RESTRICTED

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No. 1504
(D. c. 2)

Research Document No. 40

ANNUAL MEETING - JUNE 1965

Age, Length and State of Maturity of Adult Herring in Subarea 5

by H. C. Boyar
United States Bureau of Commercial Fisheries Biological Laboratory,
Boothbay Harbor, Maine

In 1964, 35 samples of Georges Bank herring (2,549 fish) and 46 samples of coastal Gulf of Main herring (3,565 fish) were obtained for study. Georges Bank herring were collected from research vessels and commercial draggers. Coastal Gulf of Maine samples, obtained from commercial draggers and purse seiners, were caught in waters beyond the limit of stop seines and weir operators who fish the inshore waters for immature herring. A few samples were taken from these inshore waters, but are not a true index of the population structure of this fishery. This report compares the maturity stages, length, and year class composition for both Georges Bank and coastal Gulf of Maine populations of adult herring.

The maturity scale proposed by ICNAF (Redbook, 1964) was used in the classification of the various gonadal stages. To simplify comparison of seasonal developments, the stages were grouped into three categories; namely, II and III-MATURING, IV and V-FULL, and VI, VII and VIII-SPAWNED. Immature fish (stage I) were omitted from the comparisons. The percentage occurrence of these groups by month is shown in Fig. 1. The year of life (ages determined from otoliths) and length comparison (natural total length) for herring during 1962, 1963 and 1964 are shown in Fig. 2 and 3. All fish older than 8 years were combined into an 8+ category.

Georges Bank.

Within the first six months of the year, the majority of herring sampled were maturing. The percentage occurrence of maturing fish decreased during August and by September was minimal. Full fish were first noted in June (no samples in May). By August the majority of fish were full, and the number decreased in September and October. No full fish were obtained in November. Spawned fish were first collected in the latter part of August and were the first indication of the onset of fall spawning. The mean length of the spawning fish was 26.7 cm. Evidence of a late August spawning was also indicated by the catches of yolk sac larvae (mean length 5.5 mm, range 4 - 7 mm) during an early September cruise. The percentage occurrence of spawned fish increased during September, reaching a peak in October. The bottom temperature (in 1964) at the sites from which spawned herring were obtained ranged from 8.3° - 8.8°C. in September, 5.8° - 11.8°C. in October, and 7.8° - 8.9°C. in November. The onset of fall spawning in 1962 and 1963 occurred during late August and reached a peak in September, 1962 and in October, 1963.

The majority of Banks herring sampled in 1964 were from the 1960 year-class (60.2%), followed in percentage occurrence by the 1958 (12.0%), 1961 (8.3%), 1959 (6.7%), 1957 (5.8%), 1962 (5.7%), 1956 (1.1%) and 8+ (0.2%) year-classes. In 1963, the 1958 year-class dominated catches until November, and after that the 1960 year-class was dominant. In 1962, 1958 was the dominant year-class. The dominance of the 1960 year-class was first indicated in 1962 when it ranked third in percentage occurrence (10.2%), and in 1963 when it ranked first (35.3%). If this year-class follows the trend of the 1957 and 1958 year-classes it should continue to provide a substantial contribution to herring catches in 1965. Herring of the 1961 year-class contributed less than 1% of the fish sampled in

1963, 8.3% in 1964 and can be expected to rank second in percentage occurrence in 1965. Herring of the 1962 year-class contributed 5.7% of the samples in 1964 and their contribution should increase in 1965.

In 1964, herring ranged in length from 14.5 - 34.5 cm and had a mean length of 26.8 cm. The range in length of herring sampled in 1963 and 1962 was similar to that of 1964. Comparison of data from 1962-64 indicated that the mean length of the 1960 year-class increased 6.5 cm and the mean length of the 1958 year-class increased 2 cm.

Most of the herring sampled in 1964 and in previous years have been from the waters of the northern portion of the Banks where they congregate in the fall prior to spawning. A cruise in June, 1964 indicated that large fish were dispersed throughout the Banks, approximately equal catches per unit time being obtained from trawl sets on the southwestern part, southeastern part, northern peak, and the northern edge as far west as Cultivator Shoals. The distribution of immature herring was restricted to the northern portion of the Banks, principally in the vicinity of Cultivator Shoals. During fall cruises, immature herring again were obtained only in the vicinity of Cultivator Shoals. Apparently these fish preferred the shallow waters of the Bank (20 fathoms or less) possibly because temperatures were warmer than those of the deeper waters. In early June, bottom temperatures of shallow waters sampled ranged from 9.2°-9.8°C.; the temperature of the deeper waters ranged from 3.0° - 8.2°C. In October, the bottom temperature of shallow waters sampled ranged from 13.1° - 15.1°C.; the temperature of the deeper waters ranged from 4.8° - 13.1°C.

Coastal Gulf of Maine

The monthly percentage occurrence of maturing herring from coastal Gulf of Maine was similar to that of herring from Georges Bank(Fig.1). Full fish, first noted in March, increased in number through July, and by August their maximum abundance was reached. During September there was a sudden drop in this frequency and in October and November only a few full fish were obtained. The presence of spawned fish in every month (except June and July) suggested the possibility of two spawning seasons in the coastal waters, namely, fall-winter and spring. Spawned fish were obtained in February. The last of the fall-winter spawners from the previous year's spawning were obtained in early April (stage VIII) and were from the waters of Cape Cod and southward. Fall spawned herring were first obtained in late August (and spawning for the first time) and had a mean length of 25.7 cm. The peak of spawning occurred in September. The spring spawned fish (stage VII) obtained in May were 29.5 cm in length and had all spawned in previous years. These spring spawned fish, obtained from samples which also included fall spawning individuals, were also from the waters of Cape Cod and southward (no eastern samples available at this time of the year). In 1963, the onset of spawning occurred in August, the peak of spawning i October. Spring spawning (stage VII) was also evident in 1963 in both eastern (Eastport, Maine - in July) and western (Cape Cod and southward and Small Point, Maine - in May and June) waters off the coast.

In 1964, no noticeable differences in gonadal development existed between western and eastern coastal herring, while differences in year class composition were apparent. The majority of herring sampled from the coastal waters were from the 1960 year-class (Fig. 3). The percentage occurrence of this year-class in eastern waters was 67.9%, in western waters 40.6%. The rank and percentage occurrence of the other year classes was different between the two regions, principally because younger fish were more prevalent in the samples from the western waters. The range in length of herring samples from the two regions differed slightly. Eastern fish ranged in length from 21.5 - 35.5 cm, western fish ranged in length from 16.5 - 34.5 cm. The mean length of eastern fish was 27.8 cm, the mean length of western fish was 27.0 cm. In 1963, 1958 was the dominant year-class in the samples obtained in both regions. The frequency occurrence of young fish was again higher in western waters than in eastern waters. The range in lengths in 1963 were similar to those of 1964.

In the coastal waters the 1960 year-class was not dominant prior to 1964. In 1962, no 1960 herring were obtained, while in 1963 only 17.4% of the herring were from this year-class. In 1962 the dominant year-class in the samples was 1959, and in 1963 the dominant year-class was 1958. If the 1960 year-class follows a trend similar to the 1959 and 1958 year-classes, it should remain dominant in herring catches in 1965.

In summary, differences in sexual maturation, year-class and length compositions were found between coastal Gulf of Maine and Georges Bank populations of adult herring. In 1964, the peak of spawning occurred earlier in coastal Gulf of Maine than on Georges Bank. There has been no evidence of spring spawning on the Banks, while in coastal Gulf of Maine spring spawning occurred in western waters samples in 1964 and in eastern and western waters samples in 1963. On the Banks, the 1960 year-class was dominant in all samples thoughout the year, and the rank in percentage occurrence of other year-classes remained stable throughout the year. In 1963, the 1960 year-class was also dominant in all samples, although its numerical importance was not evident until November and December. Prior to November, the 1958 year-class ranked first in percentage occurrence.

In coastal waters in 1964, the 1958 year-class was dominant in the samples obtained during the first four months of the year (all samples were from western waters), and the 1960 year-class was dominant during the remaining eight months. The rank in percentage occurrence of other year-classes differed from that of Georges Bank and in addition, varied considerably throughout the year. Differences in percentage occurrence of all year-classes were also noted between western and eastern coastal herring, eastern herring appearing to be more closely allied to Banks herring than to western coastal herring (Fig. 2 and 3). In 1963, the 1958 year-class was dominant having a higher frequency occurrence in the eastern coastal waters. In both 1964 and 1963, the 1959 year-class had more numerical importance in the samples collected from coastal waters than from those collected on Georges Bank. In 1964, 1962 and 1961 year-class herring were obtained from most of the sampling sites in coastal waters, but were limited on Georges Bank to the waters of Cultivator Shoals. The size of coastal Gulf of Maine herring was less than the young fish (4 years and younger) from Georges Bank, but the reverse was true for fish 5 years and older.

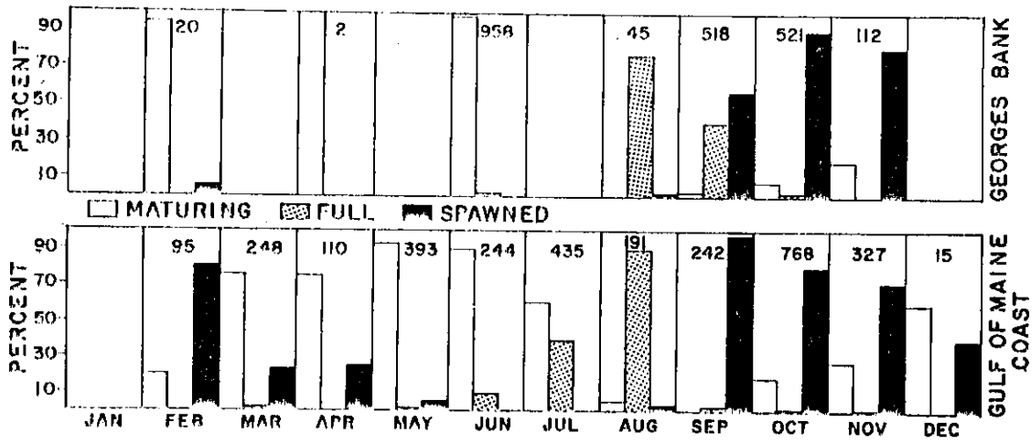

Figure 1. Monthly percentage occurrence of gonadal stages of Georges Bank and Gulf of Maine herring in 1964. Numbers of fish sampled are indicated.

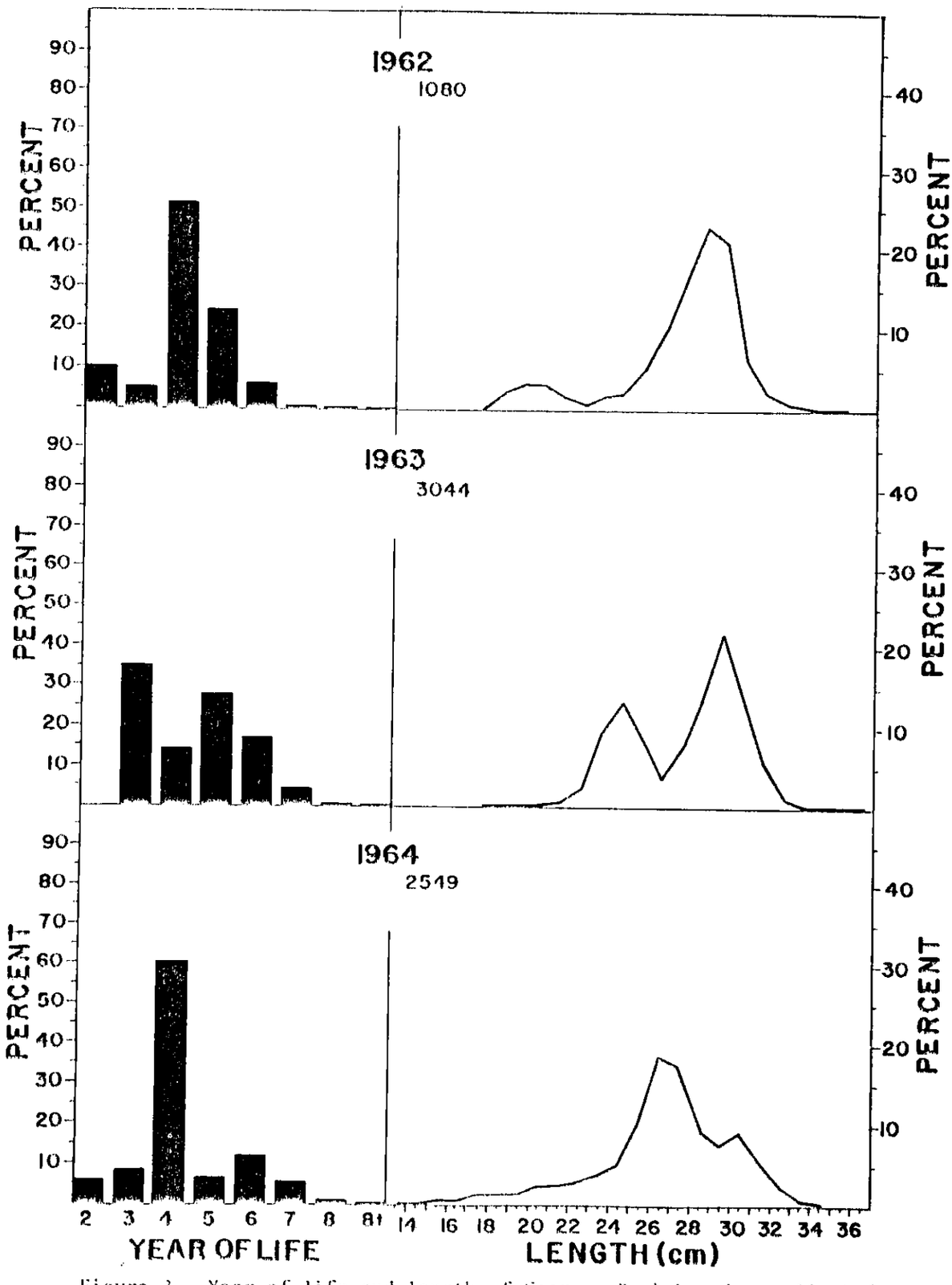

Figure 2. Year of life and length of Georges Bank herring collected in 1962, 1963 and 1964. Numbers of fish sampled are indicated.

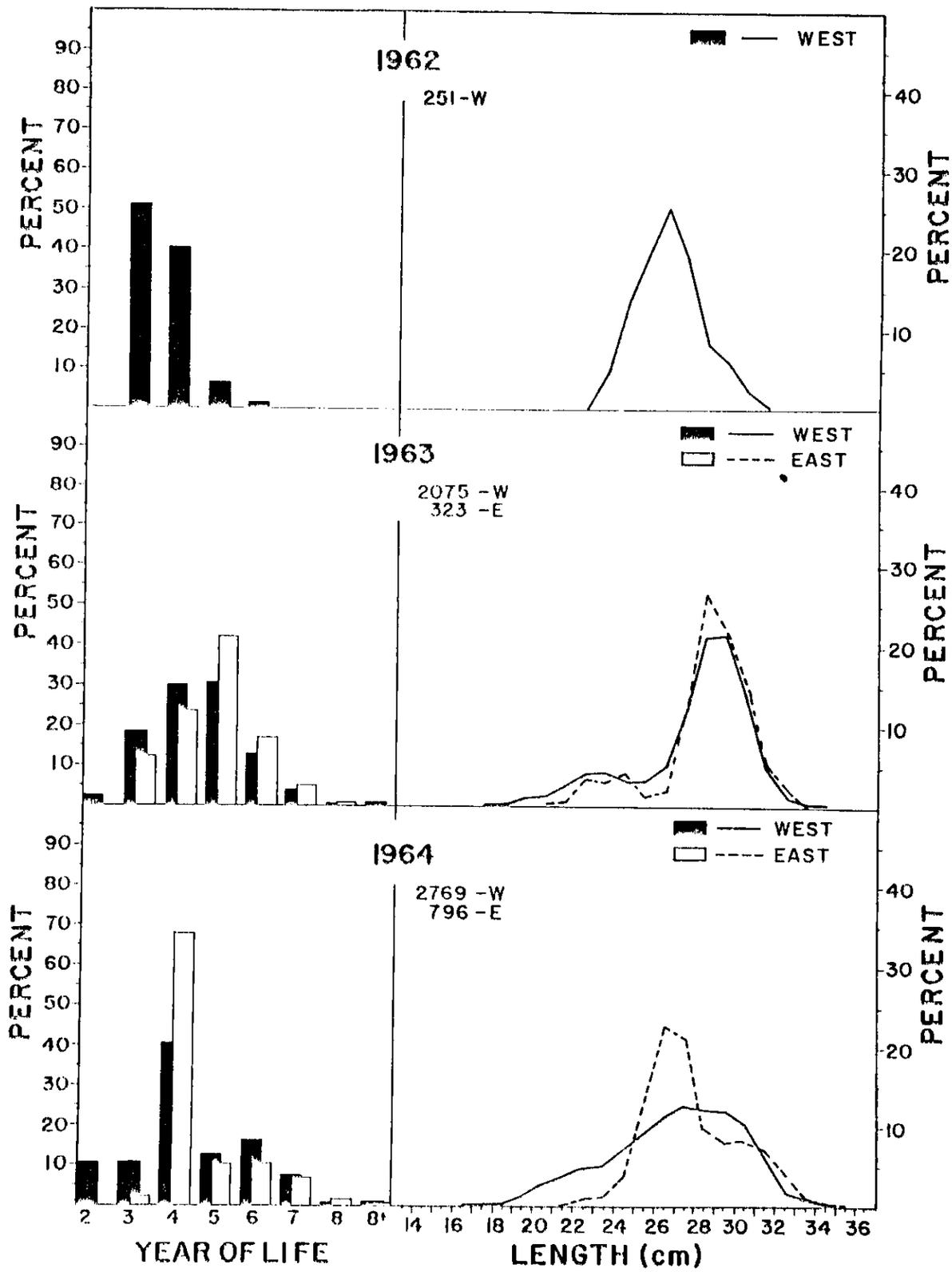

Figure 3. Year of life and length of Gulf of Maine herring collected in 1962, 1963, and 1964. Numbers of fish sampled are indicated.