

The Great Red Snapper Count

Population Estimation

GoMFMC-SSC

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Robert Ahrens

At the strata level -region, depth, and RF classification- samples were assumed to be **simple random samples with no measurement error** and strata level means and variances were calculated accordingly

$$\bar{x}_h = \sum_{i=1}^n \frac{1}{n} x_i \text{ and } s_h^2 = \frac{\sum_{i=1}^n (x_i - \bar{x}_h)^2}{n-1}$$

Where necessary samples had to be assigned to depth and RF determined category based on geographic location post-hoc.

Regional and GOM wide estimates of abundance were calculated as expanded means and variances derived using the appropriate calculations for a stratified mean and variance. Sample sizes were calculated using the Satterthwaite approximation for degrees of freedom.

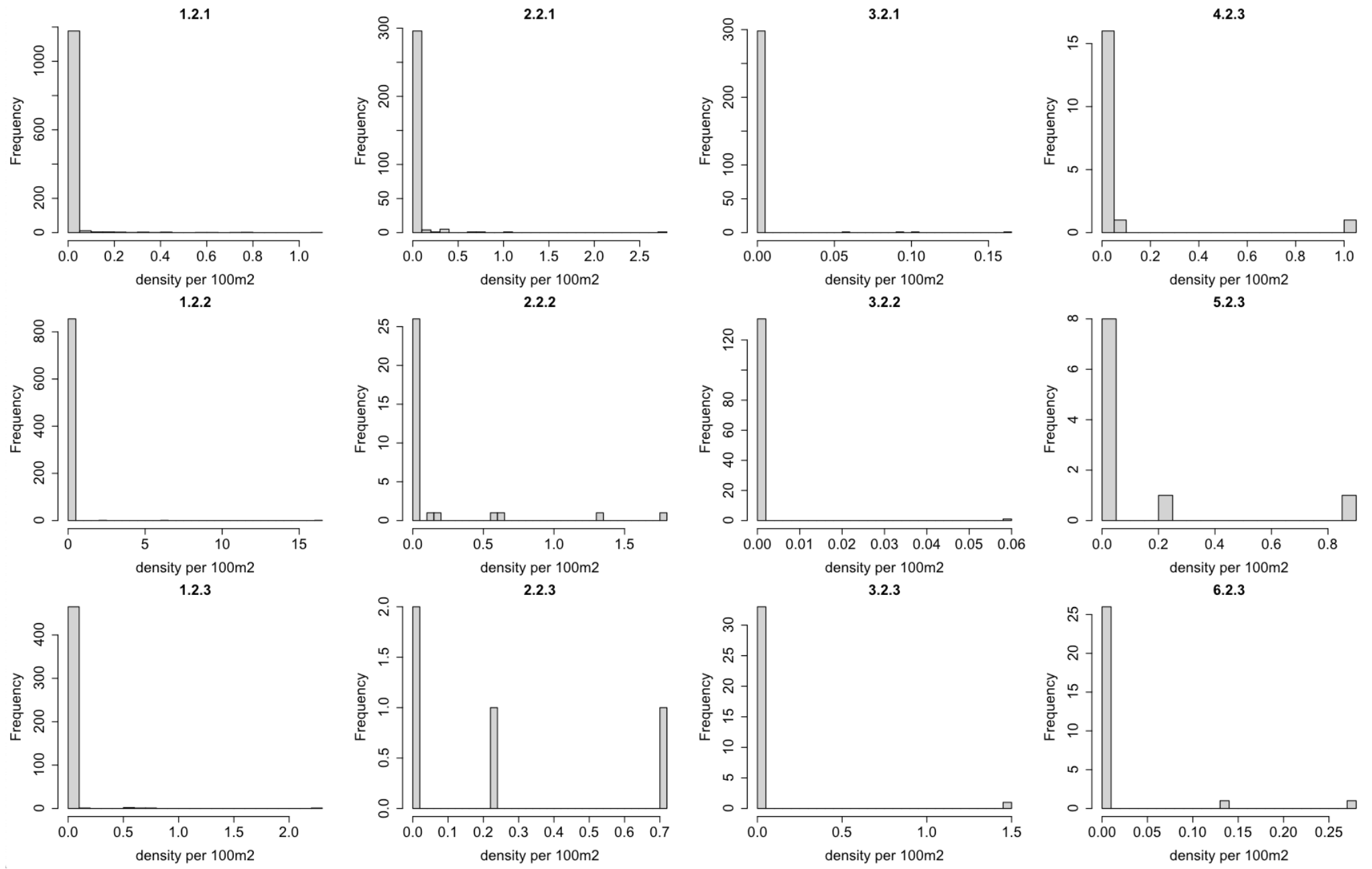
$$\bar{x} = \sum_{h=1}^K \frac{N_h}{N} \bar{x}_h \text{ and } s_{\bar{x}}^2 = \sum_{h=1}^K \left[\left(\frac{N_h}{N} \right)^2 \left(1 - \frac{n_h}{N_h} \right) \frac{s_h^2}{n_h} \right]$$

Unclassified bottom population estimates

- Texas data came from acoustic/camera and camera sled tows.
- Louisiana data came from camera sled tows.
- Mississippi and Alabama data came from camera sled tows.
- Florida data came from ROV surveys.

For some regions, depths, and RF categories data was not collected. This occurred for 2 strata in Florida and the mean and variance from most similar strata was used. For Mississippi and Alabama all missing strata (4) were assigned the mean and variance from the deepest most probable RF category.

Unclassified bottom population estimates



~88% 0s

Unclassified bottom population estimates

	Region	Depth	RF Class	Density	Variance	n	strata_size	weight	pop_est
TX	1	1	1	0.06033407	0.05269153	756	157453713	0.05772725	9,499,824
TX	1	1	2	0.00891302	0.00077386	552	111669030	0.04094122	995,309
TX	1	1	3	0.00596402	0.00057299	211	30803895	0.01129363	183,715
TX	1	2	1	0.00957834	0.00393359	1213	95597496	0.03504891	915,665
TX	1	2	2	0.0316949	0.348413	858	102106413	0.03743527	3,236,253
TX	1	2	3	0.01284231	0.01417141	471	27900774	0.01022926	358,310
TX	1	3	1	0.00431688	0.00240629	2048	32748219	0.01200648	141,370
TX	1	3	2	0.0052552	0.00489963	308	9473355	0.00347322	49,784
TX	1	3	3	0	0	18	0	0	-
TX	2	1	1	0.01134044	0.00124725	30	207383571	0.07603304	2,351,821
	Region	Depth	RF Class	Density	Variance	n	strata_size	weight	pop_est
LA	2	1	2	0	0	37	74126178	0.02717688	-
LA	2	1	3	0	0	7	13552110	0.00496861	-
LA	2	2	1	0.02653597	0.03356709	310	136972944	0.05021839	3,634,709
LA	2	2	2	0.14382776	0.15976647	32	59669946	0.02187679	8,582,194
LA	2	2	3	0.23660766	0.11512581	4	6830244	0.00250417	1,616,088
LA	2	3	1	0.03320594	0.14945434	677	42901326	0.01572891	1,424,579
LA	2	3	2	0.01750342	0.01931428	403	13880484	0.005089	242,956
LA	2	3	3	0	0	40	0	0	-
	Region	Depth	RF Class	Density	Variance	n	strata_size	weight	pop_est
MS/AL	3	1	1	0.03011908	0.02291054	84	60897501	0.02232685	1,834,177
MS/AL	3	1	2	0.03011908	0.02291054	84	35533161	0.01302752	1,070,226
MS/AL	3	1	3	0.03011908	0.02291054	84	11347614	0.00416038	341,780
MS/AL	3	2	1	0.00137536	0.00016062	302	25024788	0.00917484	34,418
MS/AL	3	2	2	0.00044181	2.64E-05	135	22733217	0.00833468	10,044
MS/AL	3	2	3	0.04311521	0.06320333	34	7257033	0.00266065	312,889
MS/AL	3	3	1	0.03011908	0.02291054	84	4790016	0.00175616	144,271
MS/AL	3	3	2	0	0	40	1437588	0.00052706	-
MS/AL	3	3	3	0.03011908	0.02291054	84	72090	2.64E-05	2,171

Unclassified bottom population estimates

	Region	Depth	RF Class	Density	Variance	n	strata_size	weight	pop_est	
FL		4	1	1	0	0	23	20090835	0.0073659	-
FL		4	1	2	0.136871	0.20607038	11	11452023	0.00419866	1,567,450
FL		4	1	3	0.01285426	0.00297418	18	3990708	0.00146311	51,298
FL		4	2	1	0.00805124	0.00110198	17	11478591	0.0042084	92,417
FL		4	2	2	0	0	7	6925176	0.00253898	-
FL		4	2	3	0	0	5	2200770	0.00080687	-
FL		4	3	1	0	0	13	15565122	0.00570664	-
FL		4	3	2	0.019553	0.00267624	7	978966	0.00035892	19,142
FL		4	3	3	0	0	6	76140	2.79E-05	-
FL		5	1	1	0.01851174	0.00630819	77	194596587	0.07134495	3,602,321
FL		5	1	2	0.07168247	0.19871312	138	80302752	0.0294414	5,756,300
FL		5	1	3	0.09247656	0.17140416	210	64872900	0.02378435	5,999,222
FL		5	2	1	0.01851174	0.00630819	77	30133539	0.01104786	557,824
FL		5	2	2	0.04946667	0.01103032	10	40256352	0.01475919	1,991,348
FL		5	2	3	0.04767936	0.01374081	10	50744880	0.0186046	2,419,483
FL		5	3	1	0	0	2	32949585	0.01208031	-
FL		5	3	2	0	0	2	4192317	0.00153703	-
FL		5	3	3	0.09247656	0.17140416	210	450684	0.00016523	41,678
FL		6	1	1	0.00387371	0.00043503	53	339052473	0.12430681	1,313,390
FL		6	1	2	0.02653621	0.01186784	49	23426739	0.00858895	621,657
FL		6	1	3	0.0097765	0.00128856	28	9324882	0.00341878	91,165
FL		6	2	1	0.03158562	0.00672491	13	183583584	0.06730725	5,798,601
FL		6	2	2	0	0	10	93833883	0.03440232	-
FL		6	2	3	0	0	14	93010518	0.03410045	-
FL		6	3	1	0	0	15	98706114	0.03618862	-
FL		6	3	2	0	0	6	19281888	0.00706932	-
FL		6	3	3	0	0	4	3904767	0.0014316	-

Artificial structure population estimates

- Texas data came from acoustics and species composition.
- Louisiana data was imputed from Texas.
- Mississippi and Alabama data came from corrected MaxN counts.
- Florida data came from ROV surveys.

Data, by region and depth, were assumed to come from **simple random samples with no measurement error**. In Florida stratification provided no benefit so structure category was not used. In Texas, estimates were made for small and extra large categories. Louisiana imputed data were assumed from extra large structures. Mississippi/Alabama data were from small structures and had a correction factor (0.06).

Total population values were estimated from expanded means and variances. Total estimates for the number of sampling units in each category were obtained from state and federal records.

Artificial structure population estimates

	Number of reefs	density per reef	variance	count	Populaiton Estimate
TX - XL	1775	524.392608	1155167.69	45	930,797
TX - SM	3406.76923	37.3532784	730.944695	4	127,254
TX - Total					1,058,051
LA - XL	4573	1474.83854	8773713.51	42	6,744,437
AL MS - SM	11617	107.048932	6319.03651	198	1,243,587
FL	7763	15.8930105	564.550031	84	123,377

Known hard bottom population estimates

At the region and depth level samples from each region were assumed to be **simple random samples with no measurement error** and mean and variances were calculated accordingly.

- Texas – density from acoustics paired with species composition
- Louisiana – imputed from Texas
- Mississippi and Alabama – Corrected maxN numbers per habitat unit.

Total population values were estimated from expanded means and variances.

Known hard bottom population estimates

	Size	Units	mean density	unit	variance	sample size	Population Estimate
TX	1916.1144	km2	0.38975666	100m2	0.80832316	36	7,468,184
LA	1329.2194	km2	0.55344899	100m2	1.23381087	22	7,356,551
AL MS	211.25	km2	2.02077338	100m2	5.72215324	32	4,268,884

Pipeline population estimates

Pipeline was classified into 3 categories (8"-12", 12-24, 24+). Total pipeline distance was calculated from the BOEM georeferenced database of active pipeline. Data was subsampled to account for potential spatial covariation.

Data were counts from segmented continuous towed video. Video segment per tow were subsampled by every 40th segment from random starting point within the first 100 observations given the results of Moran's I and spatial autocorrelation tests.

For each pipe category a mean density per linear distance was calculated. Total population values for each pipe category were estimated from expanded means and variances.

Pipeline population estimates

Pipe	Category	Density per lineal m	variance	pipelines sampled	total distance of pipe (m)	Population Estimate
8-12in	1	0.01343958	0.00016967	6	20109782	270267
12-24in	2	0.01225711	0.00032329	11	12535564	153650
>24in	3	0.02981624	0.00459149	10	7268421	216717
Total					39913767	640634

Thank you !