NOTES

SEASONAL SPAWNING CYCLES OF THE SCIAENID FISHES *GENYONEMUS LINEATUS* AND *SERIPHUS POLITUS*

The white croaker, *Genyonemus lineatus* (Ayres), and queenfish, *Seriphus politus* Ayres, are two of the common inshore fishes occurring along the southern California coast (Miller and Lea 1972). Detailed reproductive data are not available for these species. The purpose of this note is to provide information on their seasonal spawning cycles.

Materials and Methods

Monthly samples are from November 1974 to October 1975. Most specimens were collected by hook and line from the Santa Monica Pier, Los Angeles County, Calif. Remaining fishes were obtained about 4.2 km south of Santa Monica at the Scattergood Steam Plant, El Segundo, Los Angeles County. Scattergood fishes had been exposed to temperatures between 23° and 41°C. Histological comparisons of these fishes with freshly caught specimens showed the ovaries were not altered by this treatment. Specimens are deposited in the ichthyology collection of the Los Angeles County Museum of Natural History.

Fishes were immediately slit and placed in 10% Formalin.[1] Gonads were embedded in paraffin and histological sections cut at 8 μm. Slides were stained using iron hematoxylin followed by eosin counterstain. Seasonal occurrences of oocytes (Tables 1, 2) were calculated by randomly selecting areas of slides from each monthly representative and classifying oocytes as to their category (Type 1, 2, or 3). Areas of a slide were surveyed until at least 100 oocytes were classified.

Results and Discussion

Three classes of oocytes are present in the ovaries of *G. lineatus* (Table 1) and *S. politus* (Table 2). Type 1 is the most abundant class and varies from those recently derived from oogonia to those approaching Type 2 oocytes. Type 2 oocytes have diameters between 100 and 270 μm and differ from Type 1 oocytes in the presence of a zona pellucida and zona granulosa. Small quantities of yolk granules may be found on the periphery of larger representatives of this class. The diameter of yolk filled mature Type 3 oocytes is greater than 270 μm. The smallest fishes to contain Type 3 oocytes measured 143 mm standard length (SL) for *G. lineatus* and 148 mm SL for *S. politus*.

As shown in Tables 1 and 2 there are several differences in seasonal distribution of oocytes reflecting the spawning cycles of *G. lineatus* and *S. politus*. The major difference is in abundance of Type 3 oocytes indicating *G. lineatus* comes into spawning condition in October and spawns intermittently into April. *Seriphus politus* enters spawning condition in April and spawns into August. These data support the findings of Skogsberg (1939) who reported that *S. politus* spawns throughout summer and *G. lineatus* spawns from November through May off California.

TABLE 1.—Monthly distribution of *Genyonemus lineatus* oocytes with mean standard length (mm) ± standard error, November 1974-October 1975.

Month	N	Total oocytes	Type 1 (%)	Type 2 (%)	Type 3 (%)	$\overline{SL} \pm SE$
Nov.	11	1,369	60	13	27	203.3 ± 8.7
Dec.	13	1,579	65	11	24	228.8 ± 4.6
Jan.	11	1,316	60	12	28	217.3 ± 5.9
Feb.	12	1,478	64	12	24	202.1 ± 3.9
Mar.	14	1,717	69	11	20	200.7 ± 9.8
Apr.	13	1,631	77	10	13	204.2 ± 4.4
May	19	2,138	96	1	3	218.2 ± 4.7
June	10	1,251	90	5	5	218.0 ± 2.9
July	19	2,103	95	3	2	212.0 ± 4.0
Aug.	14	1,606	96	3	1	239.8 ± 3.5
Sept.	14	1,589	90	6	4	243.0 ± 3.8
Oct.	11	1,340	75	12	13	234.5 ± 6.2

TABLE 2.—Monthly distribution of *Seriphus politus* oocytes with mean standard length (mm) ± standard error, November 1974-October 1975.

Month	N	Total oocytes	Type 1 (%)	Type 2 (%)	Type 3 (%)	$\overline{SL} \pm SE$
Nov.	14	1,531	100	0	0	192.8 ± 2.6
Dec.	12	1,379	100	0	0	215.2 ± 4.6
Jan.	14	1,607	100	0	0	203.7 ± 2.4
Mar.	14	1,563	93	5	2	215.2 ± 5.1
Apr.	14	1,604	71	11	18	200.2 ± 5.5
May	15	1,729	77	9	14	214.6 ± 3.1
June	14	1,736	68	13	19	217.5 ± 3.9
July	14	1,864	72	8	20	225.8 ± 3.4
Aug.	14	1,536	78	9	13	202.9 ± 4.0
Sept.	14	1,499	97	2	1	212.9 ± 3.0
Oct.	14	1,574	98	0	2	207.6 ± 3.4

[1]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

In both species oocyte maturation is a continuous process that occurs throughout the reproductive period (Tables 1, 2) with multiple spawnings occurring. Depleted ovaries containing mainly Type 1 oocytes were not observed until conclusion of the spawning season. The presence of various groups of developing oocytes as occurs in *G. lineatus* and *S. politus* was termed asynchronism by Yamamoto and Yamazaki (1961) who found this condition common in fishes with long breeding seasons and multiple spawnings.

Another difference (Table 1) was the persistence of small quantities of Types 2 and 3 oocytes in *G. lineatus* after the conclusion of spawning in April which persist throughout summer. It is more typical for remaining vitellogenic oocytes to undergo atresia at the end of the spawning season as occurs in *S. politus* whose inactive ovaries contained only Type 1 oocytes (Table 2) from November to January. These low frequencies of mature summer *G. lineatus* oocytes may suggest spawning continued at a reduced frequency during this period. A more plausible explanation might be that these oocytes will ovulate early in the next spawning season. It thus appears that some early ovulating *G. lineatus* oocytes initiated yolk deposition late in the previous spawning season and remained over summer. It may be energetically advantageous for these yolk filled eggs to remain over summer as opposed to resorbing them.

As *G. lineatus* ranges from Baja California to British Columbia and *S. politus* from Baja California to Oregon (Miller and Lea 1972), my data may be useful for subsequent investigations to determine geographic variation in reproduction for these species.

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FOOD OF FIVE SPECIES OF COOCCURRING FLATFISHES ON OREGON'S CONTINENTAL SHELF

The purpose of this paper is to describe and to compare the food of five flatfish species that actually cooccurred at one specific time and place on the central Oregon continental shelf: English sole, *Parophrys vetulus* Girard; rex sole, *Glyptocephalus zachirus* Lockington; rock sole, *Lepidopsetta bilineata* (Ayres); petrale sole, *Eopsetta jordani* (Lockington); and Pacific sanddab, *Citharichthys sordidus* (Girard). These demersal fishes are common along the west coast of North America, their ranges overlapping between southern California and the Gulf of Alaska (Hart 1973). *Parophrys vetulus*, *C. sordidus*, and *L. bilineata* occur mainly on the inner continental shelf. *Eopsetta jordani* is fished commercially on its feeding grounds (73-128 m), and in deep water (311-457 m) where spawning occurs (Forrester 1969). *Glyptocephalus zachirus* has a broad bathymetric range—it is common off Oregon and Washington from 90 to 550 m (Alverson et al. 1964). Off Oregon it was the second most numerous member of a species association ranging from 119 to 199 m, on an average sediment type of 69% sand, 19% silt, and 12% clay (Day and Pearcy 1968). In that same study, *C. sordidus* and *P. vetulus* composed 80.3% of a species association of fishes in shallower water (42-73 m) on a sandy bottom. According to Alverson (1960), *L. bilineata* is common on sandy or gravel bottom. The five flatfish species attain maximum sizes ranging from 410 mm for *C. sordidus* to 700 mm for *E. jordani* (Hart 1973).

Pearcy and Vanderploeg (1973) listed major food items—combined from several locations, seasons, and years—for most of the above species. That