contributions to p and q have to be integrated over the energy of the state.

The various contributions to p and q and the predicted doubling of the lowest level of SiH $^2\Pi_{\frac{1}{2}}$ are given in Table 1. The figure shows the theoretical prediction compared with the experimental extrapolations. The agreement is close enough to provide some encouragement for a search for the molecule in interstellar space to be conducted, using available receivers.

I. D. L. WILSON
W. G. RICHARDS

Physical Chemistry Laboratory,
South Parks Road,
Oxford, UK

Received July 22; accepted September 17, 1975.

1 Hammersley, R. E., and Richards, W. G., *Nature*, 251, 597 (1974).
2 Hammersley, R. E., and Richards, W. G., *Astrophys. J. Lett.*, 194, L61 (1974).
3 Rydbeck, O. E. A., Elldér, I., and Irvine, W. M., *Nature*, 246, 466 (1973).
4 Douglas, R. E., and Elliot, G. A., *Can. J. Phys.*, 43, 496 (1965).
5 Walker, T. E. H., and Richards, W. G., *J. chem. Phys.*, 52, 1311 (1970).
6 Van Vleck, J. H., *Phys. Rev.*, 33, 467 (1929).
7 Bagus, P. E., in *Proc. Seminar Selected Top. Molec. Phys.* (IBM Germany, Ludwigburg, 1969).
8 Gordan, R. G., and Cashion, J. K., *J. chem. Phys.*, 44, 1190 (1966).
9 Czarny, J., Felenbok, P., and Lefebvre-Brion, H., *J. Phys. B.*, 4, 124 (1971).
10 Klynning, L., and Lindgren, B., *Ark. Fys.*, 33, 73 (1966).

Haze in the stratosphere

ON September 1, 1975 I flew as a passenger on Concorde flight OF269 from Heathrow to Gander taking off shortly before 0730, arriving at Gander shortly before 1000 (London time). The return journey on flight OF277 started an hour later and arrived at Heathrow shortly before 1400. Over the Atlantic we climbed gradually from ~ 50,000 feet to ~ 56,000 feet.

I watched carefully for visual evidence of the tropopause throughout the flights. During the descent to Gander cirrus clouds extended up to 44,000 feet. There was occasionally slight clear air turbulence, sometimes regular enough to indicate a billow wavelength of ~ 120 m, at many different heights in the stratosphere, but most remarkable of all was the extent of haze layers.

The distant horizon was the cirrus cloud top which was variously at heights between 35,000 and 44,000 feet. Above that the sky had a whitish glow, and as we ascended, several discrete layers, in which the haze was denser, were revealed as we came to the top or bottom of the layer. When the sun was low, on the outward flight, they were brown coloured in the north-west; when the sun was high on the return flight at the eastern end, they glowed white in the south-east. I had a forward starboard window. The highest layers were still above the aircraft at 56,000 feet, and the sky glowed with a paler blue than on occasions when I have observed the colour of the stratosphere from jet aircraft, for example Comets, at ~ 35,000 feet. On this occasion the weather ship radiosondes indicated a very obvious tropopause at ~ 39,000 feet but it certainly did not stand out visually.

The haze extended all the way across the Atlantic, and its extent is very significant. We tend to think of haze as a cooling agent for the air, because that is what it is in normal low altitude pollution situations; but on this occasion it was a warming agent, being probably below the radiation equilibrium temperature between the Earth and outer space. Thus the presence of haze facilitates the ascent of air without adiabatic cooling in the stratosphere, and on this occasion could well have been associated with the exceptionally large descent taking place above hurricane Donna further south in the Atlantic.

The importance of this observation is that it makes nonsense of the assumption, implicit in almost all theories concerning the consequences of putting pollution into the stratosphere, that practically everything that can, in the usual rainmaking processes, be rained out as air ascends into the stratosphere, actually is rained out and thus removed. This includes NO_x, sulphur compounds, such as SO_3, and ammonium sulphate, and a large range of organic compounds of which the most important, in today's context of ozone depletion scares, is methyl chloride.

It is probably not necessary to look further than the normal natural interchange mechanisms across the tropopause for the greatest supply of all these substances to the stratosphere, and it is easy to stipulate that mother-of-pearl clouds are formed on layers of sulphate haze at heights around 80,000 feet. The implications of these observations make nonsense of the ozone depletion theories which depend absolutely on a degree of stratospheric purity that is quite unrealistic. Furthermore the ascent of such a vast extent of air on an occasion such as this makes nonsense of the supposition that the vertical transport mechanisms in the stratosphere can be correctly represented by diffusion mechanics in which all ascending chemical species mix and react chemically with all descending chemical species. Ozone depletion theories are based completely on diffusion models.

R. S. SCORER

Department of Mathematics,
Imperial College of Science and Technology,
London SW7 5HH, UK

Received September 10; accepted October 8, 1975.

Continuous plankton records show fluctuations in larval fish abundance during 1948–72

THE continuous plankton recorder (CPR) survey[1] has sampled the plankton at a depth of 10 m around the British Isles consistently since 1948. Analysis of this material has revealed a number of trends[2,3] in the distribution, abundance and timing of seasonal cycles of zooplankton and phytoplankton. This report discusses similar changes in the distribution and abundance of planktonic fish larvae.

Counts of fish larvae from selected recorder samples are allocated to statistical rectangles of 1° latitude by 2° longitude, and the mean number of fish larvae per recorder sample per month is calculated for each rectangle. These means are then used for the analysis of variability in distribution and abundance.

In the North Sea, at a depth of 10 m, there has been a decline in abundance of some larvae (for example *Odontogadus merlangus* (whiting), *Trisopterus esmarkii* (Norway pout), *Limanda limanda* (dab) and *Pleuronectes platessa* (plaice), and for some species (for example *O. merlangus*, *P. platessa and Ammodytes* spp. (sand eels)), a shortening of the season during which the larvae have been caught, and a delay in the time of the seasonal maximum abundance. Examples of these changes are given in Fig. 1, which shows monthly and annual fluctuations in the abundance of larvae of *O. merlangus* and *P. platessa* from recorder sampling in the North Sea. The larvae of both species declined in abundance over the period; the downward trend of *O. merlangus* started in 1964, whereas for *P. platessa* there has been a general trend over the whole 25-yr period. In both species the time when most larvae were sampled has shifted to later in the season and the season itself has shortened. These patterns bear a close resemblance to those found for the zooplankton and phytoplankton in the CPR survey; over the same period the total numbers of copepods and the zooplankton biomass in the North Sea have declined[2], the duration of the