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REPORT OF THE STATE FEDERAL SCUP (STENOTOMUS CRYSOPS) AGE AND GROWTH WORKSHOP

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Louise Dery
Cathy Rearden

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole Laboratory

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The scup workshop was held at the NMFS Northeast Fisheries Center (NEFC), Woods Hole, Massachusetts in response to interest generated during the First Southern New England State Federal Assessment Workshop (July 24-25, 1979). The purpose of this workshop was to establish comparability among fishery biologists regarding scup ageing methods. The scup fishery along the Middle Atlantic and Southern New England coast has become increasingly important and in order to effectively manage this species accurate age and growth information is necessary.

Fourteen biologists participated in the workshop, representing marine fisheries agencies of Massachusetts, Rhode Island, Connecticut, New Jersey, and Southeastern Massachusetts University. Participants and organizations were as follows:

Name	Organization
David Pierce	Massachusetts Division of Marine Fisheries Saltonstall Building 100 Cambridge Street Boston, MA 02202
Richard Sisson Timothy R. Lynch	Rhode Island Division of Fisheries & Wildlife 150 Fowler Street Wickford, RI 02852
Victor Crecco Bob Jacobs Mary Ellen Dore Chris Pane	Connecticut Department of Environmental Protection, Marine Region P.O. Box 248 Waterford, CT 06385
Bruce A. Halgren John F. McClain, Jr.	New Jersey Division of Fish, Game and Wildlife, Nacote Creek Research Station Absceon, NJ 08201
Robert Rak	Southeastern Massachusetts University N. Dartmouth, MA 02714

Name	Organization
Ambrose Jearld, Jr. Louise Dery Michael Campbell Cathy Rearden	Northeast Fisheries Center Woods Hole Laboratory Woods Hole, MA 02543

Overview Session

The Monday morning session began with a discussion of past, present and future scup research efforts by participants. The interest in scup of David Pierce, of the Massachusetts Division of Marine Fisheries; was in response to a 1975 fishermen's petition regarding mesh size regulations and landing quotas for the scup fishery of Nantucket Sound. Scup age and growth determinations are currently part of his Master's thesis work. Richard Sisson of the Rhode Island Division of Fisheries and Wildlife noted that his scup completion report (scup of Narragansett Bay) of 1974 was of limited value due to problems with ageing scup scales. He expressed an interest in validation of the scale method, and in general, updating ageing methods. A research proposal including an age and growth investigation of scup of the Long Island Sound and nearby waters was recently submitted by the Connecticut Department of Environmental Protection. Although the New Jersey Division of Fish, Game and Wildlife was not currently involved in scup ageing, Bruce Halgren and John McClain were reviewing the 1950's age data of Hamer (1970) and plan to resume age and growth determinations in the future. Robert Rak of Southeastern Massachusetts University was interested in a scup research project. Michael Campbell recently submitted a report on the growth rate of scup for the Northeast Fisheries Center, ageing survey and commercial scup samples collected in 1974-1978 over most of the scup geographic range (Massachusetts waters south to Cape Hatteras).

A list of questions generated out of current scup ageing problems were presented by the Northeast Fisheries Center to be considered by participants during the two day workshop. They were as follows:

1. What is presently known about the age and growth of scup?
2. Are the two species, the scup (Stenotomus chrysops) and the long spined or southern scup (Stenotomus aculeatus) likely to be confused?
3. What structure(s) on this species should be used for ageing?
4. What problems exist with the use of this structure(s)? Are validation studies needed?
5. What are the effective methods to prepare and view this structure(s) for ageing?
6. What ageing criteria should be adopted? When are spawning times, periods of fast/slow growth, etc., and how should growth patterns on the age structure(s) be interpreted?
7. After discussion of the above, and some experience with ageing scup, what are levels of agreement among scup age readers when a "blind" sample of scup scale impressions are aged (no information given on the envelope as to fish length, etc.)? If disagreement is significant, where are areas of disagreement? Are specific anomalies responsible?

Aspects of scup life history relevant to age and growth were reviewed, including current information on distribution, migratory patterns, spawning locations and times, age at maturity, stock identification, etc. A summary of published and some recent age and growth data provided by NEFC were discussed. In most of these studies scales were used for age determination. Although it was generally agreed that

most of the published studies were dated and some of limited value due to problems with ageing methods, there are however, two recent sources of data available:

1. David Pierce's mean length at age and growth data for scup of Nantucket Sound (part of his current Master's Thesis work)
2. Michael Campbell's corresponding data, for scup pooled over the years 1974-1978 and sampled from Massachusetts waters south to Cape Hatteras.

A comparison of growth curves of two studies provided by David Pierce indicated overall similarity between the two sets of data, after adjusting for differences in assigned birthdate (Pierce-June, Campbell-January 1). Pierce's mean lengths at age were slightly less than Campbell's for scup ages one and two, and slightly greater for the older age groups. Values for L_∞ in both studies were greater than those reported in previous published studies perhaps due to greater availability of large scup. Michael Campbell reported the oldest ages determined by scales to date - up to age 19.

In terms of validation studies using scup scales, Finklestein (1968) was found to be the most comprehensive study published thus far, establishing the time of completion of annulus formation to be May in most fish but somewhat later in some individuals. He observed a good correlation and a linear relationship (recently confirmed by Pierce) between fish growth and scale growth, and determined growth parameters based upon back calculations. He also noted, observing scale growth, that most growth in scup seems to occur while they are inshore, between the months of June and November.

Workshop on Scale Preparatory Methods

During the remainder of the morning session, a brief workshop was held by Louise Dery demonstrating use of various types of plastics to impress scup scales.

In recent years, NEFC has preferred the use of laminated plastic to impress a variety of species, including haddock, yellowtail flounder, windowpane flounder, winter flounder, scup, fluke and bluefish. This laminated plastic consists of a hard vinyl chloride backing 15-20 thousandths thick with a thin underlayer of soft polyethylene 1.5 thousandths thick (ideally it could be a little thicker, about 2.5 thousandths). The advantage of using this type of plastic is that scales are only impressed into the soft polyethylene, which prevents by its thinness, overimpression of the thick center of a scale in relation to its thinner edge. A fine, even impression of the scale circuli is the result. The softness of the polyethylene layer varies, however, and recently produced laminates that have a lower percentage of acetate (probably to lower costs) hardening the polyethylene (2% acetate in polyethylene relative to the 5% used several years ago) and resulting in lower quality impressions.

In addition to the various types of laminate, other more traditionally used plastics were compared. Cellulose acetate, not demonstrated, has commonly been used to impress fish scales. It is a relatively hard plastic, necessitating the use of high pressure, heat, or solvents to obtain impressions. The resulting impressions are usually heavy; the outline and spacing of circuli are coarse and closely spaced, respectively, making circulus "typing" and counts difficult. Several other plastics that were demonstrated, such as cellulose acetate buterate and particularly

buterate, are softer, however, and impressions are found by NEFC to be fine enough if moderate pressure is combined with the use of a solvent.*

Informal Discussion of Ageing Criteria

A number of laminated scale impressions of scup sampled in recent years including spring through fall months in different areas, inshore and offshore, were provided by NEFC during the afternoon session for discussion by participants. Although overall agreement was high, several sources of disagreement in ages were evident:

1. Difficult to interpret scale edges - summer or winter, complete or incomplete annuli. David Pierce counted the edge annulus in the age only if complete, determined by the presence of "cutting over."** NEFC used a January 1 birthdate combined with the presence of winter edge, determined by circulus type and spacing.
2. Weak first annulus on many scales. Although the first annulus occurs at some distance from the focus, as the average length of young of the year scup in late fall is about 7 cm. (from published studies), it was often difficult to locate as scale growth seemed to be somewhat erratic during the first year.
3. False "cutting over." Cutting over characteristically accompanies annulus formation but evidently may also occur during first and second summer growth.

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* 50/50 EtOH/H_2O combined with several drops of dishwashing detergent.

** "Cutting over" refers to a sharp separation between two rows of circuli, appearing as a white line on the anterior scale edge. Along the lateral scale edges, rows of broken summer circuli intersect obliquely an outer row of winter circuli.

4. Occurrence of checks; particularly those formed during the second summer.
5. Difficulty with ageing older fish, due to the progressive narrowing of zones.
6. Unusual or erratic growth as reflected by the scale. On some scales a repeating pattern of very rapid growth (widely spaced, wavy broken circuli) just prior to annulus formation occurred, causing some ageing difficulties.

Although most of the scale impressions were aged using a micro-projector at 40X, Bruce Halgren and John McClain demonstrated the use of an overhead projection device traditionally used by several state fisheries agencies to age fish scales. A few cellulose acetate impressions of scup scales made by Hamer (1969) were examined; good agreement was reached with his ages of scup collected during the 1950's.

Scup Scale - Otolith Comparisons

During the afternoon session Michael Campbell demonstrated the use of scup otolith thin sections (8 thousandths thick)* to validate the scale ageing method. The following comparisons of the two methods were made:

1. Of the two methods, scales seem to be easier to collect and prepare for ageing. Otoliths may not be as conveniently available from "commercial" sources (an important source of age samples for NEFC, procured by Federal port agents) as dissection of fish lowers their market value.

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* After the method of Nichy (1976).

2. Thin sections from otoliths appear to be more useful for ageing compared to viewing the entire otolith, particularly when ageing older scup.
3. After annulus formation, summer growth seems to appear on the otolith edge sooner than on the scale edge.
4. As on some scales, the first annulus on otoliths may be weak and difficult to locate.
5. Scale and otolith ages are comparable, although the first several annuli may be easier to read on scales. Similarly, otoliths may be clearer when ageing older scup (greater than age 5).

Ageing of a Test Sample of Scup Scale Impressions

Participants able to attend the second day of the workshop were asked to age a special "blind" sample of 128 scup scale impressions with no fish lengths given. However, information as to collection date and location was provided. These samples were chosen by NEFC age readers to represent a wide range of geographic area, season, fish length, degree of difficulty, etc. As Massachusetts and Connecticut biologists were unable to participate, it was agreed that they be sent the samples to be aged after the workshop. Due to the limited time available to participants ageing the sample during the workshop, and differences in amount of ageing experience, it was decided that the group results could later be used for study and comparison by participants if they so wished. It is hoped that further insight could be gained into scup ageing problems.

Conclusions

1. Although the scale method of ageing scup was favored over the otolith method, many participants considered using otoliths to

validate at least some scale ages in future studies. Rhode Island biologists recommended this validation, particularly for older scup (greater than age 5); Bruce Halgren noted that validation of first and second annuli was important where these rings were unclear. As a further step, it was suggested that collections be made of small scup, ages one and two, which could be identified by length frequency distribution. Scales from these fish could be measured and the data applied to back calculations of older fish.

2. It was agreed that a good technique for preparing scup scales for ageing was important. It was acknowledged that softer plastics such as NEFC laminates and buterate were helpful in achieving good scale impressions, and that the amount of pressure used was critical.
3. A number of scale impressions examined during the workshop were of scup scales probably from the caudal area rather than the standard pectoral area. Several biologists found these smaller scales easier to read. Unfortunately, scales from both areas on individual fish were not available, thus comparisons could not be made.
4. Participants reached a high level of agreement during informal age readings and discussions of ageing criteria on the first day of the workshop. Demonstrations of scale preparatory methods, and scale-otolith comparisons were found to be useful. Age reading of the test sample on the second day of the workshop, however, was considered difficult due to the large number of samples, lack of fish length information and consultation.

5. Based on current information from the NEFC survey investigation, it was felt that the two species, Stenotomus chrysops and Stenotomus aculeatus would not be confused (the latter is distributed too far south).

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