

Summary Table of Gag, (<u>Mycteroperca microlepis</u>) life history for the Gulf of Mexico. Associations and interactions with environmental and habitat variables are listed with citations.												
							Trophic relationships		Habitat Associations and Interactions			
Life Stage	Season	Location	Temp(°C)	Salinity(ppt)	Oxygen	Depth(m)	Food	Predators	Habitat Selection	Growth	Mortality	Production
Egg	Dec-Apr	Offshore; area of abundance: west Florida shelf	Hatch in 45h at 21.0 C			Pelagic						
Citation	4,5,9,13	13,24	19			7						
Larvae	Early Spring; stage lasts 40-50 days	Larvae move inshore				Pelagic						
Citation	13,24	21				13,19						
Postlarvae (Pelagic Juveniles)	Recruit to seagrass beds in April-May	Move through inlets into coastal lagoons and high-salinity estuaries							Move into estuaries, settling into seagrass beds			Successful larval transport into estuaries dependent upon oceanographic conditions
Citation	21	10,21							10,13,21			10
Early Juveniles (Benthic Juveniles)	Late spring to early fall	Spend 3-5 months inshore and estuarine habitats	Collected at 22-32 C	Collected at 25.9 - 35.5 ppt		Very shallow to 12 m; most common <5m	Predominately crustaceans, such as amphipods, copepods, and grass shrimp	Survival near 100% in seagrass beds	Seagrass beds in sheltered bays, lagoons, coastal grass flats and oyster beds. Move to offshore in fall to shallow reef habitat	Grow rapidly during association with seagrass beds		Availability of estuarine habitat critical to survival and growth
Citation	1,2,13,21,2,4	13,21,24	13,21	3,13		6,7,24	2,13,21,23	28	1,6,13,21,24	21		10Gag (<u>Mycteroperca microlepis</u>) cont.
							Trophic relationships		Habitat Associations and Interactions			
Life Stage	Season	Location	Temp(°C)	Salinity(ppt)	Oxygen	Depth(m)	Food	Predators	Habitat Selection	Growth	Mortality	Production
Late Juveniles	Recruit to offshore reefs in fall		22-32C	28.8-37.6ppt		1-50m	Primarily decapod crustaceans and fishes	Cannibalistic; also larger fishes. Survival near 100% in seagrass beds	Inshore seagrass beds and rock piles; move into deeper hard bottom habitats as size increases		Small gag vulnerable to recreational fishery; also are part of shrimp fishery bycatch	
Citation	13,21		3,13	3,11,13		2,26	2,15,21,23	24, 28	2,7,21		2,26	

Adults	More common in fishery in northeast gulf in summer; winter in southeast	Most common eastern Gulf of Mexico, especially west Florida shelf	14-24 C		A mean DO of 6.6 mg/L was used in culture experiments	20-100 m; larger fish occur at greater depths	Mainly fishes; also crustaceans and cephalopods	Top predators such as sharks	Hard bottom; offshore reefs and wrecks; coral and live bottoms; depressions and ledges	Growth rate greater in 1991 than in 1979-1980	Vulnerable to sudden low temperatures; fishing mortality	
Citation	22,24	20,24	20		18	2,9,13,20	2,6,15,16,23	2	2,6,13	29	2	
Spawning Adults	Protogynous hermaphrodites; spawn Dec-Apr with peak in early spring (Mar-Apr) on west Florida shelf	Offshore; major spawning area on west Florida shelf	Spawning induced at 21-30C in culture experiments	Min. of 30 ppt was used in culture experiments		50-120m			Major spawning habitat on west Florida shelf. Form spawning aggregations		Spawning aggregations vulnerable to fishery; fishing may cause reduction of proportion of males in population and a decrease in size at transition from female to male	Annual fecundity estimated at 0.065 to 61.4 million
Citation	4,5,9,13,14,25	2,4,25	18,19	18		4,8,25			25		4,25	27

Gag Grouper Table References

1. Beaumariage, D.S., and L.H. Bullock. 1976. Biological research on snappers and groupers as related to fishery management requirements. Fla. Sea Grant Prog. Rep. no. 17:86-94.
2. Bullock, L.H., and G.B. Smith. 1991. Seabasses (Pisces: Serranidae). Fla. Mar. Res. Inst., Mem. Hourglass Cruises 8(2), 243 p.
3. Christensen, R.F. 1965. An ichthyological survey of Jupiter inlet and Loxahatchee River, Florida. M.S. Thesis, Florida State Univ., 318 p.
4. Coleman, F.C., C.C. Koenig, and L.A. Collins. 1996. Reproductive styles of shallow-water groupers (Pisces: Serranidae) in the eastern Gulf of Mexico and the consequences of fishing spawning aggregations. Environ. Biol. Fishes 47:129-141.
5. Collins, M.R., C.W. Waltz, W.A. Roumillat, and D.L. Stubbs. 1987. Contribution to the life history and reproductive biology of gag, *Mycteroperca microlepis* (Serranidae), in the South Atlantic Bight. Fish. Bull. (U.S.) 85(3):648-653.
6. Gulf of Mexico Fishery Management Council. 1981. Final environmental impact statement for the reef fish fishery of the Gulf of Mexico. Section 4. Gulf of Mex. Fish. Manage. Council., Tampa, FL.
7. Hardy, J.D., Jr. 1978. Development of fishes of the Mid-Atlantic Bight: an atlas of egg, larval and juvenile stages. U.S. Fish Wildl. Serv. Biol. Serv. Prog. 78/12, v. III:64-66.
8. Heemstra, P.C., and J.E. Randall. 1993. FAO species catalogue, v. 16. Groupers of the world. FAO Fish. Synop. no. 125:269-270.
9. Hood, P.B., and R.A. Schlieder. 1992. Age, growth, and reproduction of gag, *Mycteroperca microlepis* (Pisces: Serranidae), in the eastern Gulf of Mexico. Bull. Mar. Sci. 51(3):337-352.
10. Keener, P., G.D. Johnson, B.W. Stender, E.B. Brothers, and H.R. Beatty. 1988. Ingress of postlarval gag, *Mycteroperca microlepis* (Pisces: Serranidae), through a South Carolina barrier island inlet. Bull. Mar. Sci. 42(3):376-396.
11. Lindall, W.N., Jr., J.R. Hall, W.A. Fable, Jr., and L.A. Collins. 1973. A survey of fishes and commercial invertebrates of the nearshore and estuarine zone between Cape Romano and Cape Sable, Florida. U.S. Dep. Commer., Natl. Mar. Fish. Serv., St. Petersburg, FL, 62 p.
12. Low, R.A., and G.F. Ulrich. 1982. Reef fishes and associated management issues in South Carolina. S.C. Wildl. Mar. Resour. Dep., Educ. Rep. no. 14, 49 p.
13. McErlean, A.J. 1963. A study of the age and growth of the gag, *Mycteroperca microlepis* Goode and Bean (Pisces: Serrandiae) on the west coast of Florida. Fla. Board Conserv. Mar. Lab. Tech. Ser. 41, 29 p.
14. McErlean, A.J., and C. Lavett Smith. 1964. The age of sexual succession in the protogynous hermaphrodite *Mycteroperca microlepis*. Trans. Am. Fish. Soc. 93(3):301-302.
15. Mullaney, M.D., Jr. 1994. Ontogenetic shifts in the diet of gag, *Mycteroperca microlepis* (Goode and Bean) (Pisces: Serranidae). Proc. Gulf Caribb. Fish. Inst. 43:432-445.

16. Naughton, S.P., and C.H. Saloman. 1985. Food of gag (*Mycteroperca microlepis*) from North Carolina and three areas of Florida. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFC-160, 36 p.
17. Reid, G.K., Jr. 1952. A study of the gulf fishes in the vicinity of Cedar Key, Florida. Ph.D. Diss., Univ. Florida, 235 p.
18. Roberts, D.E., Jr., C.W. Dennis, G. Harrington, and A. Burke. 1994. Captive broodstock maintenance and photothermal induction of gonadal maturation in gag, *Mycteroperca microlepis* and jewfish, *Epinephelus itajara*, for controlled production of fry. Proc. Gulf Caribb. Fish. Inst. 43:429-430.
19. Roberts, D.E., Jr., and R.A. Schlieder. 1983. Induced sex inversion, maturation, spawning and embryogeny of the protogynous grouper *Mycteroperca microlepis*. J. World Maricult. Soc. 14:639-649.
20. Roe, Richard B. 1976. Distribution of snappers and groupers in the Gulf of Mexico and Caribbean Sea as determined from exploratory fishing data. Fla. Sea Grant Prog. Rep. no 17:129-164.
21. Ross, S.W., and M.L. Moser. 1995. Life history of juvenile gag, *Mycteroperca microlepis*, in North Carolina estuaries. Bull. Mar. Sci. 56(1):222-237.
22. Smith, G.B. 1978. Ecology and distribution of mid-eastern Gulf of Mexico reef fishes. Ph.D. Diss., Univ. South Florida, 254 p.
23. Weaver, D.C. 1996. Feeding ecology and ecomorphology of three sea basses (Pisces: Serranidae) in the northeastern Gulf of Mexico. M.S. Thesis, Univ. Florida, 93 p.
24. Koenig, C.C., Natl. Mar. Fish. Serv., Panama City, FL, pers. comm.
25. Koenig, C.C., F.C. Coleman, L.A. Collins, Y. Sadovy, and P.L. Colin. 1996. Reproduction in gag (*Mycteroperca microlepis*) (Pisces: Serranidae) in the eastern Gulf of Mexico and the consequences of fishing spawning aggregations. p. 307-323 In: F. Arreguin-Sanchez, J.L. Munro, M.C. Balgos and D. Pauly (eds.), Biology, fisheries and culture of tropical groupers and snappers. ICLARM Conf. Proc. 48.
26. Johnson, A.G., M.S. Baker, Jr., and L.A. Collins 1997. Preliminary examination of undersized grouper bycatch. Proc. Gulf Caribb. Fish. Inst. 49:161-172.
27. Collins, L.A., A.G. Johnson, C.C. Koenig, and M.S. Baker, Jr., 1998. Reproductive patterns, sex ratio, and fecundity in gag, *Mycteroperca microlepis* (Serranidae) a protogynous grouper from the northeastern Gulf of Mexico. Fish. Bull. 96:415-427.
28. Koenig, C.C., and F.C. Coleman. 1998. Absolute abundance and survival of juvenile gags in seagrass beds of the northeastern Gulf of Mexico. Trans. Am. Fish. Soc. 127:44-55.
29. Johnson, A.G., L.A. Collins and J.J. Isley. 1993. Age-size structure of gag, *Mycteroperca microlepis*, from the northeastern Gulf of Mexico. Northeast Gulf Science. 13(1)59-63.