View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Aquila Digital Community

Northeast Gulf Science

Volume 4
Number 1 *Number 1*

Article 9

9-1980

Ageing Red Snapper, *Lutjanus campechanus*, with Otoliths, Scales and Vertebrae

Stephen A. Bortone
University of West Florida

Charles L. Hollingsworth
University of West Florida

DOI: 10.18785/negs.0401.09
Follow this and additional works at: https://aquila.usm.edu/goms

Recommended Citation
Bortone, S. A. and C. L. Hollingsworth. 1980. Ageing Red Snapper, *Lutjanus campechanus*, with Otoliths, Scales and Vertebrae. Northeast Gulf Science 4 (1).
Retrieved from https://aquila.usm.edu/goms/vol4/iss1/9

This Article is brought to you for free and open access by The Aquila Digital Community. It has been accepted for inclusion in Gulf of Mexico Science by an authorized editor of The Aquila Digital Community. For more information, please contact Joshua.Cromwell@usm.edu.

60 Northeast Gulf Science Vol. 4, No. 1 September 1980

AGEING RED SNAPPER, *Lutjanus campechanus*, WITH OTOLITHS, SCALES, AND VERTEBRAE

In the northern Gulf of Mexico the red snapper, *Lutjanus campechanus,* is considered one of the most important commercial and recreational fishes both by weight and economic value. The colloquium on the snapper-grouper fishery (Bullis and Jones, 1976) produced numerous references pertaining to the decline of red snapper catch in recent years. This decline has been further substantiated by the, as yet unpublished, Fisheries Management Plan on Reef Fish Resources submitted to the Gulf of Mexico Fishery Management Council (Tampa, FL).

In attempting to further clarify and describe the life history of the red snapper for management purposes it is essential to have an accurate data base on its biological parameters. There have been, to date, several studies concerned with ageing red snapper: Moseley (1966) used scales to age red snapper off Texas and Louisiana; Bradley and Bryan (1974) used length-frequency to age fish off Texas; and Futch and Bruger (1976) used otoliths for ageing red snapper from the west coast of Florida. There have been, however, some problems noted in the literature with regard to ageing fish from subtropical waters (Mathews, 1974). Additionally, there have been questions raised as to the use of scales in ageing *Lutjanus* spp. (Moseley, 1966; Pino, 1962; Talbot, 1960).

In this study we estimated the age of a population of *L. campechanus* from the northern Gulf of Mexico. The specimens were aged using hard parts (i.e., otoliths, scales, and vertebrae). These age data were used to evaluate the hypothesis of comparability of age determination utilizing different body parts.

MATERIALS AND METHODS

Specimens were obtained by hook-and-line or fish trap from artificial reefs located 5-8 km S of Orange Beach, Alabama (30° 15′ N lat) from a depth of 8-12 m on 17 October 1978. Both sagitta otoliths were removed, rinsed with tapwater and stored in a 9:1 solution of 95% ethanol and glycerin. Otoliths were allowed to clear for six months in this solution before being aged. Scales were removed from an area under the left pectoral fin, rinsed with tapwater, and mounted between two microscope slides. The first three thoracic vertebrae were removed and air dried. All materials were studied by a stereomicroscope with transmitted, darkfield and/or reflected light. Standard length (SL) was measured on each fish to the nearest mm.

An annular growth or age-group mark on an otolith was considered to be a distinct boundary between the opaque and translucent areas along the longitudinal axis of the otolith (Fig. 1). Annuli on scales were considered to occur at areas of changes in the junction on circuli on the lateral field of the scale (Fig. 2). Annular rings on vertebrae occurred between dense and less dense patterns of bone matrix in the coelous portion of the centrum (Fig. 3). All materials were aged at least twice to insure reliability. Materials with questionable or incomplete annuli or growth rings were noted but not used in age determination. Whether or not the annuli or age-group marks represent years or parts of years is being examined in a three year study on the life history of these fish (Bortone and Hollingsworth, in prep.). We prefer to assign fish to age-groups, as indicated by annuli, until verifying data are available.

Statistical procedures were conducted according to Siegel (1956).

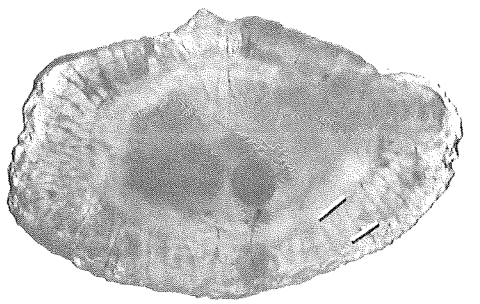

Figure 1. Otolith (transmitted illumination) from an age-group 2 red snapper, 230mm SL. Annuli are indicated by black lines.

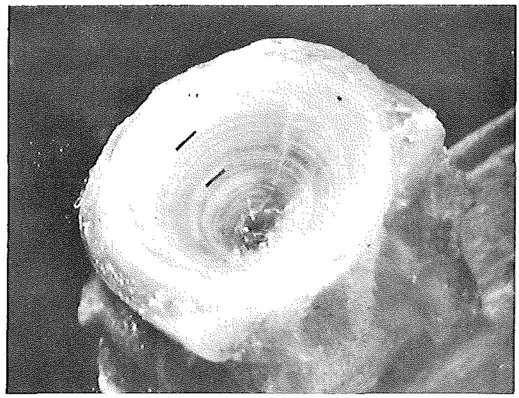

Figure 3. Posterior-lateral view of the acoelous portion of the vertebrae from an age-group 2 red snapper, 222mm SL. Annuli are indicated by black lines.

RESULTS

Forty-six specimens of red snapper from the sample area were examined to compare methods of ageing using otoliths, scales and vertebrae. Not all specimens could be utilized for ageing in all methods as often annuli or growth rings were difficult to discern, lacking, or morphologically distorted. Of the 46 fish examined, otoliths could be used to age 37 fish (80.4%), scales 36 (78.3%), and vertebrae 35 (76.1%). A Chi-Square test was used to test the hypothesis that the proportion of readable hard parts was the same for all methods. The calculated Chi-Square of .256 at 2 degrees of freedom (df) indicated that we cannot reject the null hypothesis at the .05 level. We therefore assume the proportion of readable materials equal for otoliths, scales and vertebrae.

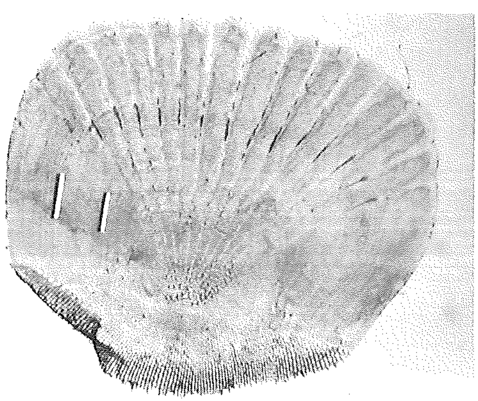

Figure 2. Scale (dark field) from an age-group 2 red snapper, 222mm SL. Annuli are indicated by black lines.

A comparison was made between the lengths of fish ascribed to age-group 1 as determined by the three methods of ageing (Fig. 4).

The average length of fish in age-group 1 using otoliths for age determination was 159.25 mm SL (standard deviation = 8.13), scales 163.76 (17.98), and vertebrae 165.24 (11.12). An ANOVA analysis of length produced an F value of 1.212 (df = 57) which indicates no significant differences between the mean lengths at $\alpha = .05$. Similarly, there was no significant difference between mean length of fish ascribed to age-group 2 (F = 2.023, df = 49). The mean lengths for age-group 2 were 193.65 (19.82), 193.79 (19.99), and 205.64 (15.60) for fish aged by otoliths, scales, and vertebrae respectively.

Not all fish were ascribed to the same age-group using all three methods. In comparable fish, for which age data were obtained with both otoliths and scales, there was agreement in 25 out of 29 fish; for otoliths and vertebrae, 25 out of 29; and for scales and vertebrae, 20 out of 26. To

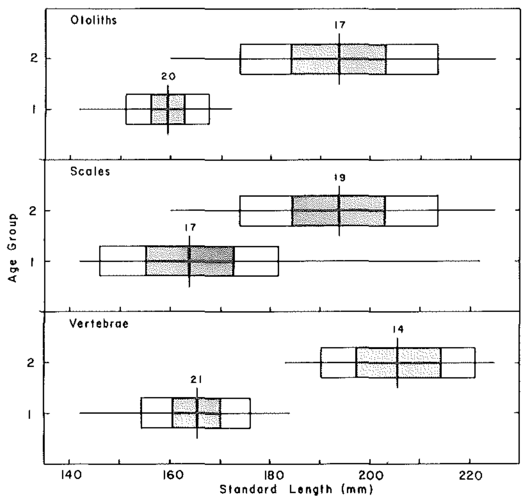

Figure 4. Summary of length data as determined by method of ageing (otoliths, scales, and vertebrae) and age-group (1 or 2). Vertical line indicates mean, horizontal line indicates range, white bar represents ± one standard deviation of the mean and the shaded bar represents ± two standard errors of the mean.

test the hypothesis that there was a difference between the methods as to how they agreed with each other, the McNemar test was employed to test for the significance of change. That is, we assume no difference in the age of a fish as determined by otoliths, scales and/or vertebrae. None of the null hypotheses could be rejected (α = .05) and therefore we assume there were no significant differences in ageing with otoliths, scales and/or vertebrae.

For additional corroboration for otoliths, scales, and vertebrae to distinguish age-groups, a length-frequency histogram for all 46 fish was constructed (Fig. 5). The histogram indicates that a frequency mode occurs at class mark 164.5 mm SL. This value corresponds to 162.74 mm SL as a mean fish length calculated for age-group 1 using otoliths, scales and vertebrae. Another mode occurs at class mark 194.5 mm SL and it corresponds to mean of mean length calculated for age-group 2 (197.06).

DISCUSSION

All three body parts utilized for ageing had a statistically similar level of readability (between 76% - 80%). Futch and Bruger (1976) found 83.3% of red snapper with readable otoliths from the west coast of Florida. Talbot (1960) used scales to age *Lutjanus bohar* from tropical waters off East Africa and could only discern readable scales in 25% of the fish examined. The problem of ageing fish from tropical, subtropical and warm-temperate waters has been discussed by other authors (e.g., Moseley, 1966; Talbot, 1960; Futch and Bruger, 1976; Mathews, 1976). It would appear that *L. campechanus* from inshore, northern Gulf areas are subjected to substantial cyclic change in environmental parameters such as temperature and productivity and that changes in growth rates are readily recorded on fish hard body parts. *L. campechanus* from more thermally mediated areas may not be as easy to age using these same structures.

Statistically all three methods yield similar population parameters with re-

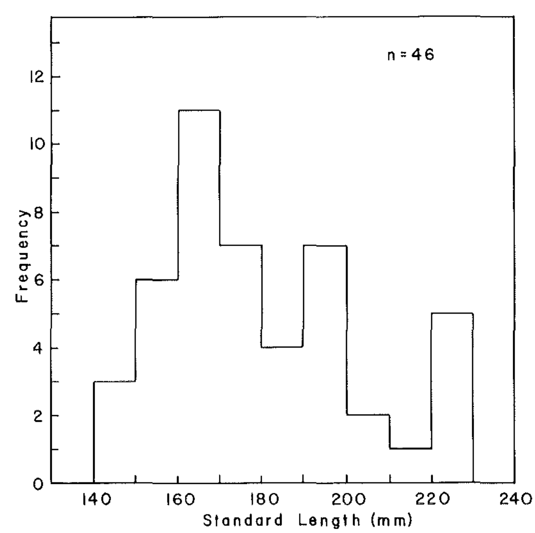

Figure 5. Length-frequency histogram for fish aged by all three methods.

gard to fish length by age-group and comparability between methods. The only obvious discrepancy in the data is the corroborative evidence in the length-frequency histogram. While the first two modal peaks correspond to age-groups 1 and 2 respectively, a third mode occurs (Fig. 5) which needs explanation. The third mode appears to represent a third age-group at class mark 224.5 mm SL. These specimens were ascribed to age-group 2 using ageing techniques. We believe the capture methods employed in the present study may have selected for a predominance of some of the larger fish in the area.

This study indicates that all three methods are similar to each other as to how they describe the age structure of inshore *L. campechanus.* There may, however, be a preference of one method over another based on several factors: (1) larger specimens may be aged more reliably with one type of body part as opposed to another; (2) scales may be more economical to prepare and easier to obtain; (3) researchers may be experienced in using a particular body part for ageing. Nevertheless, it appears that otoliths, scales, and vertebrae each yield comparable and repeatable age information on inshore red snapper.

ACKNOWLEDGMENTS

We thank Capt. Armand Annan for providing his experience and his vessel "The Gulf Rebel"; Dr. J. L. Oglesby for statistical advice; and D. Drysdale, D. Siegel, L. Touart, and K. Armsby for aid in collecting specimens. This article was developed under the auspices of the Florida Sea Grant College with support from the National Oceanic and Atmospheric Administration, Office of Sea Grant, U. S. Department of Commerce, Grant No. 04-8-MO1-76.

LITERATURE CITED

Bradley, E., and C. E. Bryan. 1974. Life history and fishery of the red snapper *(Lutjanus campechanus)* in the Northwestern Gulf of Mexico: 1970-1974. Proc. 27th Ann. Sess. Gulf and Carib. Fish Inst.: 77-106.

Bullis, H. R., Jr., and A. C. Jones (editors). 1976. Proceedings: colloquium on snapper-grouper fishery resources of the western central Atlantic Ocean. Florida Sea Grant Rep. No. 17:1-333.

Futch, R. B., and G. E. Bruger. 1976. Age, growth, and reproduction of red snapper in Florida waters. pp. 165-184. *In:* H. R. Bullis, Jr., and A. C. Jones (eds). Proceedings: colloquium on snapper-grouper fishery resources of the western central Atlantic Ocean. Florida Sea Grant Rep. No. 17.

Mathews, C. P. 1974. An account of some methods of overcoming errors in ageing tropical and subtropical fish populations when hard tissue growth markings are unreliable and the data sparse. pp. 158-166. *In:* T. B. Bagenal (ed). The ageing of fish. Unwin Brothers Limited, Surrey, England.

Moseley, F. N. 1966. Biology of the red snapper, *Lutjanus aya* Bloch, off the Northwestern Gulf of Mexico. Publ. Inst. Mar. Sci. Univ. Texas 11:90-101.

Pino, Z. R. 1962. Estudias estadisticos y biologicos sobre la biajaiba *(Lutjanus synagris).* Notas Invest. Cent. Invest. pesq., Havana, Cuba No. 4:1-91. (as cited by Moseley, 1966).

Siegel, S. 1956. Nonparametric statistics for the behavioral sciences. McGraw-Hill Book Company, New York.

Talbot, F. H. 1960. Notes on the biology of the Lutjanidae (Pisces) of the East African coast, with special reference to *L. bohar* (Forskal). Annals South African Mus. 45(5):549-579.

Stephen A. Bortone and Charles L. Hollingsworth, *Department of Biology, University of West Florida, Pensacola, FL 32504.*