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The Effect of Weather and Other Environmental Variables upon Larval Fish Survival Leading to Recruitment of the Northern Anchovy

Reuben Lasker
Southwest Fisheries Center
National Marine Fisheries Service
La Jolla, California

Recent work in the California Current on the effect of weather and other environmental variables upon larval fish survival leading to recruitment of the northern anchovy (Lasker, 1975, 1978) presents us with evidence which clearly shows that in some cases upwelling (Figure 1), while effective in enriching the upper layers of the sea for phytoplankton production, could also be detrimental to larval fish survival because of great dilution of larval fish food organisms and the subsequent replacement of these with diatoms which cannot be fed upon by first-feeding larval anchovy (Figures 2 and 3). Storms also can be detrimental by preventing stratification of potential larval food organisms (Figure 4). The mechanism of dilution keeps the concentration of larval fish food organisms below a threshold needed for supplying the metabolic and growth needs of anchovy larvae.

It has been suggested that the same procedures used for predicting wheat yields in Russia by using climate data bases could be used in fishery predictions. This premise is challenged, for the life history of the anchovy illustrates that the correlation between weather and recruitment cannot be a simple one. Rather, it must take into consideration nuances of the larval life history that are not necessarily consistent from year to year because of biotic and abiotic changes in the environment.

References

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Lasker, R. 1978. The relation between oceanographic conditions and larval anchovy food in the California Current: identification of factors contributing to recruitment failure. Rapp. P.-v. Reun. Cons. Int. Explor. Mer 173:212-230.

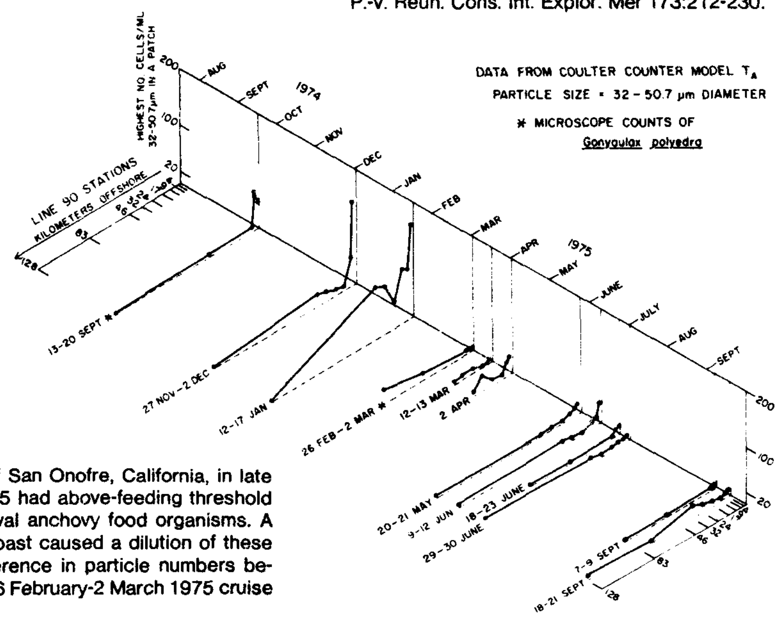


Figure 2. The inshore zone off San Onofre, California, in late 1974 and through January 1975 had above-feeding threshold concentrations of potential larval anchovy food organisms. A massive upwelling along the coast caused a dilution of these food organisms. Note the difference in particle numbers between the 12-17 January and 26 February-2 March 1975 cruise (Lasker, 1978).

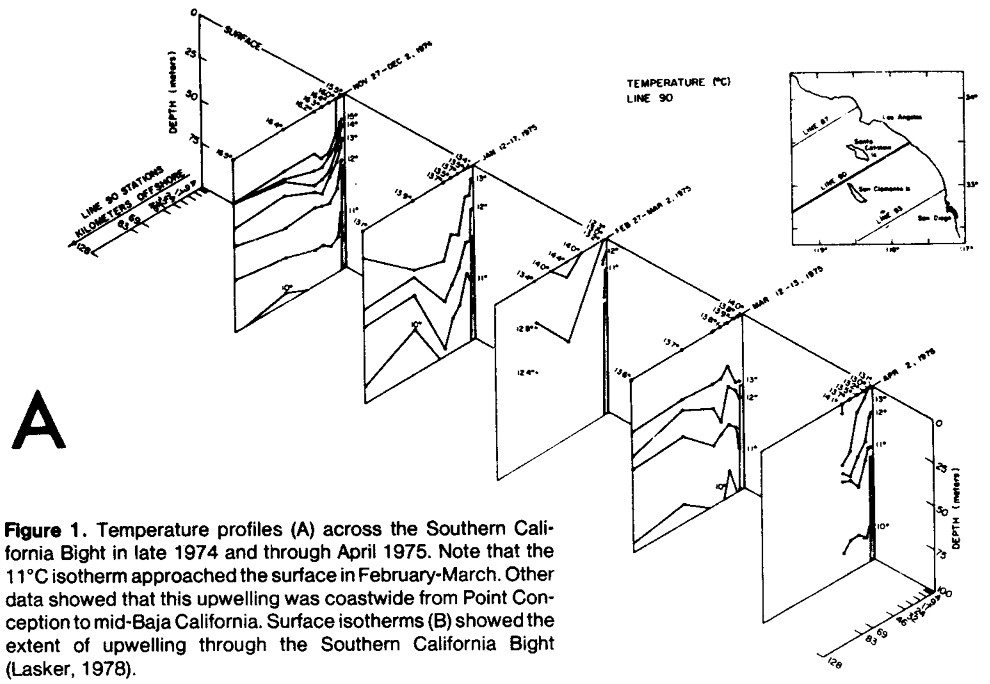
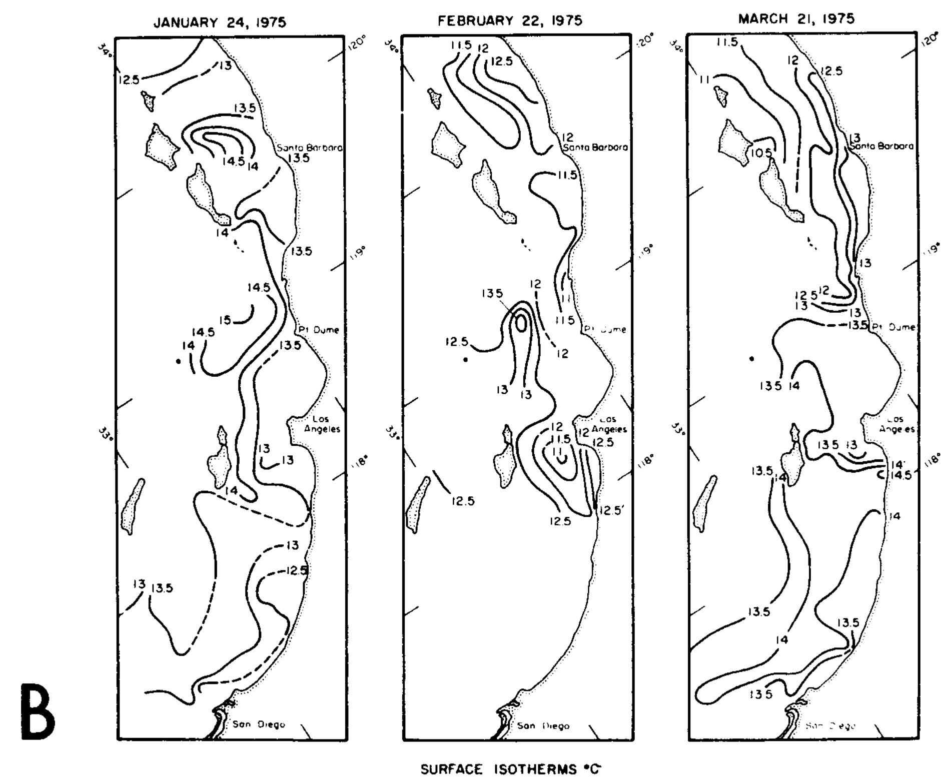


Figure 1. Temperature profiles (A) across the Southern California Bight in late 1974 and through April 1975. Note that the 11°C isotherm approached the surface in February-March. Other data showed that this upwelling was coastwide from Point Conception to mid-Baja California. Surface isotherms (B) showed the extent of upwelling through the Southern California Bight (Lasker, 1978).



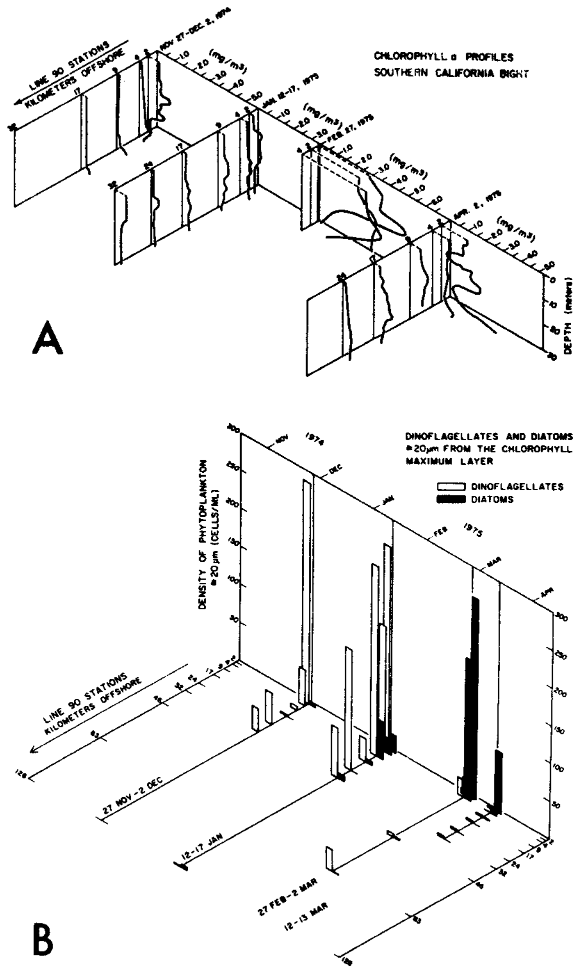


Figure 3. The upwelling shown in Figure 1 resulted in high productivity of diatoms. However, diatoms, unlike dinoflagellates, are not eaten by first-feeding anchovy larvae and do not contribute to their survival. (A) chlorophyll profiles, (B) diatoms replaced dinoflagellates (Lasker, 1978).

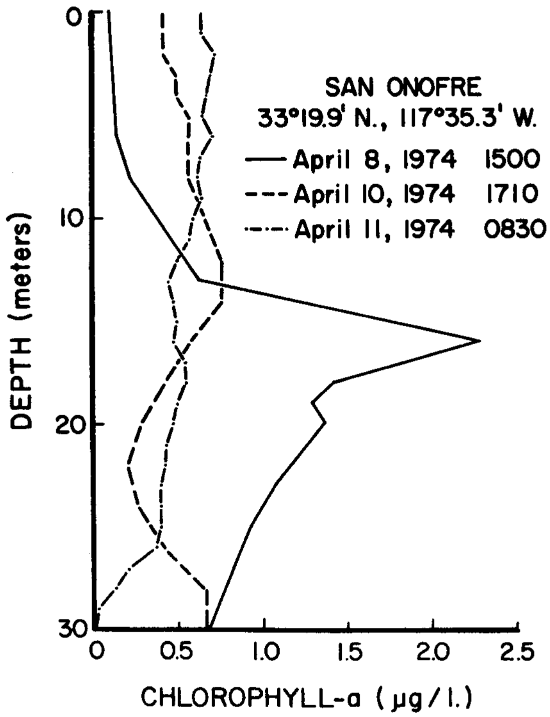


Figure 4. Induced turbulent mixing by storms are also effective in lowering threshold concentrations of larval anchovy food aggregations. In this figure, chlorophyll profiles are shown which were taken the day before and two successive days after a violent wind storm in the Southern California Bight off San Onofre, California. Reduction in chlorophyll indicated the extent of turbulent mixing (Lasker, 1975).