Fishery Dependent Index for Atlantic Cobia from MRIP Data, 1981-2017

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SEDAR 58 – ATLANTIC COBIA

INDICES WORKGROUP

WORKING PAPER DW-02

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Introduction

The Atlantic Coast cobia fishery has been determined to be supported by a unit stock that extends from the northeast (NY area) through Georgia, with the GA/FL border recognized as the southern boundary of the stock (Cobia Stock ID workshop recommendation). The Marine Recreational Information Program (MRIP) conducts complementary surveys in these states from March to December each year, providing a time series of catch and effort estimates from March, 1981 through 2017 (the terminal year of this stock assessment). The Access Point Angler Intercept Survey collects angler trip information about catch, by three categories: landed whole fish identified by an interviewer to species (type A), harvested (dead), reported by the angler catch (numbers by fish ID, type B1), released alive, reported by the angler catch (numbers by fish ID, type B2). Both types reported by the angler (counts only, no sizes) may not be identified to species, but could include a higher taxon identifier in the data (family or genus level). For this index both harvested fish per angler trip (A+B1 catch per trip) and total fish per angler trip (A+B1+B2 catch per trip) were used for cobia catch rate computation. In this analysis, no higher level taxa were included because cobia is considered unique enough that the angler can either identify the fish to species (=cobia) or has no idea what he just caught (=unidentified fish) which would be unreasonable to include by proportion.

Methods

There are two overall issues to consider in subsetting all the MRIP APAIS interview data available for the Atlantic Coast:

1) Which trips with 0 catch to include along with all trips that had reported or observed cobia catch.
2) Which years and waves (2-month sampling periods) to include in the index, which is a time series of annual mean catch-per-unit-effort (cpue).

Directed trips for cobia

To address the first issue, I used the directed trip methodology and defined as any angler trip that caught cobia (A, B1, or B2) and any trip likely to catch cobia defined by target species reported in the interview by the angler (Table 1). Those target species included cobia but also include king mackerel in the entire range from NY to GA. King mackerel was the top species in a frequency distribution of other fishes caught with at least one cobia during the trip (Table 2). Based on this frequency distribution of co-catch data from 1990-2017 the criteria used to include an APAIS trip in the cpue analysis was either catch of cobia, or a reported target species of cobia or king mackerel. APAIS data collected from NY through GA were included in all but one run.

Years and waves – Included, Excluded – in Index time series

Wave 1, Jan-Feb, is not sampled by APAIS in Atlantic States north of FL except for NC beginning in 2010, so wave 1 data were not included in the time series of cpue. Waves 2 through 6 were possible inclusions as sampling was conducted in each states, NY – GA, throughout the survey time series of 1981-2017. Annual cpue for each catch type was produced for all years in this time series – any reduction in consideration for the Index would need to be made by the SEDAR Indices Work Group.

Table 1. Number of angler intercepts from MRIP APAIS that either caught cobia or targeted cobia or king mackerel (=cobia 'directed trips'). Stock ID workshop defined the range of the unit stock on the Atlantic Coast.

COBIA TRIPS

	STATE								
	DE	GA	MD	NJ	NY	NC	SC	VA	Total
	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS
YEAR									
1981	.	9	.	.	.	24	48	1	82
1982	.	65	.	.	.	102	45	11	223
1983	.	30	3	.	.	53	19	3	108
1984	.	20	.	.	.	67	66	4	157
1985	.	57	8	3	1	125	96	57	347
1986	.	37	4	1	.	177	290	71	580
1987	.	126	28	.	.	947	406	32	1539
1988	.	27	.	.	.	280	219	20	546
1989	.	9	1	.	.	953	401	85	1449
1990	.	12	.	3	.	955	252	31	1253
1991	8	32	2	2	.	1321	241	63	1669
1992	10	90	2	.	.	1002	517	45	1666
1993	2	17	2	.	.	905	169	53	1148
1994	1	22	3	.	1	1197	204	111	1539
1995	.	25	.	.	.	1115	181	67	1388
1996	.	23	.	.	.	647	229	55	954
1997	.	13	3	.	.	570	270	52	908
1998	.	13	.	.	.	525	213	64	815
1999	.	34	1	.	1	279	118	90	523
2000	.	75	.	2	.	558	186	60	881
2001	.	39	.	.	1	608	140	67	855
2002	1	21	.	.	.	482	109	85	698
2003	.	30	3	.	1	498	62	86	680
2004	.	18	.	1	.	419	80	37	555
2005	1	22	2	.	.	493	118	47	683
2006	.	10	5	1	.	448	73	33	570

COBIA TRIPS

	STATE								Total
	DE	GA	MD	NJ	NY	NC	SC	VA	
	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS	ANGLER TRIPS
2007	1	27	1	.	1	550	194	135	909
2008	1	39	.	2	.	447	106	148	743
2009	.	20	.	.	.	533	132	118	803
2010	1	39	1	3	.	758	121	124	1047
2011	3	24	.	.	1	502	69	90	689
2012	.	13	3	2	.	674	108	76	876
2013	.	18	.	.	.	546	90	165	819
2014	4	20	2	.	.	590	161	118	895
2015	.	43	.	2	.	703	133	189	1070
2016	.	10	5	.	.	660	157	250	1082
2017	.	41	3	.	.	717	97	181	1039

Table 2. Fishes caught with cobia (same angler-trip); from APAIS data, 1990-2017, waves 2-6 - frequency of occurrence. Cobia count = number of trips with catch observed, landed or reported.

---------- SUB REGION OF TRIP=MID-ATLANTIC ----------

Obs	common	COUNT
1	COBIA	528
2	ATLANTIC CROAKER	99
3	BLUEFISH	56
4	SUMMER FLOUNDER	50
5	SPOT	40
6	COWNOSE RAY	37
7	UNIDENTIFIED (SHARKS)	32
8	BLACK SEA BASS	30
9	SANDBAR SHARK	17
10	SKATE GENUS	17
11	OYSTER TOADFISH	15
12	ATLANTIC SPADEFISH	14
13	CLEARNOSE SKATE	14
14	SOUTHERN KINGFISH	14
15	SPANISH MACKEREL	13
16	WEAKFISH	12
17	PIGFISH	11
18	RED DRUM	11

---------- SUB REGION OF TRIP=SOUTH ATLANTIC ----------

Obs	common	COUNT
19	**COBIA**	**2801**
20	**KING MACKEREL**	**408**
21	BLACK SEA BASS	256
22	LITTLE TUNNY	232
23	BLUEFISH	230
24	DOLPHIN	201
25	SPANISH MACKEREL	188
26	GREATER AMBERJACK	148
27	RED SNAPPER	138
28	PINFISH	137
29	GREAT BARRACUDA	136
30	UNIDENTIFIED (SHARKS)	123
31	GRAY TRIGGERFISH	114
32	VERMILION SNAPPER	114
33	BLUE RUNNER	101

Catch-per-Unit-Effort and Directed Trip Analysis

CPUE was calculated for several combinations of catch-type and waves to include in the weighted, annual value. Landings cpue included only the harvested or dead fish removed by anglers, including both the available, counted and identified by interviewer fish (type A) and the reported by angler counts by disposition (type B1: to be eaten, used for bait, to be sold, discarded dead, other use). Total catch included all the landed fish, as well as those released alive (type B2). For each time series annual cpue was produced for both landings and total catch, and output to tables and figures. Tabulated results include annual weighted mean cpue, standard error of the mean, and coefficient of variation (cv), and the figures plot the time series of annual cpue (Tables 3-7, Figures 1-5). The entire geographic range of NY to GA was included in these runs. A final run subset the geographic range to the southern states of VA to GA where cobia catches are most common over the time series (1981-2017).

Figure 1. CPUE by catch type, Waves 2-3 only (Mar-Jun), NY to GA included.

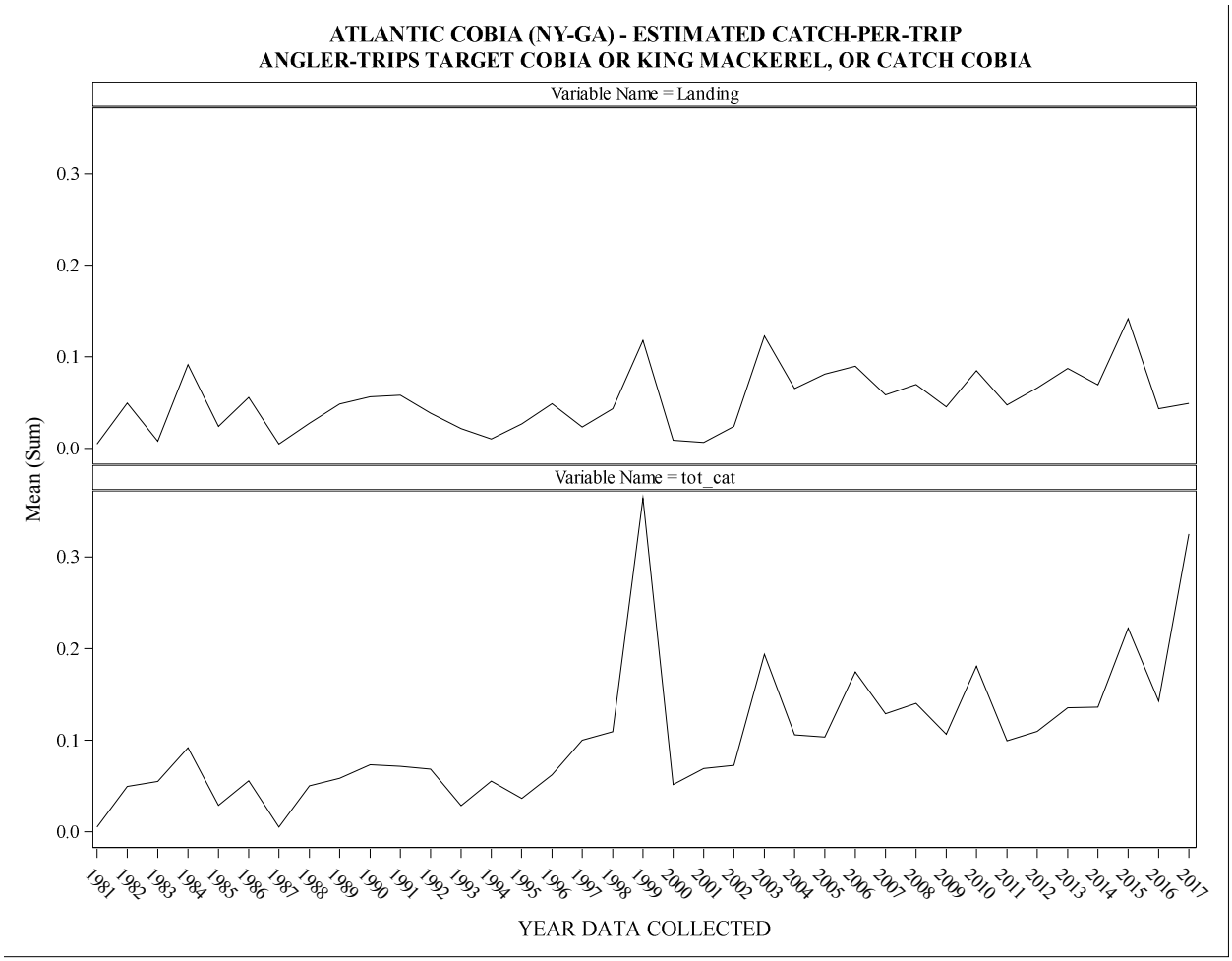

Figure 2. CPUE by catch type, Waves 4-5 only (Jul-Oct), NY to GA included.

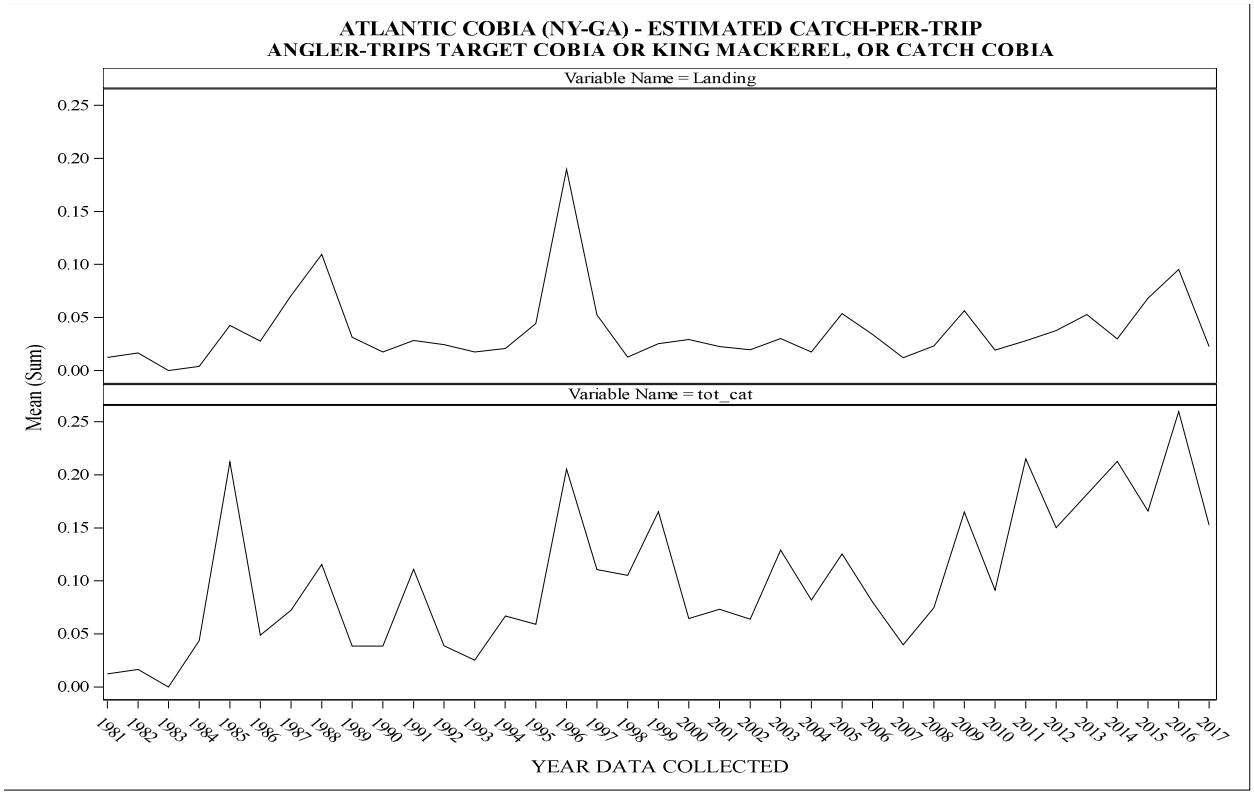

Table 3. CPUE by catch type, Waves 2-6 only (Mar-Dec), NY to GA included.

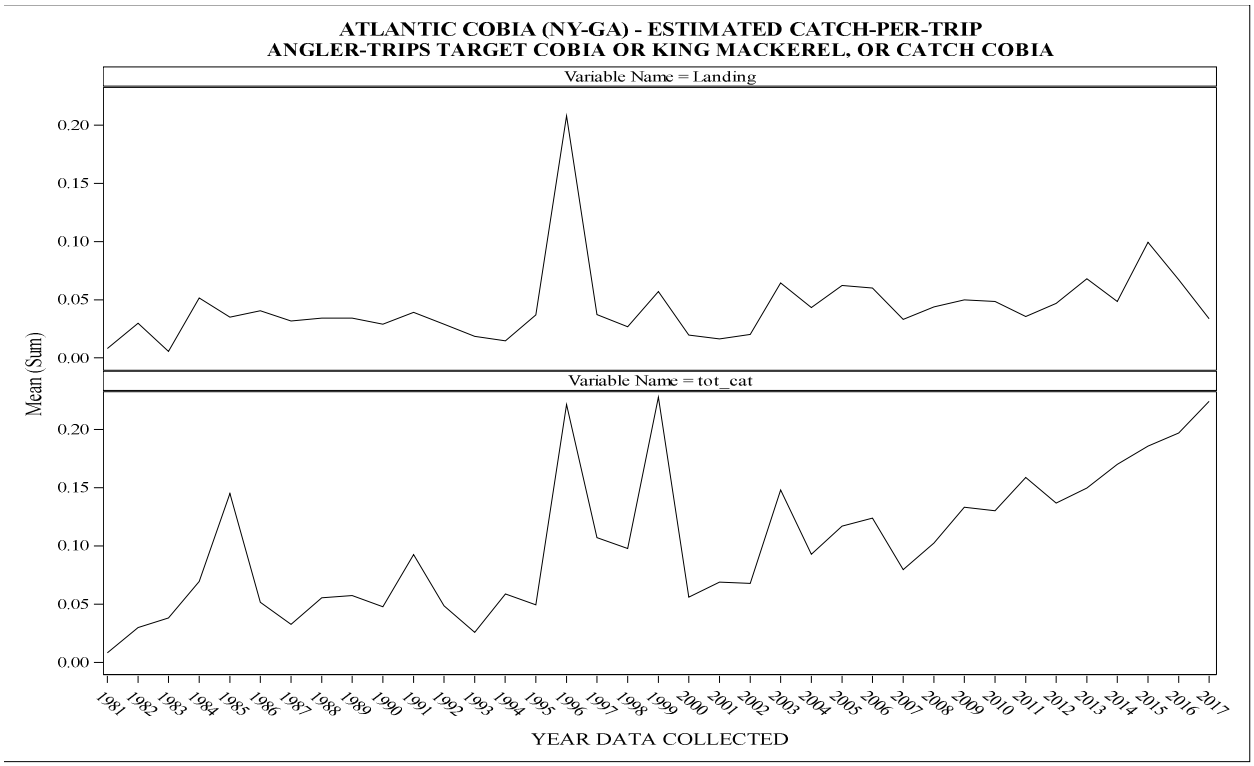

Table 4. CPUE by catch type, Waves 3-5 only (May-Oct), NY to GA included.

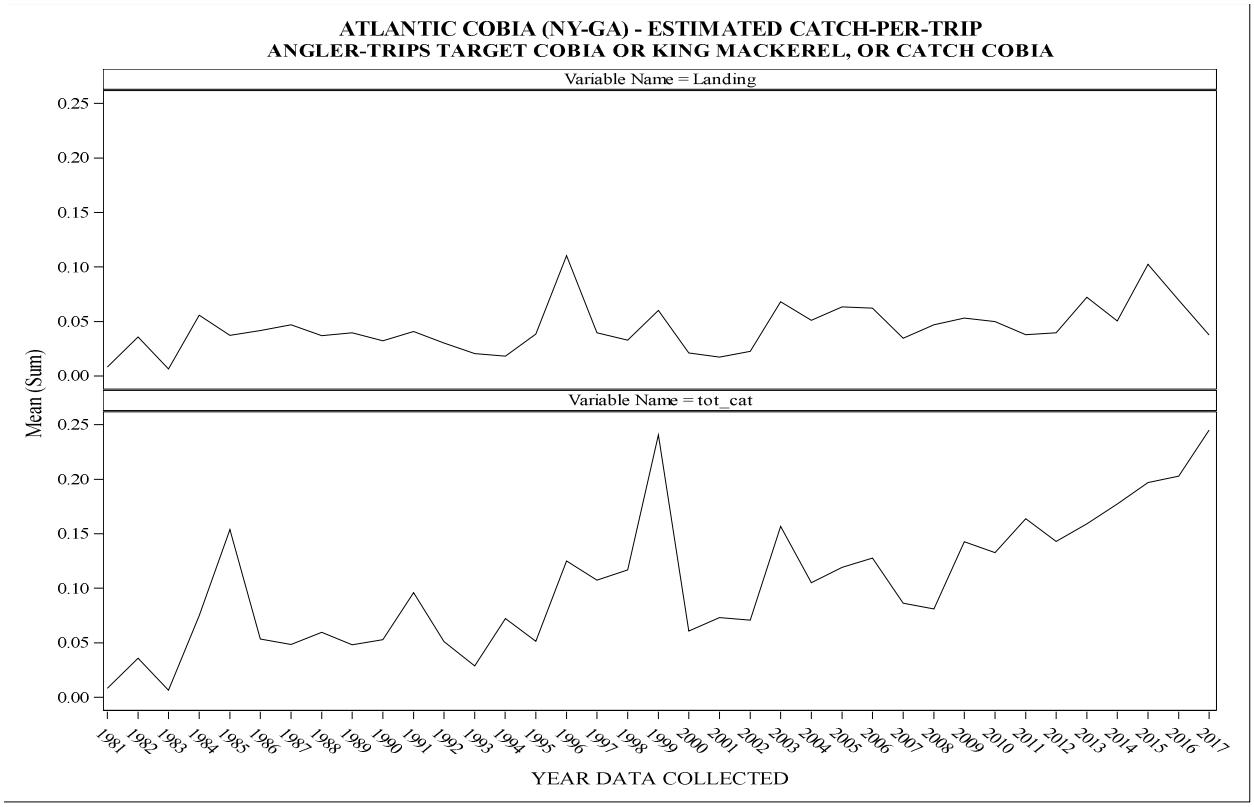

Table 5. CPUE by catch type, Waves 3-5 only (May-Oct), VA to GA only.

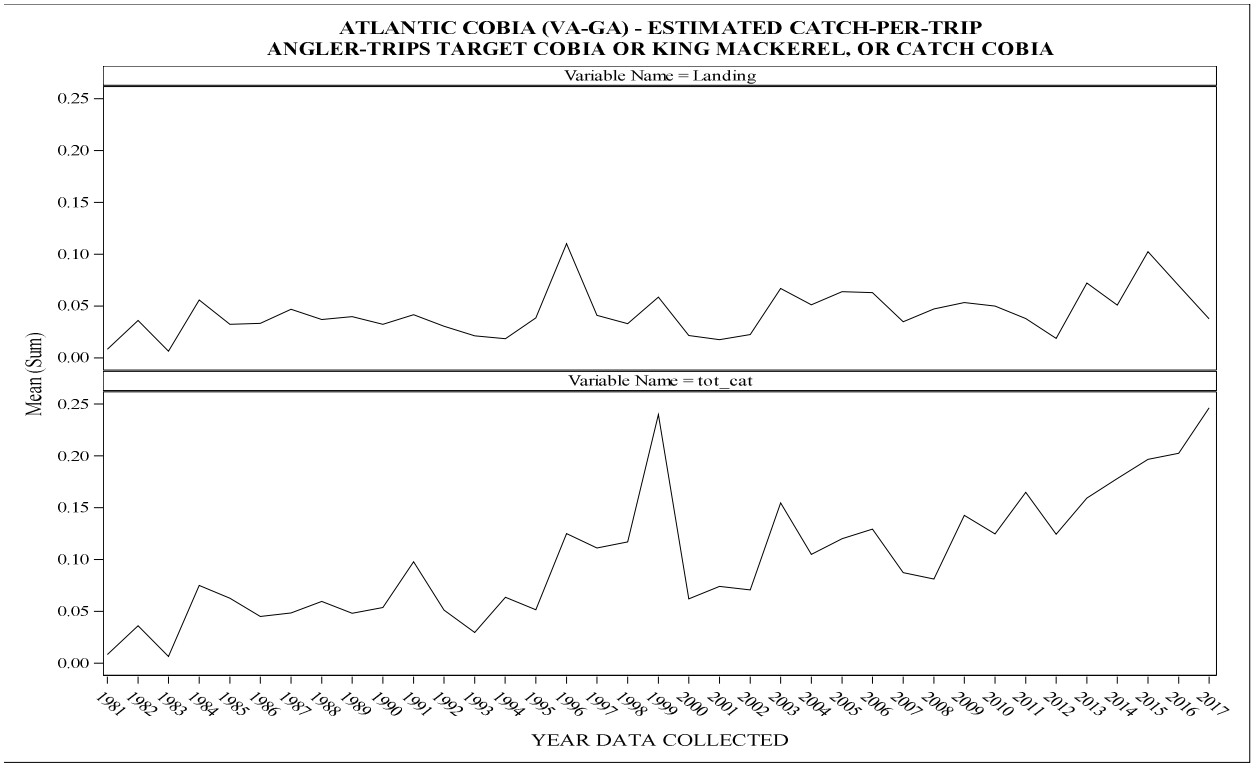

Table 3. Annual cpue of Atlantic Cobia from MRIP APAIS – Waves 2 - 3, NY to GA. Angler trips that targeted either cobia or king mackerel, or trips that caught cobia were included in cpue computation.

	Landing = Harvest (A+B1)				Tot_cat = Total Catch (A+B1+B2)			
YEAR	Mean	CV	StdErr	pse	Mean	CV	StdErr	pse
1981	0.0051	1.0096	0.0051	100.96	0.0051	1.0096	0.0051	100.96
1982	0.0496	0.8152	0.0404	81.52	0.0496	0.8152	0.0404	81.52
1983	0.0081	1.0106	0.0082	101.07	0.0552	0.8541	0.0471	85.41
1984	0.0917	0.5144	0.0471	51.44	0.0917	0.5144	0.0471	51.44
1985	0.0243	0.5865	0.0142	58.65	0.0288	0.5107	0.0147	51.07
1986	0.0557	0.5449	0.0303	54.49	0.0557	0.5449	0.0303	54.49
1987	0.0049	0.5134	0.0025	51.34	0.0052	0.4947	0.0026	49.47
1988	0.0277	0.4014	0.0111	40.14	0.0501	0.3227	0.0162	32.27
1989	0.0486	0.3282	0.0160	32.82	0.0583	0.3028	0.0177	30.28
1990	0.0565	0.3052	0.0172	30.52	0.0733	0.3015	0.0221	30.15
1991	0.0582	0.6580	0.0383	65.80	0.0716	0.5297	0.0379	52.97
1992	0.0387	0.3341	0.0129	33.41	0.0685	0.3128	0.0214	31.28
1993	0.0216	0.5925	0.0128	59.25	0.0286	0.5115	0.0146	51.15
1994	0.0104	0.4426	0.0046	44.26	0.0555	0.7168	0.0398	71.68
1995	0.0270	0.3075	0.0083	30.75	0.0364	0.2595	0.0095	25.95
1996	0.0488	0.3058	0.0149	30.58	0.0623	0.2548	0.0159	25.48
1997	0.0235	0.5182	0.0122	51.82	0.1001	0.3819	0.0382	38.19
1998	0.0434	0.4769	0.0207	47.70	0.1095	0.3517	0.0385	35.17
1999	0.1180	0.6154	0.0726	61.54	0.3645	0.4144	0.1510	41.44
2000	0.0090	0.6272	0.0057	62.72	0.0514	0.5763	0.0296	57.63
2001	0.0068	0.5118	0.0035	51.19	0.0691	0.4244	0.0293	42.44
2002	0.0242	0.6098	0.0148	60.98	0.0725	0.3264	0.0236	32.64
2003	0.1229	0.5804	0.0713	58.04	0.1939	0.3960	0.0768	39.60
2004	0.0654	0.3531	0.0231	35.31	0.1061	0.2980	0.0316	29.80
2005	0.0812	0.7948	0.0645	79.48	0.1036	0.6246	0.0647	62.46
2006	0.0897	0.3830	0.0343	38.30	0.1745	0.3382	0.0590	33.82
2007	0.0586	0.4714	0.0276	47.14	0.1288	0.5262	0.0678	52.62
2008	0.0699	0.4930	0.0344	49.30	0.1404	0.3438	0.0483	34.38
2009	0.0456	0.3322	0.0152	33.22	0.1066	0.2096	0.0223	20.96
2010	0.0850	0.2538	0.0216	25.38	0.1807	0.2275	0.0411	22.75
2011	0.0476	0.4314	0.0205	43.14	0.0993	0.3668	0.0364	36.68
2012	0.0662	0.6385	0.0423	63.85	0.1098	0.4689	0.0515	46.89
2013	0.0873	0.2742	0.0239	27.42	0.1354	0.3148	0.0426	31.48
2014	0.0697	0.3687	0.0257	36.87	0.1362	0.3475	0.0473	34.75
2015	0.1417	0.2118	0.0300	21.18	0.2226	0.2020	0.0450	20.20
2016	0.0433	0.3150	0.0136	31.50	0.1426	0.2067	0.0295	20.67
2017	0.0493	0.4428	0.0219	44.28	0.3253	0.3319	0.1080	33.19

Table 4. Annual cpue of Atlantic Cobia from MRIP APAIS – Waves 4 – 5, NY to GA. Angler trips that targeted either cobia or king mackerel, or trips that caught cobia were included in cpue computation.

	Landing = Harvest (A+B1)				Tot_cat = Total Catch (A+B1+B2)			
YEAR	Mean	CV	StdErr	pse	Mean	CV	StdErr	pse
1981	0.0124	1.0131	0.0125	101.31	0.0124	1.0131	0.0125	101.31
1982	0.0164	0.7231	0.0119	72.32	0.0164	0.7231	0.0119	72.32
1983	0.0000		0.0000		0.0000		0.0000	
1984	0.0039	0.8332	0.0033	83.32	0.0437	0.9455	0.0413	94.55
1985	0.0424	0.4015	0.0170	40.15	0.2120	0.5207	0.1104	52.07
1986	0.0278	0.5999	0.0167	59.99	0.0487	0.5785	0.0282	57.85
1987	0.0705	0.6114	0.0431	61.14	0.0724	0.5926	0.0429	59.26
1988	0.1096	0.8702	0.0954	87.02	0.1155	0.8603	0.0994	86.03
1989	0.0314	0.4321	0.0135	43.21	0.0385	0.3739	0.0144	37.39
1990	0.0175	0.5242	0.0092	52.42	0.0385	0.4582	0.0176	45.82
1991	0.0282	0.3486	0.0098	34.86	0.1110	0.3082	0.0342	30.82
1992	0.0244	0.4187	0.0102	41.87	0.0388	0.3574	0.0139	35.74
1993	0.0175	0.4249	0.0074	42.49	0.0254	0.4480	0.0114	44.80
1994	0.0207	0.3747	0.0077	37.47	0.0670	0.3222	0.0216	32.22
1995	0.0444	0.4713	0.0209	47.13	0.0592	0.3579	0.0212	35.79
1996	0.1897	0.8546	0.1621	85.46	0.2053	0.7831	0.1608	78.31
1997	0.0526	0.5107	0.0269	51.07	0.1108	0.3157	0.0350	31.57
1998	0.0127	0.4414	0.0056	44.14	0.1053	0.3596	0.0379	35.96
1999	0.0252	0.4139	0.0105	41.39	0.1653	0.3703	0.0612	37.03
2000	0.0292	0.5608	0.0164	56.08	0.0645	0.3440	0.0222	34.40
2001	0.0224	0.4628	0.0104	46.28	0.0733	0.2921	0.0214	29.21
2002	0.0195	0.5204	0.0101	52.04	0.0639	0.3231	0.0207	32.31
2003	0.0300	0.4376	0.0131	43.76	0.1291	0.2582	0.0333	25.82
2004	0.0174	0.4496	0.0078	44.96	0.0821	0.3140	0.0258	31.40
2005	0.0536	0.4321	0.0232	43.21	0.1254	0.2888	0.0362	28.88
2006	0.0340	0.8784	0.0298	87.84	0.0802	0.4157	0.0333	41.57
2007	0.0119	0.4786	0.0057	47.86	0.0397	0.3353	0.0133	33.53
2008	0.0231	0.6105	0.0141	61.05	0.0748	0.3018	0.0226	30.18
2009	0.0564	0.3108	0.0175	31.08	0.1649	0.3241	0.0534	32.41
2010	0.0192	0.4887	0.0094	48.87	0.0913	0.3253	0.0297	32.53
2011	0.0280	0.5508	0.0154	55.08	0.2150	0.2959	0.0636	29.59
2012	0.0376	0.7388	0.0278	73.88	0.1503	0.2890	0.0434	28.90
2013	0.0528	0.5066	0.0267	50.66	0.1815	0.3896	0.0707	38.96
2014	0.0299	0.3976	0.0119	39.76	0.2127	0.2104	0.0448	21.04
2015	0.0680	0.4594	0.0312	45.94	0.1659	0.4519	0.0750	45.19
2016	0.0953	0.1872	0.0178	18.72	0.2598	0.1525	0.0396	15.25
2017	0.0226	0.4354	0.0098	43.54	0.1526	0.2595	0.0396	25.95

Table 5. Annual cpue of Atlantic Cobia from MRIP APAIS – Waves 2 – 6, NY to GA. Angler trips that targeted either cobia or king mackerel, or trips that caught cobia were included in cpue computation.

	Landing = Harvest (A+B1)				Tot_cat = Total Catch (A+B1+B2)			
YEAR	Mean	CV	StdErr	pse	Mean	CV	StdErr	pse
1981	0.0082	0.7428	0.0061	74.28	0.0082	0.7428	0.0061	74.28
1982	0.0299	0.6045	0.0181	60.45	0.0299	0.6045	0.0181	60.45
1983	0.0056	1.0072	0.0056	100.72	0.0382	0.8608	0.0329	86.08
1984	0.0516	0.5282	0.0273	52.82	0.0694	0.4682	0.0325	46.82
1985	0.0351	0.3291	0.0115	32.91	0.1452	0.4875	0.0708	48.75
1986	0.0405	0.4029	0.0163	40.29	0.0515	0.3925	0.0202	39.25
1987	0.0316	0.6212	0.0197	62.12	0.0326	0.6017	0.0196	60.17
1988	0.0343	0.3330	0.0114	33.30	0.0553	0.2890	0.0160	28.90
1989	0.0342	0.2758	0.0094	27.58	0.0574	0.3188	0.0183	31.88
1990	0.0289	0.2838	0.0082	28.38	0.0477	0.2823	0.0135	28.23
1991	0.0391	0.4212	0.0165	42.12	0.0926	0.2637	0.0244	26.37
1992	0.0289	0.2708	0.0078	27.08	0.0486	0.2396	0.0116	23.96
1993	0.0185	0.3535	0.0065	35.35	0.0257	0.3353	0.0086	33.53
1994	0.0146	0.2926	0.0043	29.26	0.0588	0.3688	0.0217	36.88
1995	0.0370	0.3586	0.0133	35.86	0.0495	0.2745	0.0136	27.45
1996	0.2078	0.5662	0.1177	56.62	0.2216	0.5282	0.1170	52.82
1997	0.0374	0.4070	0.0152	40.70	0.1071	0.2373	0.0254	23.73
1998	0.0269	0.3994	0.0107	39.94	0.0978	0.2531	0.0248	25.31
1999	0.0570	0.5018	0.0286	50.18	0.2277	0.3026	0.0689	30.26
2000	0.0196	0.4682	0.0092	46.82	0.0560	0.3019	0.0169	30.19
2001	0.0165	0.4064	0.0067	40.64	0.0689	0.2398	0.0165	23.98
2002	0.0203	0.4013	0.0081	40.13	0.0677	0.2251	0.0152	22.51
2003	0.0645	0.4868	0.0314	48.68	0.1481	0.2503	0.0371	25.03
2004	0.0432	0.3016	0.0130	30.16	0.0929	0.2187	0.0203	21.87
2005	0.0622	0.4236	0.0263	42.36	0.1172	0.2730	0.0320	27.30
2006	0.0600	0.3722	0.0223	37.22	0.1240	0.2665	0.0330	26.65
2007	0.0331	0.3972	0.0131	39.72	0.0796	0.4039	0.0322	40.39
2008	0.0437	0.3980	0.0174	39.80	0.1026	0.2458	0.0252	24.58
2009	0.0498	0.2285	0.0114	22.85	0.1332	0.2183	0.0291	21.83
2010	0.0485	0.2194	0.0106	21.94	0.1303	0.1849	0.0241	18.49
2011	0.0357	0.3351	0.0120	33.51	0.1589	0.2527	0.0401	25.27
2012	0.0469	0.4969	0.0233	49.69	0.1369	0.2437	0.0334	24.38
2013	0.0680	0.2520	0.0171	25.20	0.1496	0.2583	0.0387	25.83
2014	0.0485	0.2647	0.0128	26.47	0.1700	0.1984	0.0337	19.84
2015	0.0993	0.2136	0.0212	21.36	0.1859	0.2322	0.0432	23.22
2016	0.0672	0.1665	0.0112	16.65	0.1971	0.1210	0.0238	12.10
2017	0.0337	0.3417	0.0115	34.17	0.2243	0.2418	0.0542	24.18

Table 6. Annual cpue of Atlantic Cobia from MRIP APAIS – Waves 3 – 5, NY to GA. Angler trips that targeted either cobia or king mackerel, or trips that caught cobia were included in cpue computation.

	Landing = Harvest (A+B1)				Tot_cat = Total Catch (A+B1+B2)			
YEAR	Mean	CV	StdErr	pse	Mean	CV	StdErr	pse
1981	0.0083	0.7431	0.0061	74.31	0.0083	0.7431	0.0061	74.31
1982	0.0360	0.6030	0.0217	60.30	0.0360	0.6030	0.0217	60.30
1983	0.0065	1.0067	0.0065	100.67	0.0065	1.0067	0.0065	100.67
1984	0.0557	0.5271	0.0294	52.71	0.0749	0.4684	0.0351	46.84
1985	0.0372	0.3347	0.0124	33.47	0.1539	0.4886	0.0752	48.86
1986	0.0418	0.4117	0.0172	41.17	0.0535	0.4002	0.0214	40.02
1987	0.0470	0.5981	0.0281	59.81	0.0485	0.5787	0.0280	57.87
1988	0.0369	0.3353	0.0124	33.53	0.0596	0.2916	0.0174	29.16
1989	0.0397	0.2754	0.0109	27.54	0.0481	0.2449	0.0118	24.49
1990	0.0322	0.2850	0.0092	28.50	0.0530	0.2837	0.0150	28.37
1991	0.0409	0.4209	0.0172	42.09	0.0961	0.2658	0.0255	26.58
1992	0.0304	0.2709	0.0082	27.09	0.0511	0.2398	0.0122	23.98
1993	0.0207	0.3502	0.0073	35.02	0.0289	0.3314	0.0096	33.14
1994	0.0183	0.2886	0.0053	28.86	0.0724	0.3679	0.0266	36.79
1995	0.0384	0.3590	0.0138	35.90	0.0515	0.2742	0.0141	27.42
1996	0.1103	0.6621	0.0731	66.21	0.1251	0.5801	0.0725	58.01
1997	0.0396	0.4050	0.0160	40.50	0.1074	0.2449	0.0263	24.49
1998	0.0330	0.3977	0.0131	39.78	0.1168	0.2536	0.0296	25.36
1999	0.0601	0.5006	0.0301	50.06	0.2407	0.3004	0.0723	30.04
2000	0.0213	0.4696	0.0100	46.96	0.0609	0.3007	0.0183	30.07
2001	0.0175	0.4068	0.0071	40.68	0.0731	0.2404	0.0176	24.04
2002	0.0226	0.4017	0.0091	40.17	0.0707	0.2304	0.0163	23.04
2003	0.0682	0.4840	0.0330	48.40	0.1566	0.2479	0.0388	24.79
2004	0.0512	0.2975	0.0152	29.75	0.1050	0.2200	0.0231	22.00
2005	0.0633	0.4233	0.0268	42.33	0.1194	0.2727	0.0326	27.27
2006	0.0622	0.3712	0.0231	37.12	0.1278	0.2673	0.0342	26.73
2007	0.0345	0.4132	0.0143	41.32	0.0863	0.4084	0.0352	40.84
2008	0.0470	0.3973	0.0187	39.73	0.0811	0.2630	0.0213	26.30
2009	0.0533	0.2272	0.0121	22.73	0.1427	0.2169	0.0310	21.69
2010	0.0498	0.2197	0.0109	21.97	0.1327	0.1865	0.0247	18.65
2011	0.0378	0.3352	0.0127	33.52	0.1638	0.2574	0.0422	25.74
2012	0.0395	0.5815	0.0230	58.15	0.1430	0.2495	0.0357	24.95
2013	0.0724	0.2494	0.0181	24.94	0.1591	0.2557	0.0407	25.57
2014	0.0506	0.2660	0.0134	26.60	0.1772	0.2002	0.0355	20.02
2015	0.1023	0.2179	0.0223	21.79	0.1970	0.2367	0.0466	23.68
2016	0.0696	0.1674	0.0117	16.75	0.2027	0.1226	0.0249	12.26
2017	0.0375	0.3407	0.0128	34.07	0.2451	0.2456	0.0602	24.56

Table 7. Annual cpue of Atlantic Cobia from MRIP APAIS – Waves 3 – 5, VA to GA only. Angler trips that targeted either cobia or king mackerel, or trips that caught cobia were included in cpue computation.

	Landing = Harvest (A+B1)				Tot_cat = Total Catch (A+B1+B2)			
YEAR	Mean	CV	StdErr	pse	Mean	CV	StdErr	pse
1981	0.0083	0.7431	0.0061	74.31	0.0083	0.7431	0.0061	74.31
1982	0.0360	0.6030	0.0217	60.30	0.0360	0.6030	0.0217	60.30
1983	0.0064	1.0159	0.0065	101.59	0.0064	1.0159	0.0065	101.59
1984	0.0557	0.5271	0.0294	52.71	0.0749	0.4684	0.0351	46.84
1985	0.0324	0.3301	0.0107	33.01	0.0627	0.2940	0.0184	29.40
1986	0.0333	0.4496	0.0150	44.96	0.0451	0.4347	0.0196	43.47
1987	0.0470	0.5981	0.0281	59.81	0.0485	0.5787	0.0280	57.87
1988	0.0369	0.3353	0.0124	33.53	0.0596	0.2916	0.0174	29.16
1989	0.0396	0.2757	0.0109	27.57	0.0481	0.2451	0.0118	24.51
1990	0.0325	0.2853	0.0093	28.53	0.0535	0.2840	0.0152	28.40
1991	0.0415	0.4283	0.0178	42.83	0.0978	0.2688	0.0263	26.88
1992	0.0304	0.2709	0.0082	27.09	0.0511	0.2398	0.0123	23.98
1993	0.0211	0.3500	0.0074	35.00	0.0295	0.3311	0.0098	33.12
1994	0.0183	0.2887	0.0053	28.87	0.0634	0.4006	0.0254	40.06
1995	0.0384	0.3590	0.0138	35.90	0.0515	0.2742	0.0141	27.42
1996	0.1103	0.6621	0.0731	66.21	0.1251	0.5801	0.0725	58.01
1997	0.0409	0.4027	0.0165	40.27	0.1110	0.2427	0.0269	24.27
1998	0.0330	0.3977	0.0131	39.78	0.1168	0.2536	0.0296	25.36
1999	0.0587	0.5150	0.0302	51.50	0.2398	0.3025	0.0726	30.25
2000	0.0216	0.4697	0.0102	46.97	0.0618	0.3003	0.0186	30.03
2001	0.0177	0.4067	0.0072	40.67	0.0739	0.2404	0.0178	24.04
2002	0.0226	0.4017	0.0091	40.17	0.0708	0.2304	0.0163	23.04
2003	0.0670	0.5061	0.0339	50.61	0.1546	0.2569	0.0397	25.69
2004	0.0512	0.2975	0.0152	29.75	0.1049	0.2201	0.0231	22.02
2005	0.0637	0.4238	0.0270	42.38	0.1202	0.2728	0.0328	27.28
2006	0.0628	0.3725	0.0234	37.25	0.1294	0.2673	0.0346	26.74
2007	0.0349	0.4130	0.0144	41.30	0.0873	0.4082	0.0356	40.82
2008	0.0471	0.3973	0.0187	39.73	0.0812	0.2632	0.0214	26.32
2009	0.0533	0.2272	0.0121	22.73	0.1427	0.2169	0.0310	21.69
2010	0.0501	0.2200	0.0110	22.00	0.1248	0.1907	0.0238	19.07
2011	0.0380	0.3353	0.0127	33.53	0.1647	0.2574	0.0424	25.74
2012	0.0186	0.5251	0.0098	52.51	0.1244	0.2438	0.0303	24.38
2013	0.0724	0.2494	0.0181	24.94	0.1591	0.2557	0.0407	25.57
2014	0.0508	0.2662	0.0135	26.62	0.1781	0.2005	0.0357	20.05
2015	0.1024	0.2179	0.0223	21.79	0.1967	0.2372	0.0467	23.72
2016	0.0699	0.1676	0.0117	16.76	0.2025	0.1231	0.0249	12.31
2017	0.0377	0.3407	0.0128	34.07	0.2464	0.2457	0.0605	24.57

Appendix 1. SAS code for producing catch-per-unit-effort, Atlantic cobia, using directed trip program.

```
*****************************************************************
MRIP directed angler-trips (effort) for custom domains
USE SURVEYMEANS TO PRODUCE CPUE TIME-SERIES INDEX
SPECIES SPECIFIC - CRITERIA TO INCLUDE CATCH AND TARGET SPECIES
MAY INCLUDE ASSOCIATED SPECIES TARGETED
TRS - DEC 2018 - FOR COBIA SEDAR58-DW02
*****************************************************************;
*location of MRIP trip_yyyyw and catch_yyyyw sas datasets;

libname mrip "M:\products\mrip_estim\Public_data_cal2018";
OPTIONS LS=80 PS=80;

%let yr_st=1981;  *start year;
%let yr_nd=2017;  *end year;
%let wv_st=3;     *start wave;
%let wv_nd=5;     *end wave;

proc datasets lib=work kill memtype=data; run; quit;

%Macro compile_data;
data mytrip_catch;
run;

%do y = &yr_st. %to &yr_nd.;
  data mytrip;
       set
             %do w = &wv_st. %to &wv_nd.;
                   mrip.trip_&y.&w.
             %end;
       ;
       *dtrip will be used to estimate total directed trips,do not change it;
       dtrip = 1;
       keep year wave strat_id psu_id id_code dtrip mode_fx area_x sub_reg st
            leader prim1 prim2 prim1_common prim2_common wp_int;
  run;

  proc sort data=mytrip;
       by strat_id psu_id id_code;
  run;

       *Catch fields
             common=common name
             sp_code=MRFSS 10 digit species code
             claim=harvested fish observed by interviewer A-catch (no. fish)
             release=reported fish released alive B2-catch (no. fish)
             harvest=harvested fish not observed by interviewer B1-catch (no. fish)
             landing=claim + harvest
             tot_cat=claim + harvest + release
             wgt_ab1=landing in kg instead of no. fish
             wgt_a=claim in kg instead of no. fish
             wgt_b1=harvest in kg instead of no. fish;
  data catch;
       set
```

```
            %do w = &wv_st. %to &wv_nd.;
                  mrip.catch_&y.&w.
            %end;
       ;
       if common="COBIA"; * or common="KING MACKEREL";
  run;

  proc sort data=catch;
       by strat_id psu_id id_code;
  run;

  data cat_cobia;
       merge mytrip(in=t)
           catch (keep=strat_id psu_id id_code common
                  sp_code claim release harvest landing
                  tot_cat wgt_ab1 wgt_a wgt_b1);
       by strat_id psu_id id_code;
       if t;
       if sub_reg in(5,6);
       if st=12 then delete;
  *      if st in(51,37,45,13);
       if tot_cat=. then tot_cat=0;
       if landing=. then landing=0;
  run;

  data mytrip_catch;
    set mytrip_catch cat_cobia;
  run;
%end;

%Mend compile_data;

%compile_data;

data mytrip_cobia;
       set mytrip_catch;
       if year=. then delete;
    dom_id=2; * 2='OTHER' DOMAIN (default value);
       if tot_cat>0 or (prim1_common="COBIA" or prim1_common="KING MACKEREL" or
                     prim2_common="COBIA" or prim2_common="KING MACKEREL")
                     then dom_id=1;
run;

data mytrip_cobia;
       set mytrip_cobia;
       my_dom_id = dom_id;
       *my_dom_id = compress(year||wave||intsite||dom_id);
run;

/*************************************************************************
* Surveymeans will estimate trip totals in each domain and put them      *
*   in the output dataset 'my_domain_trip_totals'.                       *
*     Then modify surveymeans to use my_xxx_trip in place of mytrip.     *
*************************************************************************/
proc surveymeans data=mytrip_cobia mean cv stderr ;
```

```
      strata      strat_id;
      cluster     psu_id;
      weight      wp_int;
      domain      year*my_dom_id;
      var         tot_cat landing;
      ods output domain=sa_cobia_cat;
run;
*******************************************************************************;
data sa_cobia_cat;
 set sa_cobia_cat;
 if my_dom_id=1;
 common='COBIA';
run;
options nodate pageno=1 orientation=landscape;
ods graphics on / height=7in width=9in;
goptions vsize=7in hsize=9in;
ods rtf file="C:\SEDAR_58 SA COBIA\MRIP Index\Cobia_cpt_VA-GA_&wv_st._&wv_nd..doc";
proc sort data=sa_cobia_cat;
 by common varname year;
proc sgpanel data= sa_cobia_cat;
  panelby varname /  columns=1 rows=2;
  vline year / response=mean;
  title1 "ATLANTIC COBIA (VA-GA) - ESTIMATED CATCH-PER-TRIP";
  title2 "ANGLER-TRIPS TARGET COBIA OR KING MACKEREL, OR CATCH COBIA";
run;
ods rtf close;
run;

data cpuelnd;
 set sa_cobia_cat;
 pse=100*stderr/mean;
run;

ODS CSV file="C:\SEDAR_58 SA COBIA\MRIP Index\Cobia_cpt_VA-GA_&wv_st._&wv_nd..csv";;
 PROC PRINT DATA = cpuelnd NOOBS;
 RUN;
ODS CSV CLOSE;

* proc print;
*  format mean stderr 8.6 pse 5.2;
*  var common year mean stderr pse cv;
*  title1 "ATLANTIC COBIA (NY-GA) - ESTIMATED CATCH-PER-TRIP (A+B1+B2)";
*  title2 "ANGLER-TRIPS TARGET COBIA OR KING MACKEREL, OR CATCH COBIA";
run;
```