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LARGE-SCALE ENVIRONMENTAL EVENTS ASSOCIATED WITH CHANGES IN THE MORTALITY RATE OF THE LARVAL NORTHERN ANCHOVY

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The larvae of the northern anchovy central subpopulation may be collected over 250 000 square miles of the northeast Pacific ocean. The spawning area is off central and southern California and northern Baja California and Mexico (Smith, 1978). Half of the larvae are normally concentrated in a 20 000 square mile area off southern California. In the late 1950's and early 1960's, the spawning area increased southward and offshore as the apparent biomass increased ten-fold.

Physiological data on the northern anchovy from the central stock indicate that they withstand colder temperatures than the Pacific sardine which occasionally inhabits the same spawning area. Thus, considerations of physiological tolerance relative to the sardine, upwelling of nutrient-rich water, and transport of plankton-rich water from the north would all tend to favor the survival of the northern anchovy in cold waters. This is not supported by the biological and physical oceanographic data now available. All of the onsets of apparent year-class failure to recruit to the fishable stock of northern anchovy; namely 1951, 1955, 1965, and 1974; have begun with abnormally cold seas. Persistence of the apparent year-class failure has been of the order 1 to 3 years.

Early larval mortality was found to be greater than 0.25 for 43% (46) of the region/quarter sets in the "bad" recruitment years, while only 27% of the region/quarter sets were characterized by this high mortality rate in the "good" recruitment years. No difference in mortality rate was noted for the late larvae in the same sets of years for the same region/quarter strata.

It appears that the best oceanographic indicator for larval anchovy "climate" is the January 30-m tempeature within the inshore and offshore regions of southern California and northern Baja California. The temperatures encountered are not near the lethal limit for larval anchovy, so that temperature is assumed to be merely an indicator of other oceanographic or biological events, such as transport from the subarctic water mass, deep mixing of the surface layer, upwelling, delayed embryonic development, or some combination. Twelve and 13° C temperatures at 30 m depth in the Los Angeles Bight appear to accompany poor recruitment while temperatures of 14° to 16° C appear to favor moderate or high recruitment.

The mechanism or mechanisms leading to poor recruitment are not known, but events at the yolk-sac larval stage are implicated in certain extremely cold years.

REFERENCES

Smith, P. E. 1978. Biological effects of ocean variability: time and space scales of biological response. Rapp. P.-v. Réun. Cons. int. Explor. Mer, 173: 117–127.