SEDAR52-WP-15: Reproductive data compiled for the Gulf of Mexico Red Snapper, *Lutjanus campechanus*, SEDAR 52

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Reproductive data compiled for the Gulf of Mexico Red Snapper, *Lutjanus campechanus,* SEDAR 52

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Data overview:

- This document was prepared as a contribution to SEDAR 52 and summarizes red snapper reproductive data obtained from research survey samples or specimens otherwise harvested from the Gulf of Mexico (GOM).
- GOM red snapper reproductive potential has been modeled based on batch fecundity (BF) and female spawning fraction (SF) at size & age, with an age-based fecundity vector used as input for SEDAR 31 (Porch et al. 2013, Cass-Calay et al. 2015 SEDAR 2014 update assessment, Porch et al. 2015).
- SEDAR31 & update utilized batch fecundity data covering years 1992-2011, n= 591 records based on age, n=648 based on length. The S31 BF data are compiled from several studies and sources (see Table 2.13.11 SEDAR 31 Stock Assessment Report 2013). In 2011, a Gulf-wide multi-vessel survey was conducted that provided ovarian samples of red snapper females throughout their spawning season. Based upon histological examination of n=1002 females (by length, n=992 by age), the proportion of females bearing spawning markers (postovulatory follicles and hydrated oocytes) was used to estimate spawning fraction. The SF results from 2011 together with BF data were then used to develop a statistical model of egg production (Porch et al. 2013, 2015).
- SEDAR 52 available new batch fecundity data: new BF data are available from years 2007-2016 and sum to 248 records by age and 256 records by length. Most of these records for batch fecundity (n=221) are from years 2012-2015. Data providers of processed BF records include the NMFS Panama City Laboratory, University of Florida (Debra Murie, PI), and Louisiana Department of Wildlife and Fisheries (Eric Lang, PI). Most BF records were from scientific surveys and tournaments with 68% of samples obtained by hook and line fishing (Figure 1). BF Samples were obtained Gulf-wide with most (66%) from the eastern Gulf.
- SEDAR52 available new spawning fraction data: new SF data are available from years 2012-2016 and sum to 949 histological records by age and 1008 records by length. These records are provided by the NMFS Panama City Laboratory and sourced from SEFSC fishery-independent surveys (reef fish and longline) and observer programs (Galveston and shark-bottom long-line programs). Most SF records were obtained from scientific surveys and recreational fisheries with 59% of samples obtained using hook and line gear (Figure 2). SF samples were obtained Gulf-wide with most (57%) from the eastern Gulf.

Results:

- BF data available for S52 largely overlap observations used for SEDAR-31 by size but reflect smaller BF values at age particularly for youngest females (Figure 3).
- Differences are most pronounced by region when all BF data are combined. For youngest and smallest females from the western GOM, observations of BF tend to be lower at age and size (Figure 4). However, there are more observations of BF from larger and older females (> 700 mm FL, > age 9) from the western GOM presumably related to greater occurrence of older females in the west.
- Overall, spawning fraction (SF) trends to increase with size and age (discounting effect of low sample numbers among smallest size bins). This trend, observed for S31, is also apparent for S52. However, differences are evident for the new SF results; SF is greater at size and age (regions combined).
- As with BF findings, SF differences are also evident by region. For youngest and smallest females, SF is lower in the western GOM.
- With the increased data, regional differences in reproductive output at size/age are becoming more apparent. As with observations of delayed maturity among western compared to eastern females (SEDAR 31 life history review), we see lower reproductive effort in the west in terms of batch fecundity and spawning fraction—among smallest and youngest females. Thus older females may be contributing more to egg production in the west contrasted with the eastern Gulf.
- As noted in Porch et al. 2015, these regional differences may be related to recovery of red snapper and potential for density dependent changes in surplus energy for growth and reproduction. These observations are also consistent with other observers noting regional and temporal reproductive and growth differences (Glenn et al. 2017, Kulaw et al. 2017, Nieland et al. 2007).

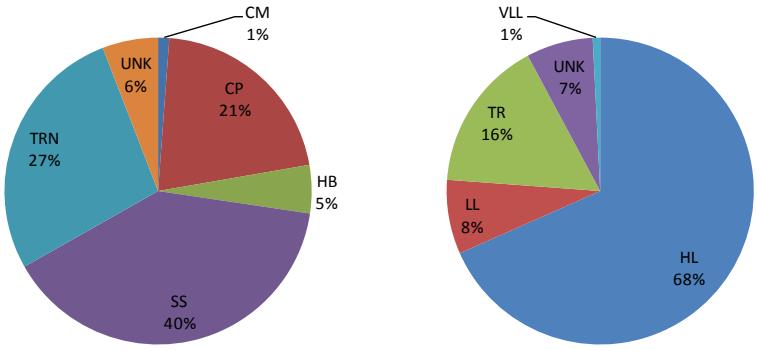


Figure 1. Available BF records for S52 by mode and gear. Mode notations: TRN-tournament, SS-scientific survey, HB-headboat, CP-charter party, CM-commercial, and UNK-unknown. Gear notations: HL-hook and line, VLL-vertical long line (SEAMAP), UNK-unknown, TR-trap, LL-long line.

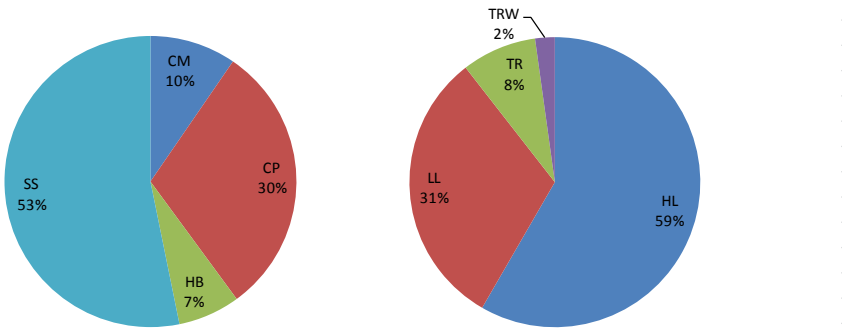


Figure 2. Available SF records for S52 by mode and gear. Mode notations: SS-scientific survey, HB-headboat, CP-charter party, CM-commercial. Gear notations: HL-hook and line, TRW-trawl, TR-trap, LL-long line.

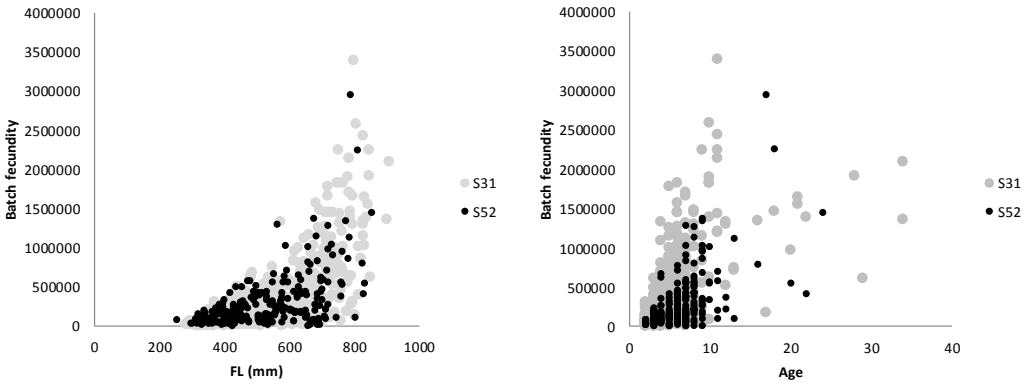


Figure 3. BF by length and age contrasting S31 and S52. One outlier (BF=7980111, S31, not shown).

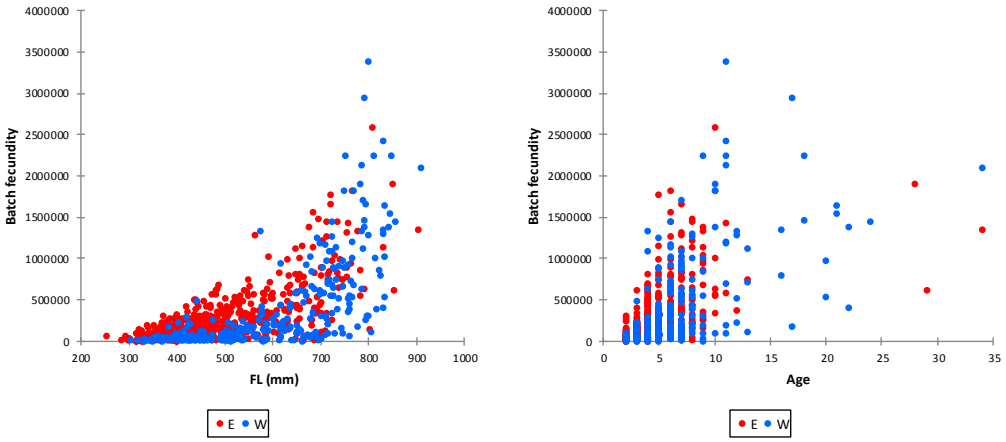
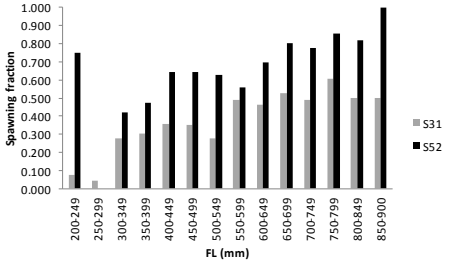


Figure 4. BF by length and age contrasting eastern and western GOM samples (S31 and S52 values combined). One outlier (BF=7980111, S31, not shown).

FL bin	S31	S52
200-249	0.077	0.750
250-299	0.047	0.000
300-349	0.278	0.423
350-399	0.302	0.472
400-449	0.356	0.646
450-499	0.353	0.642
500-549	0.278	0.628
550-599	0.491	0.558
600-649	0.465	0.695
650-699	0.529	0.802
700-749	0.492	0.776
750-799	0.609	0.857
800-849	0.500	0.818
850-900	0.500	1.000
N=	1002	1008



Age	S31	S52
2	0.164	0.412
3	0.192	0.533
4	0.379	0.616
5	0.344	0.520
6	0.420	0.659
7	0.511	0.690
8	0.422	0.683
9	0.560	0.792
10	0.778	0.643
11	0.643	0.889
12+	0.517	0.831
N=	992	949

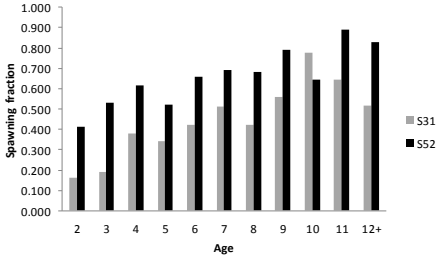
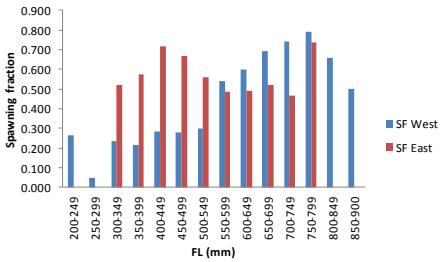


Figure 5. SF by length and age contrasting S31 and S52.

FL bin	SF West	SF East
200-249	0.267	0.000
250-299	0.049	0.000
300-349	0.236	0.520
350-399	0.216	0.573
400-449	0.286	0.718
450-499	0.278	0.667
500-549	0.301	0.560
550-599	0.542	0.487
600-649	0.602	0.491
650-699	0.691	0.519
700-749	0.741	0.468
750-799	0.792	0.737
800-849	0.659	
850-900	0.500	
N=	1188	822



Age	SF West	SF East
2	0.172	0.308
3	0.181	0.565
4	0.311	0.609
5	0.315	0.527
6	0.513	0.547
7	0.597	0.583
8	0.511	0.740
9	0.747	0.750
10	0.674	0.632
11	0.778	1.000
12+	0.680	0.778
N=	1149	792

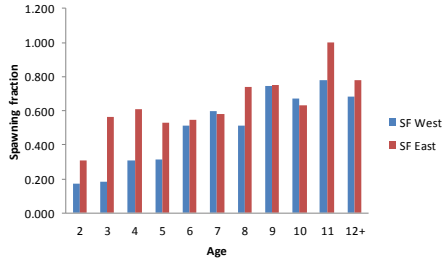


Figure 6. SF by length and age contrasting eastern and western samples (S31 and S52 values combined).

References:

Cass-Calay, S.L, C.E. Porch, D.R. Goethel, M.W. Smith, V. Matter, and K.J. McCarthy. 2015. Stock assessment of Red Snapper in the Gulf of Mexico 1872-2015 – with provisional 2014 landings. SEDAR Red Snapper 2014 Update Assessment, North Charleston, SC. 242 p.

Glenn, H.D., J.H. Cowan and J.E. Powers. 2017. A Comparison of Red Snapper Reproductive Potential in the Northwestern Gulf of Mexico: Natural versus Artificial Habitats. Marine and Coastal Fisheries 9:139-148.

Kulaw, D.H., J.H. Cowan and M.W. Jackson. 2017. Temporal and spatial comparisons of the reproductive biology of northern Gulf of Mexico (USA) red snapper (*Lutjanus campechanus*) collected a decade apart. PLoS ONE 12(3):e0172360. https://doi.org/10.1371/journal.pone.0172360.

Nieland, D.L. C.A. Wilson III and A.J. Fischer. 2007. Declining size at age among red snapper in the northern Gulf of Mexico off Louisiana, USA: Recovery or Collapse?

Porch, C.E., G.R. Fitzhugh, and B.C. Linton. 2013. Modeling the dependence of batch fecundity and spawning frequency on size and age for use in stock assessments of red snapper in U.S. Gulf of Mexico waters. SEDAR31-AW03.

Porch, C.E., G.R. Fitzhugh, E.T. Lang, H.M. Lyon and B.C. Linton. 2015. Estimating the dependence of spawning frequency on size and age in Gulf of Mexico red snapper. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 7(1):233-245.