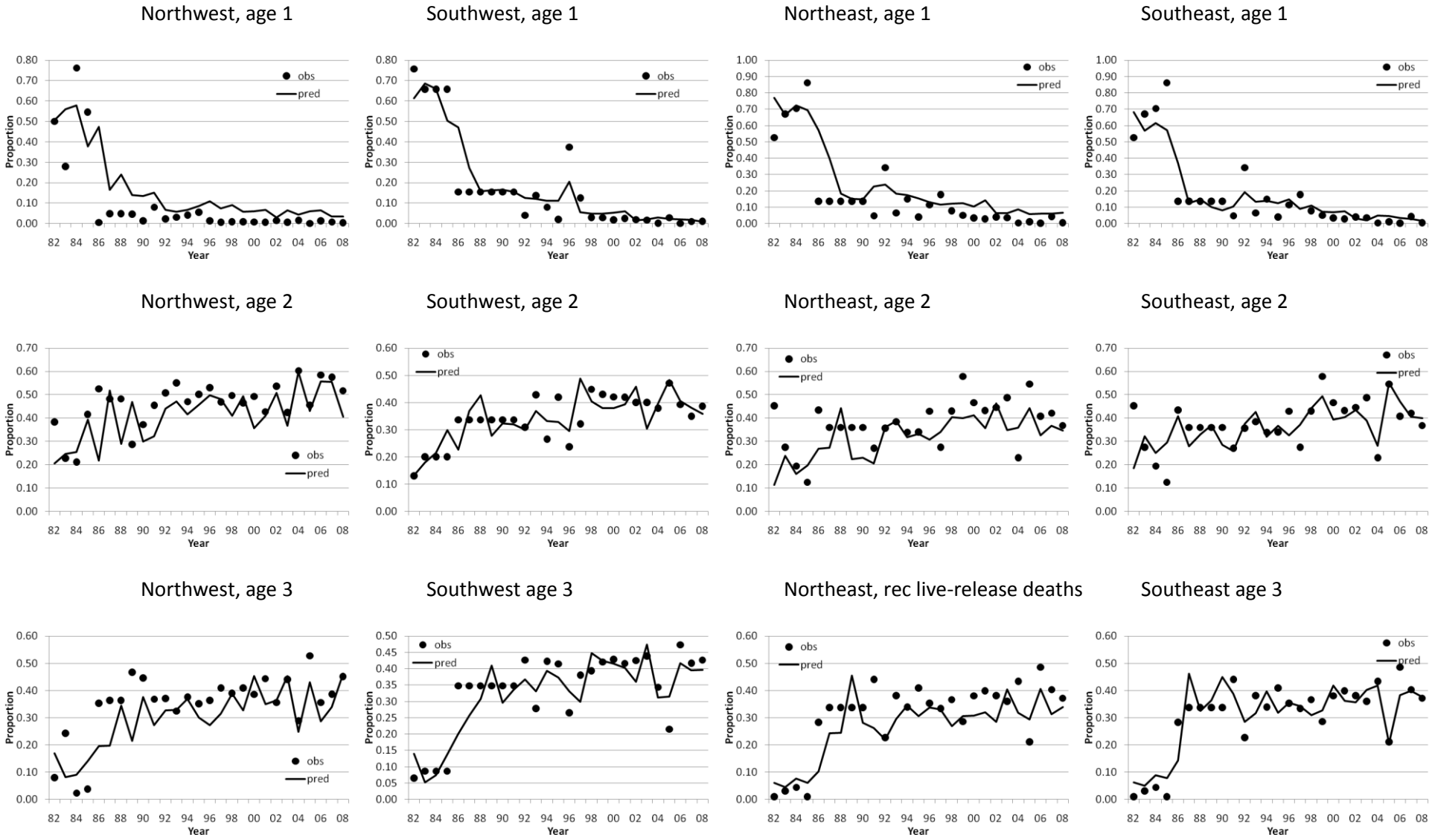

Figure 3. Observed and predicted annual recreational landings age composition for red drum in each of the four regions.

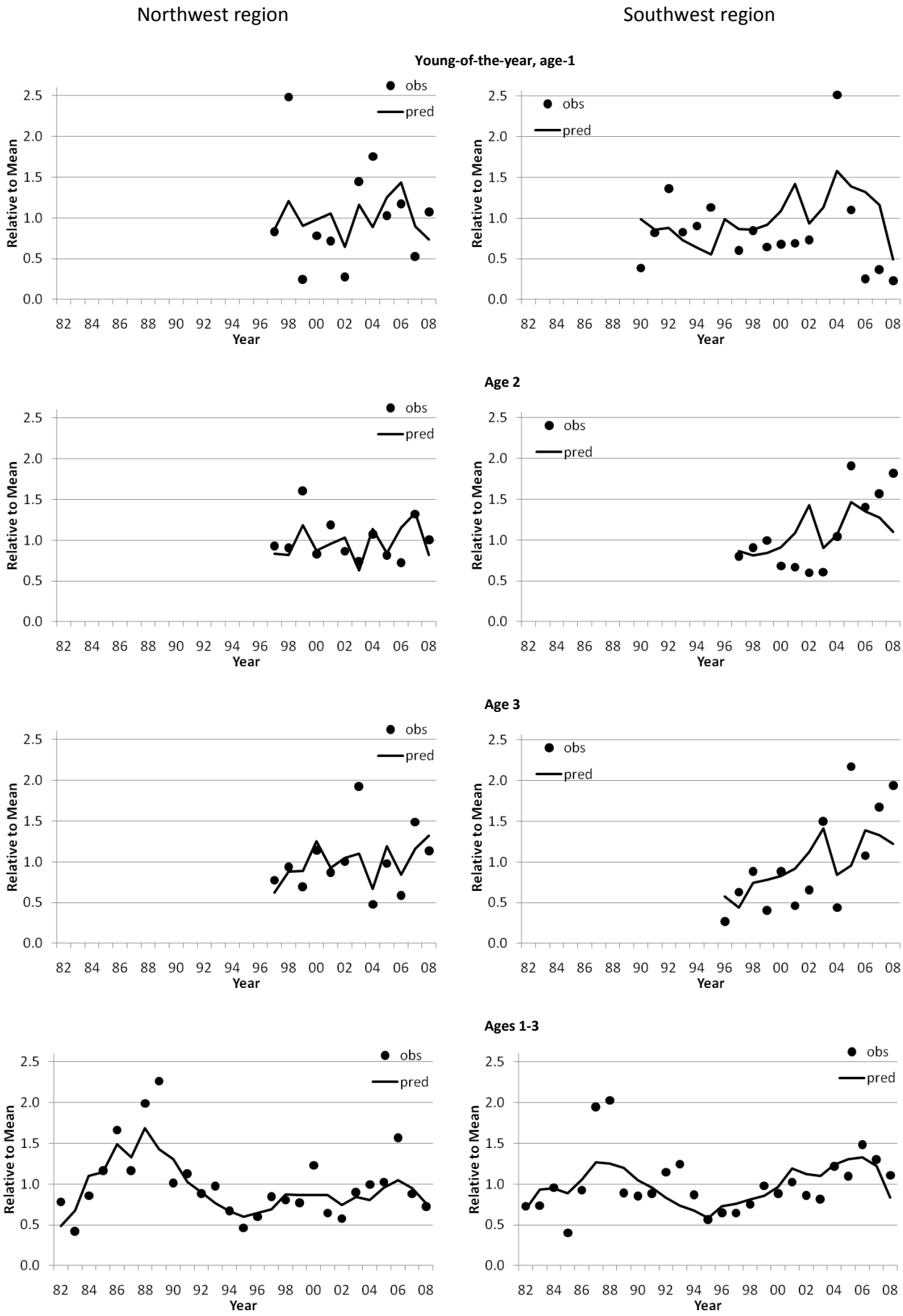

Figure 4. Observed and predicted relative abundance indices for the gulf coast regions.

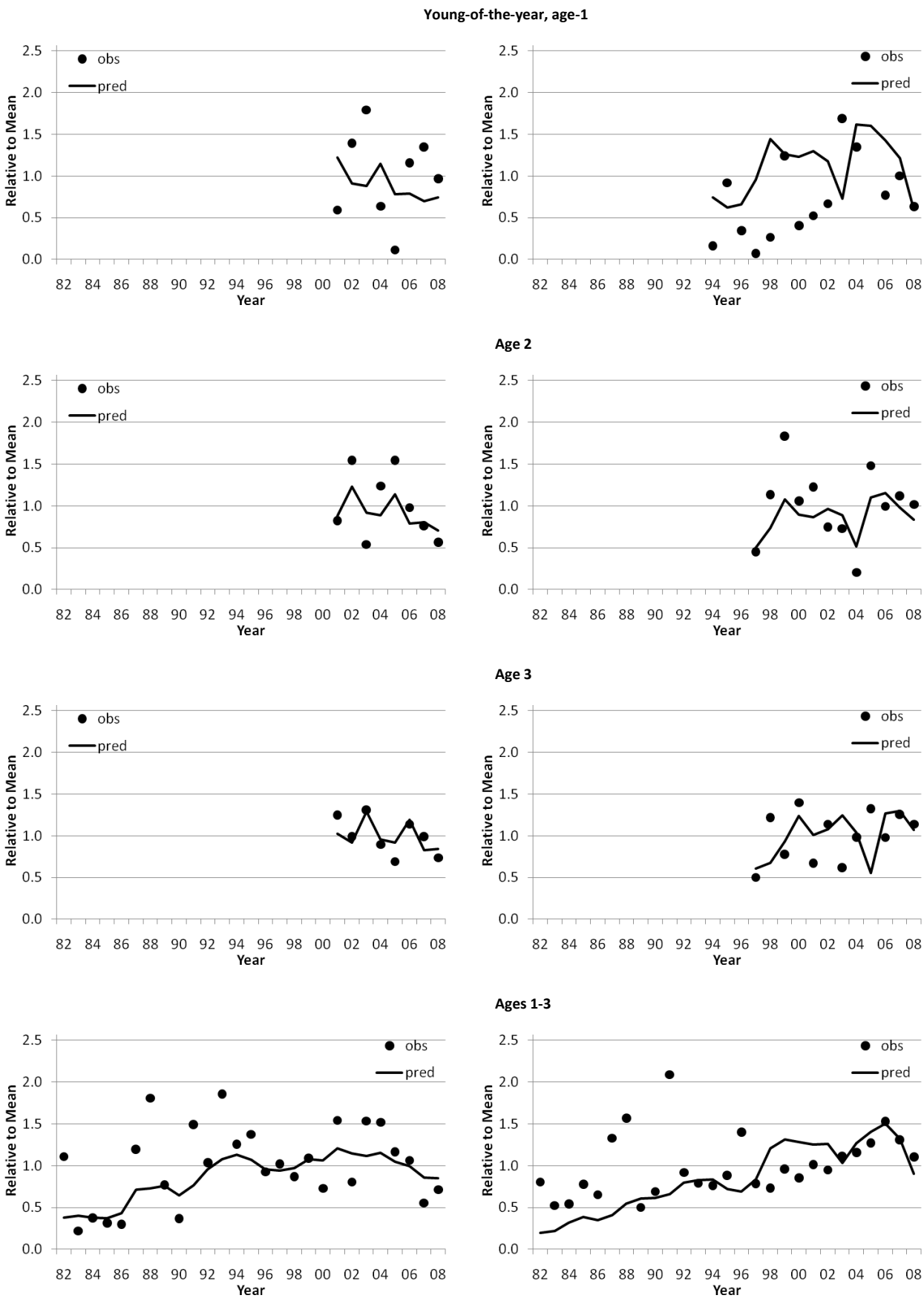

Figure 5. Observed and predicted relative abundance indices for the Atlantic coast regions.

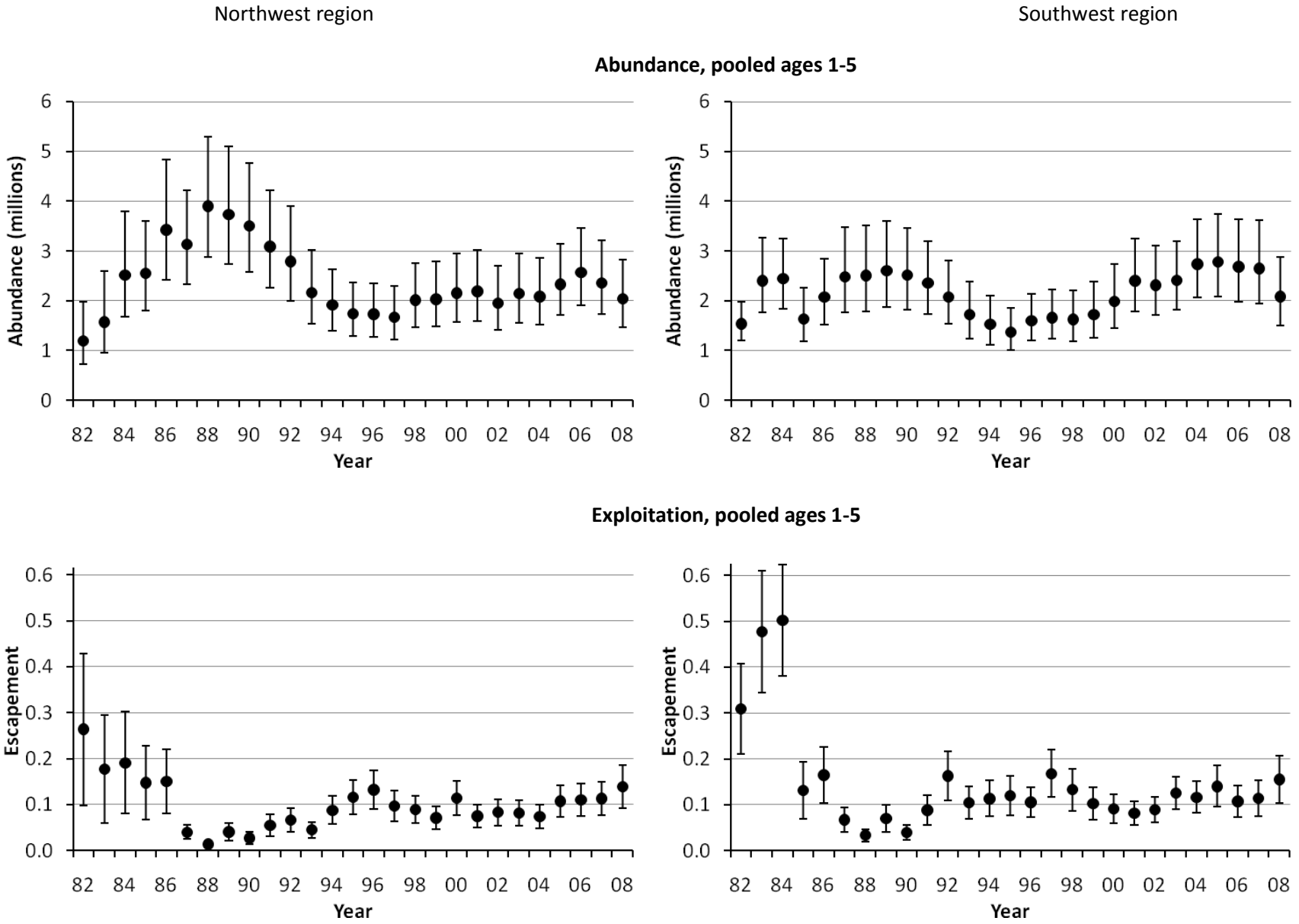

Figure 6. Estimated beginning-of-the-year abundance and exploitation for age 1 through 5 red drum in each region along the gulf coast. Error bars show ±2 standard errors of the estimates.

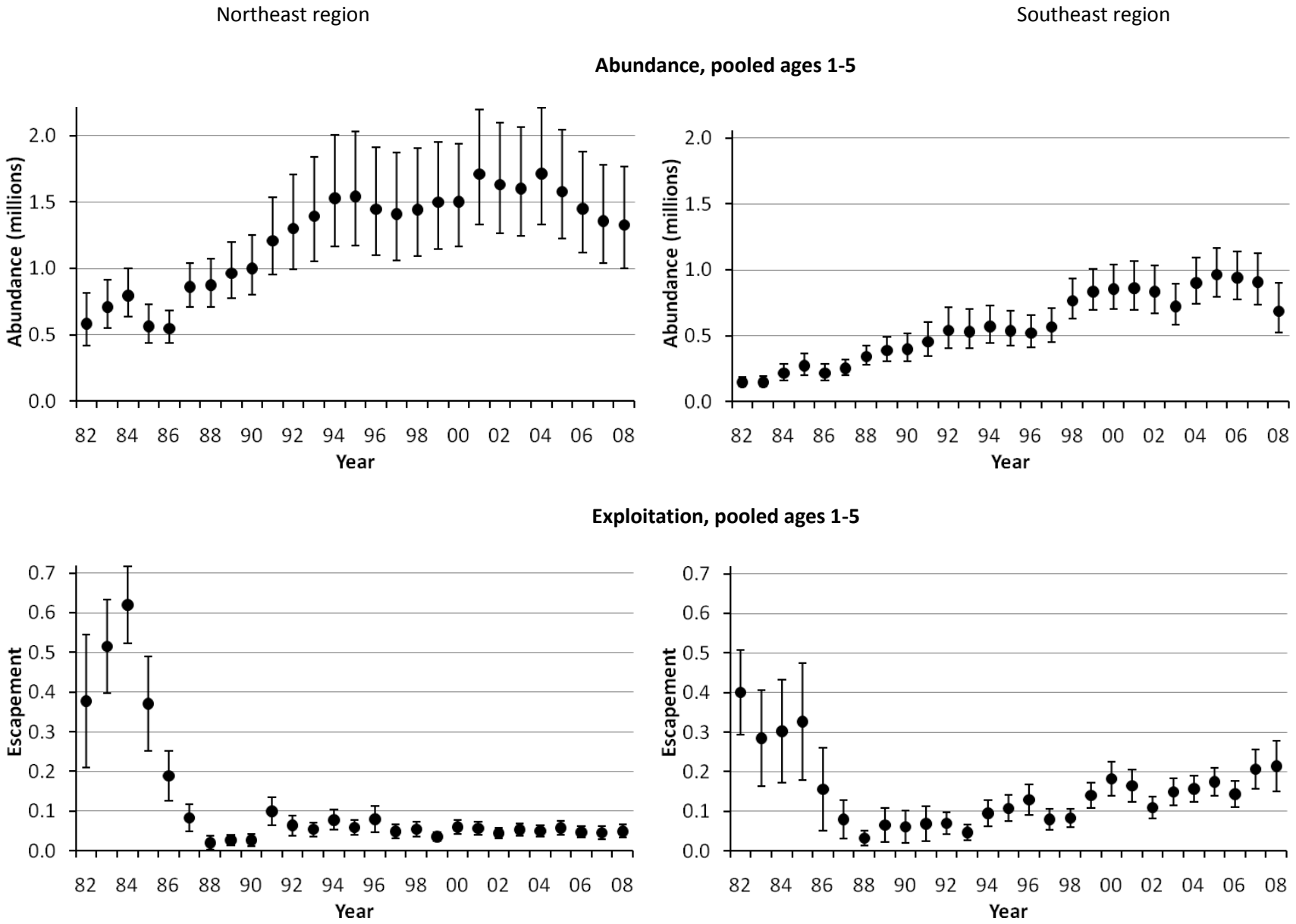

Figure 7. Estimated beginning-of-the-year abundance and exploitation for age 1 through 5 red drum in each region along the Atlantic coast. Error bars show ±2 standard errors of the estimates.

Table 7. Estimated static spawning potential ratio each year for red drum in the four regions as estimated in this analysis and for each coast as estimated by Murphy and Munyandorero (2009). The regional average SPR for 2005-2008 is also given.

	NW	SW	Gulf	NE	SE	Atlantic
1982	0.149	0.089	0.037	0.056	0.021	0.255
1983	0.279	0.015	0.007	0.013	0.087	0.121
1984	0.261	0.011	0.001	0.003	0.079	0.050
1985	0.404	0.417	0.035	0.067	0.081	0.114
1986	0.376	0.323	0.011	0.297	0.368	0.218
1987	0.810	0.648	0.215	0.549	0.585	0.575
1988	0.925	0.831	0.736	0.892	0.814	0.886
1989	0.807	0.655	0.540	0.862	0.648	0.783
1990	0.863	0.779	0.645	0.857	0.694	0.787
1991	0.730	0.564	0.489	0.516	0.634	0.627
1992	0.669	0.310	0.418	0.656	0.637	0.622
1993	0.781	0.494	0.575	0.729	0.769	0.716
1994	0.598	0.480	0.522	0.632	0.572	0.550
1995	0.481	0.456	0.461	0.712	0.525	0.623
1996	0.415	0.437	0.343	0.630	0.437	0.573
1997	0.539	0.247	0.342	0.745	0.562	0.671
1998	0.557	0.368	0.410	0.718	0.514	0.563
1999	0.662	0.471	0.530	0.810	0.383	0.498
2000	0.502	0.497	0.393	0.712	0.292	0.374
2001	0.627	0.528	0.491	0.703	0.310	0.409
2002	0.642	0.569	0.496	0.780	0.476	0.590
2003	0.590	0.415	0.379	0.739	0.409	0.529
2004	0.651	0.376	0.376	0.731	0.262	0.347
2005	0.509	0.336	0.289	0.719	0.235	0.349
2006	0.489	0.459	0.359	0.764	0.366	0.521
2007	0.542	0.452	0.460	0.767	0.239	0.447
2008	0.467	0.384		0.741	0.269	
05-08 Ave	0.502	0.408		0.748	0.277	

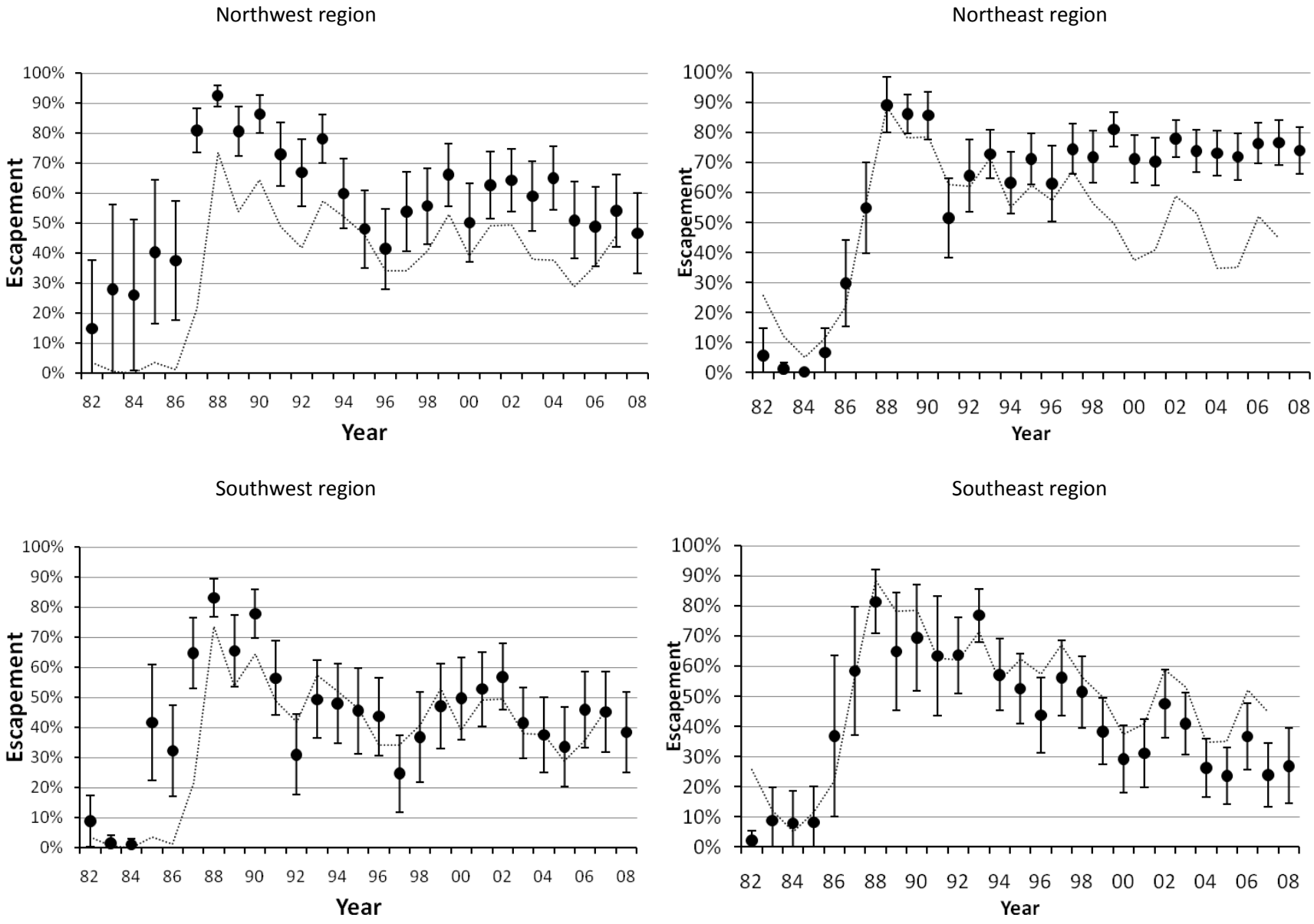

Figure 8. Estimated escapment rates for red drum through age 5 in each region of Florida. Error bars show ±2 standard errors of the estimates. The lighter dashed line shows the estimates from the last coast-wide assessment (Murphy and Munyandorero 2009).