sea water, we asked the ship's crew to watch the pressure gage occasionally. The ship usually uses MGPS, *i.e.*, injection of chlorine gas to prevent biofouling in the sea water pipe. The resulting concentration of chlorine gas is usually very low and seems harmless for the measurement of T, S, pH and fluorescence. To avoid the bias in the specific chemical measurements, unchlorinated sea water may be safe. When we performed the bottle and filter sampling and manned pCO_2 measurements, we asked the ship crew to suspend MGPS.

Another improvement in the new program begun in 1994 is the direct monitoring of ship positions using GPS on the bridge. The sea water supply is stopped automatically when sensors detect leakage on the floor. Freshwater supply has been found useful in cleaning the sensors.

Despite the inconveniences of working aboard non-research vessels, the feasibility of biogeochemical monitoring from ferries has been demonstrated. Such monitoring programs can obtain time series data of directly sensed variables with high spatial resolution unlike those available from satellites or other platforms.

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This project has been performed by the participants and organizations of the Monitoring Execution Group based on discussions with the Subcommittee for Japan-Korea Ferry Monitoring, which has been organized by NIES-CGER. The members of this groups shown as follows.

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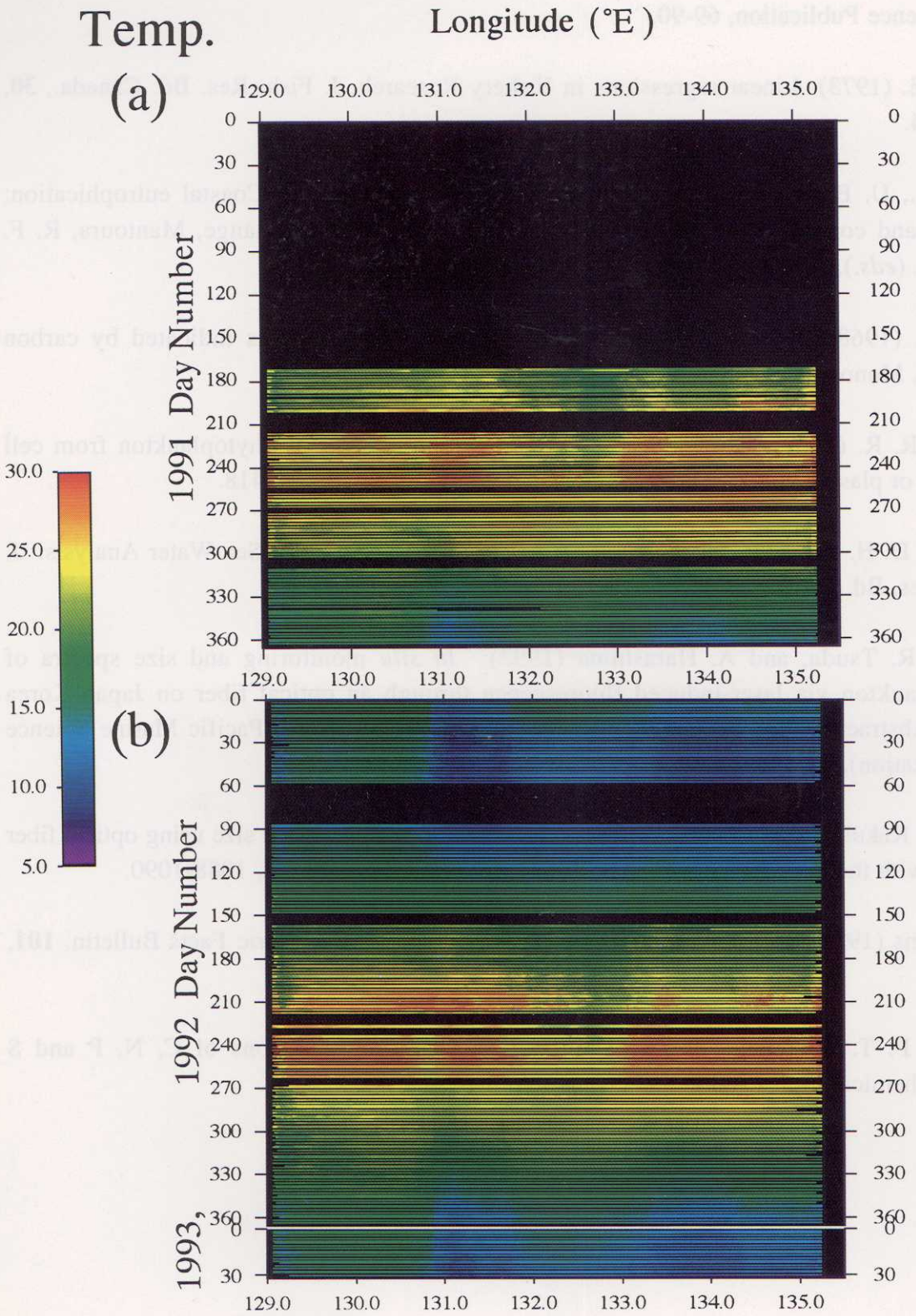

Fig. 5. Time-space variation of Level-2 temperature data in 1991 (a) and in 1992+1993 (b). The vertical axis downward shows the day of the year. The horizontal axis shows the longitude between Pusan, Korea (left end) and Kobe, Japan (right). Missing data are shown in black.

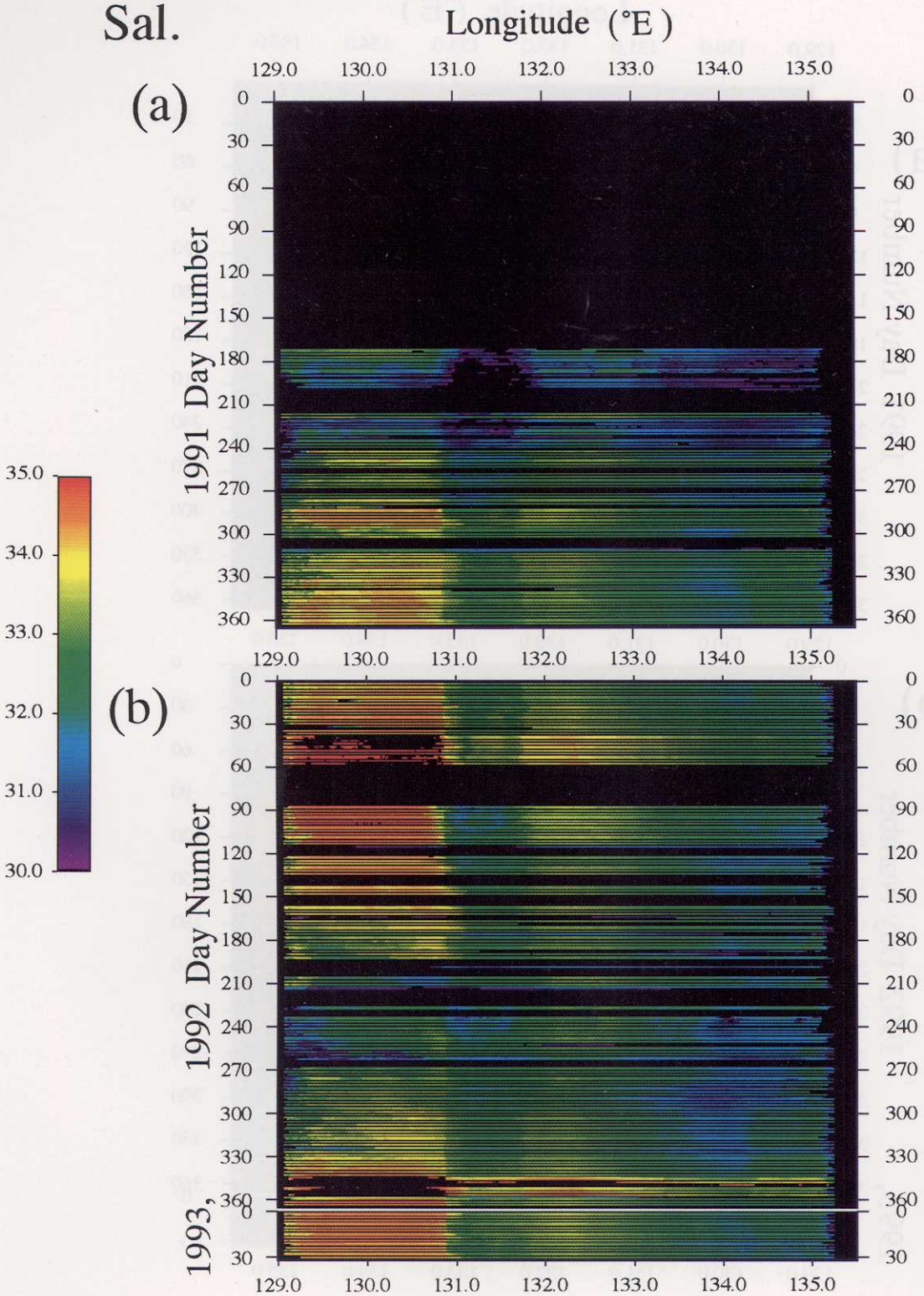

Fig. 6 Level-2 salinity data in 1991 (a) and in 1992+1993 (b). Missing data are mainly due to the fouling of the conductivity sensor by organic matter, which tends to occur more often in summer.

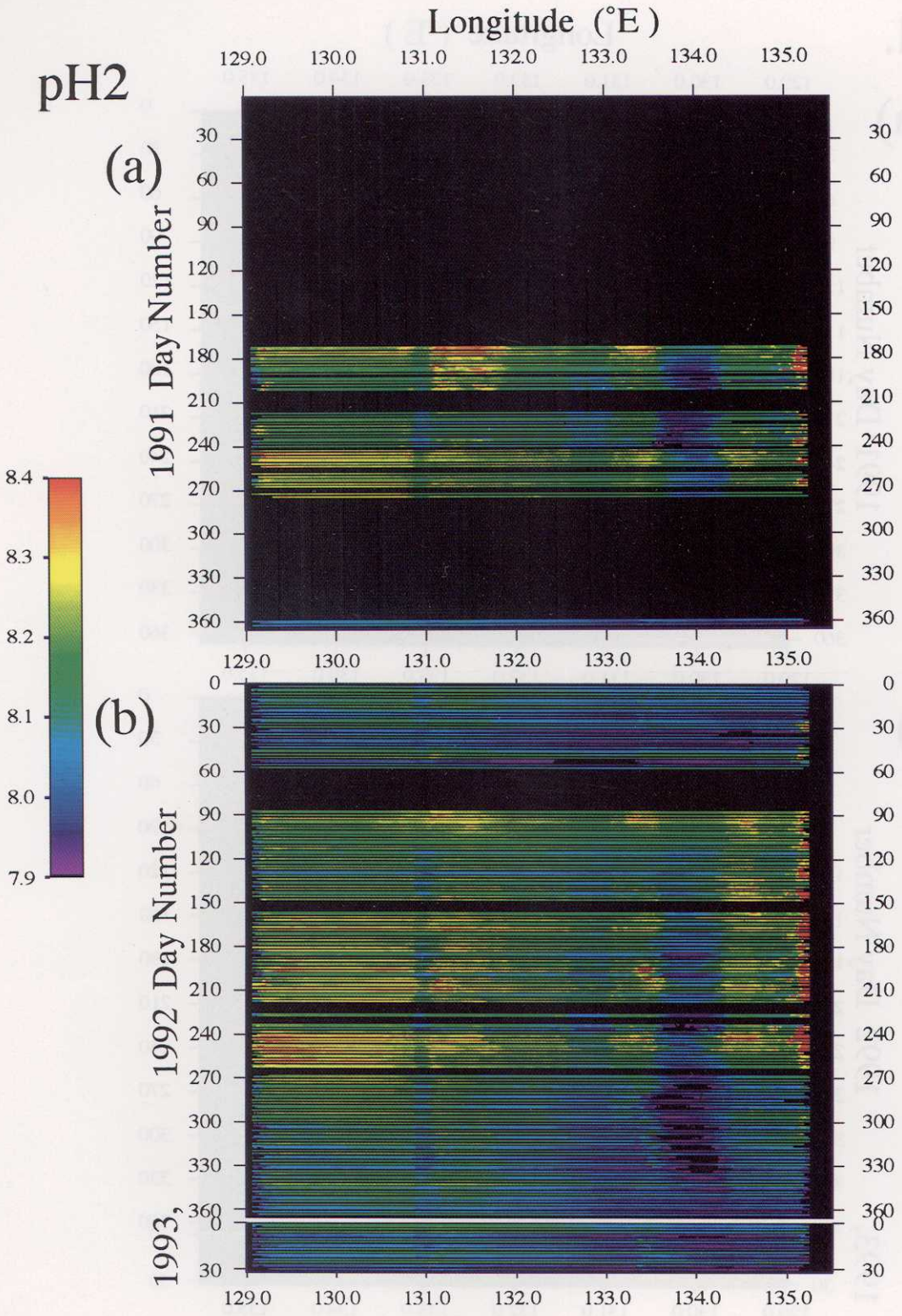

Fig. 7 Level-2 pH (at 25°C) data in 1991 (a) and in 1992+1993 (b). In the period from November to December 1991, the baseline of the pH electrode rose by 0.3 pH unit presumably because of a change in the quality of pH buffer solutions for calibration. The data during this period are omitted.

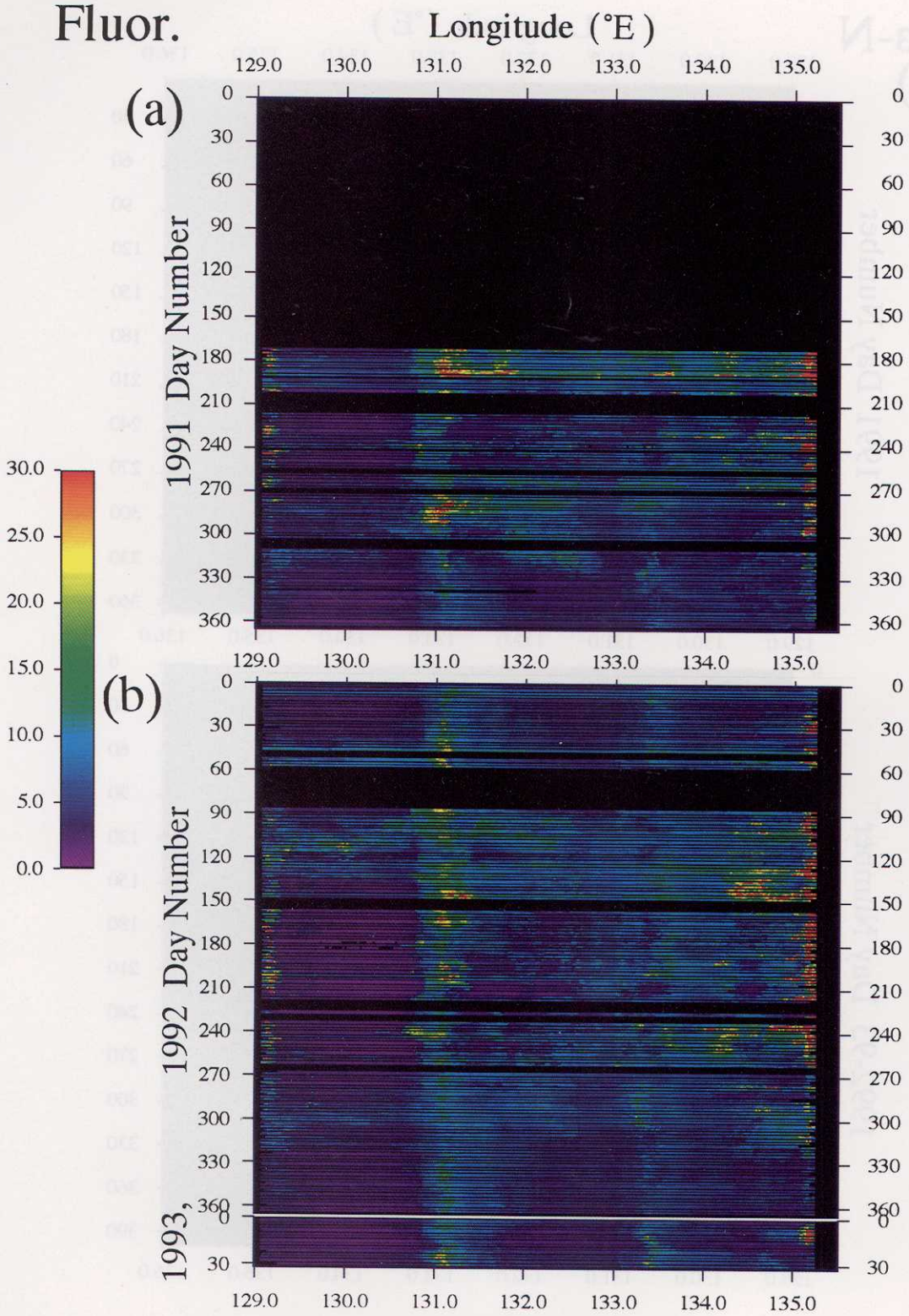

Fig.8 Level-2 fluorescence data in 1991 (a) and in 1992+1993 (b). Unit is fluorescence equivalent of a 1ppb fluorescein solution. One unit corresponds roughly to 0.28 μg/l chlorophyll-a. In February, 1992, the fluorometer's lamp failed as indicated by missing data. The data before the lamp failure appear as a rise of the baseline. This rise is not a bloom.

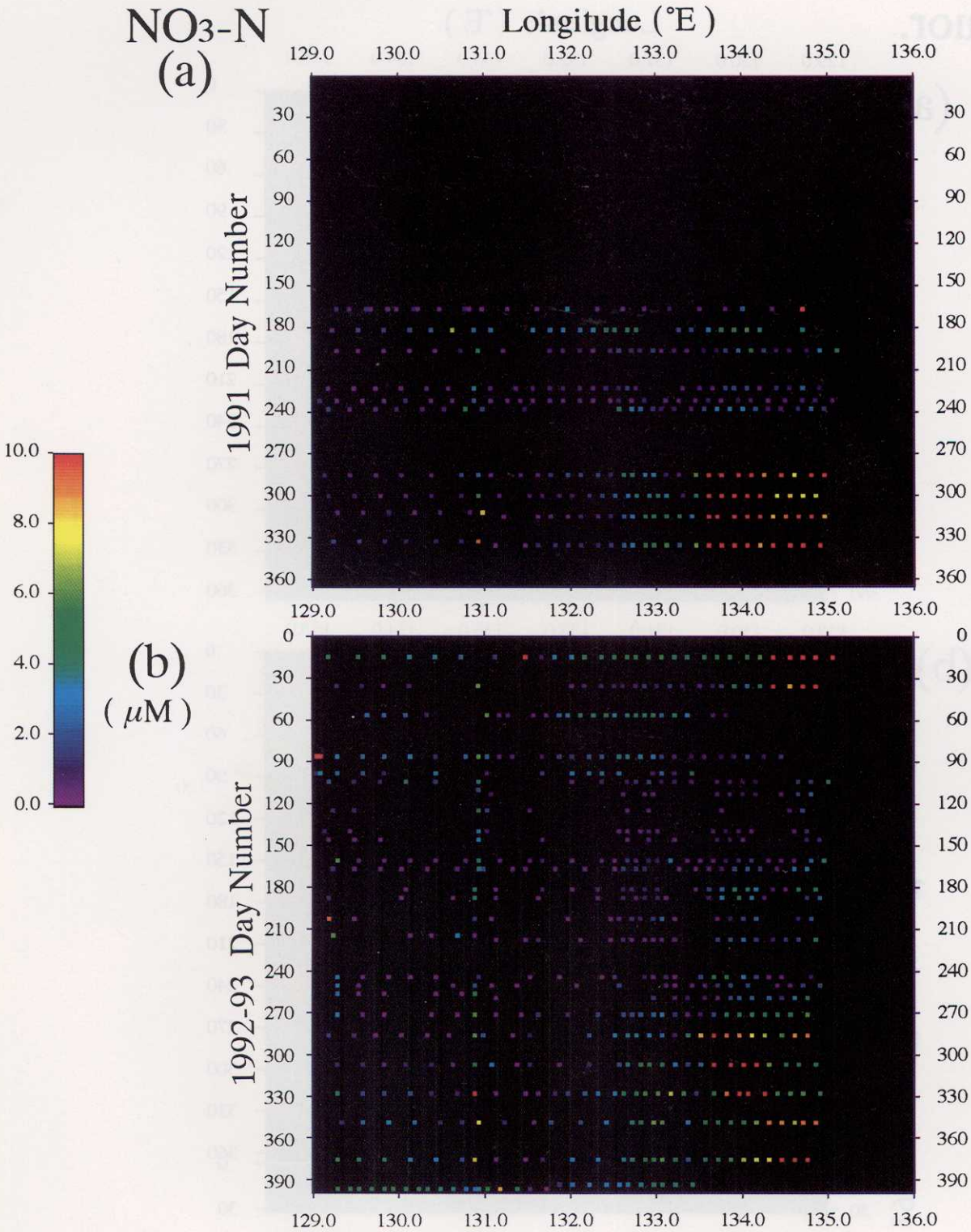

Fig. 9 NO_3-N in 1991 (a) and in 1992+1993 (b). The area east of 131°E is the Seto Inland Sea. Values that exceed the maximum in the color scale (left) are shown by the maximum color.

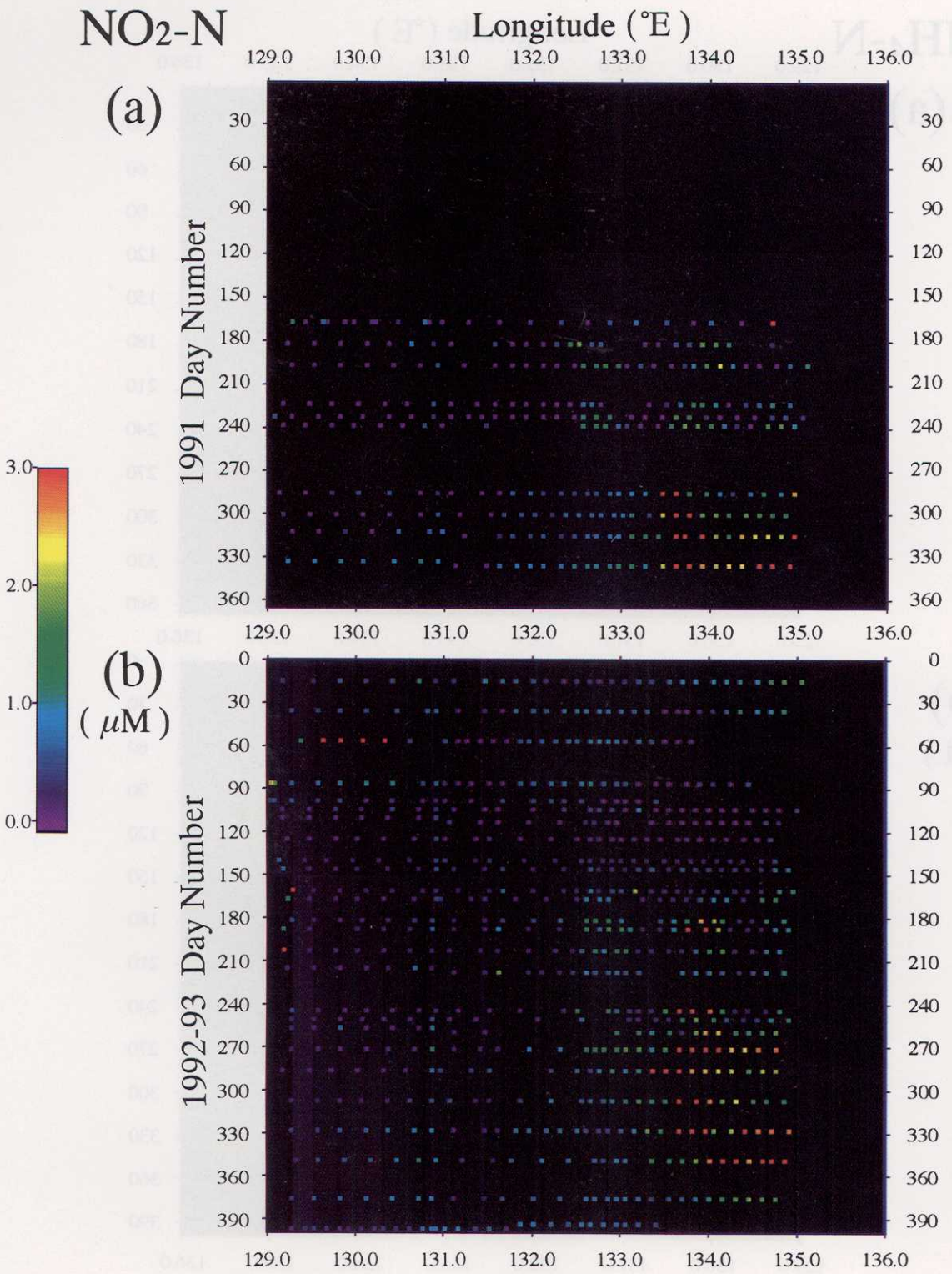

Fig. 10 NO_2-N in 1991 (a) and in 1992+1993 (b).

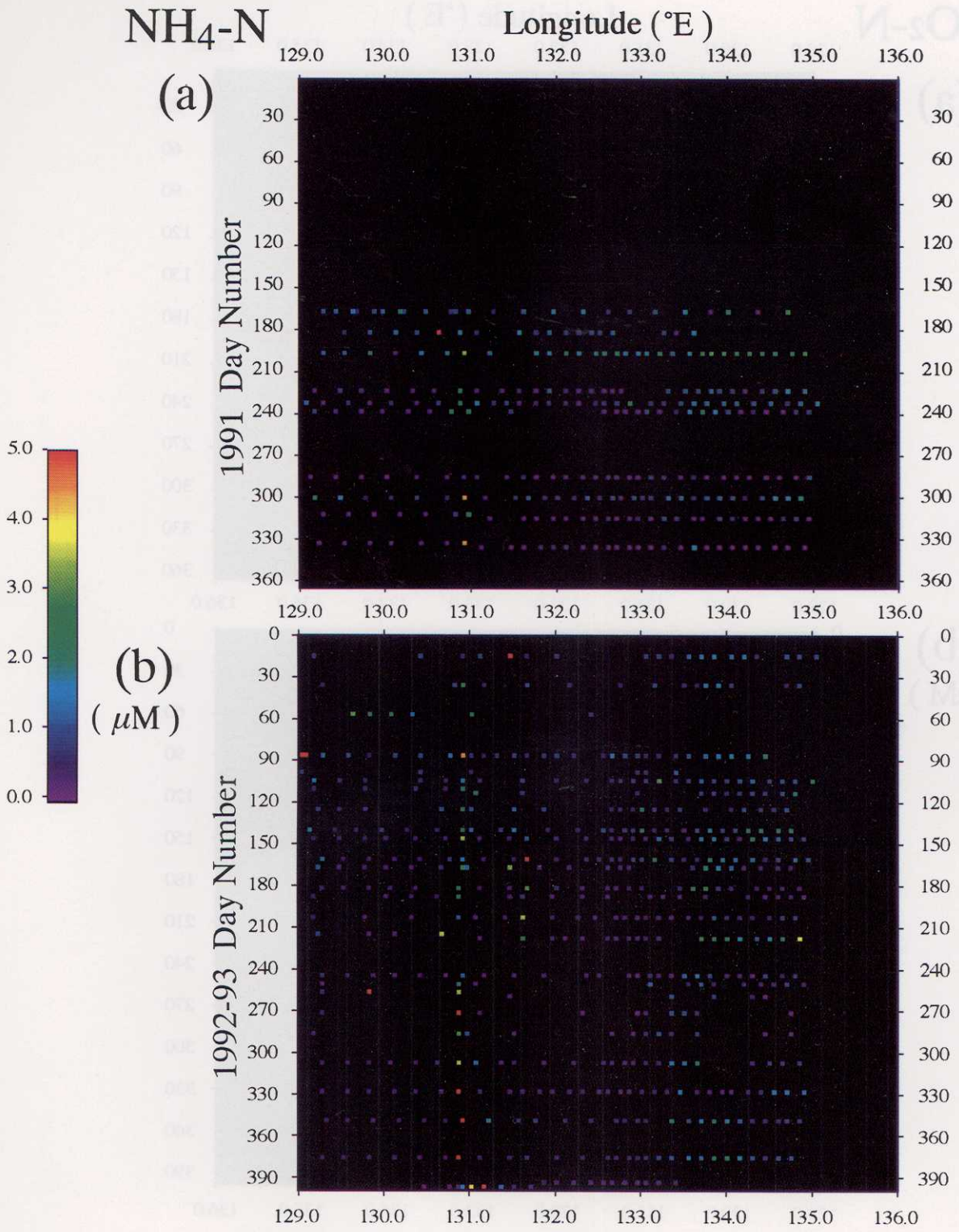

Fig. 11 NH_4-N in 1991 (a) and in 1992+1993 (b).

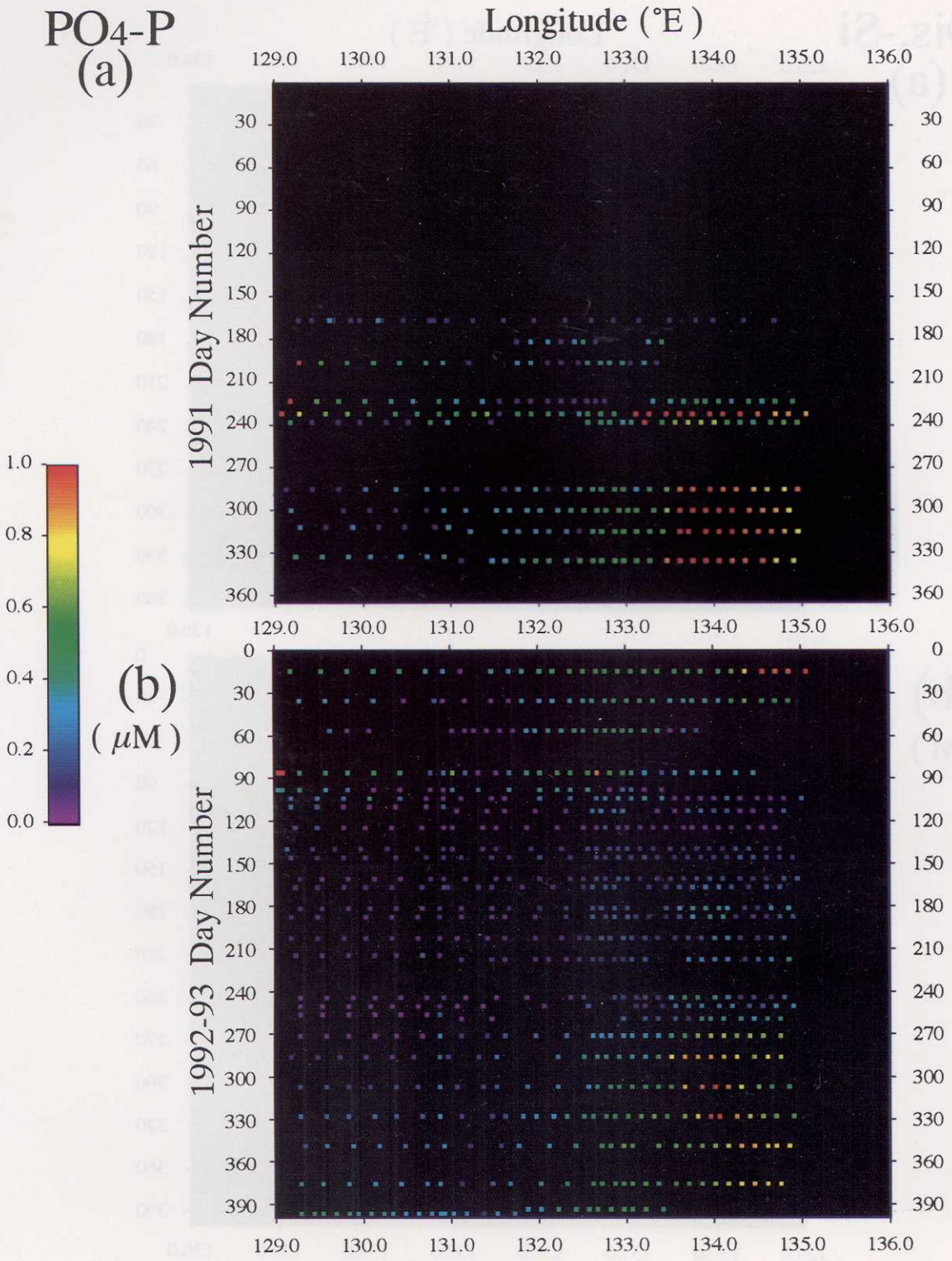

Fig. 12 PO_4-P in 1991 (a) and in 1992+1993 (b).

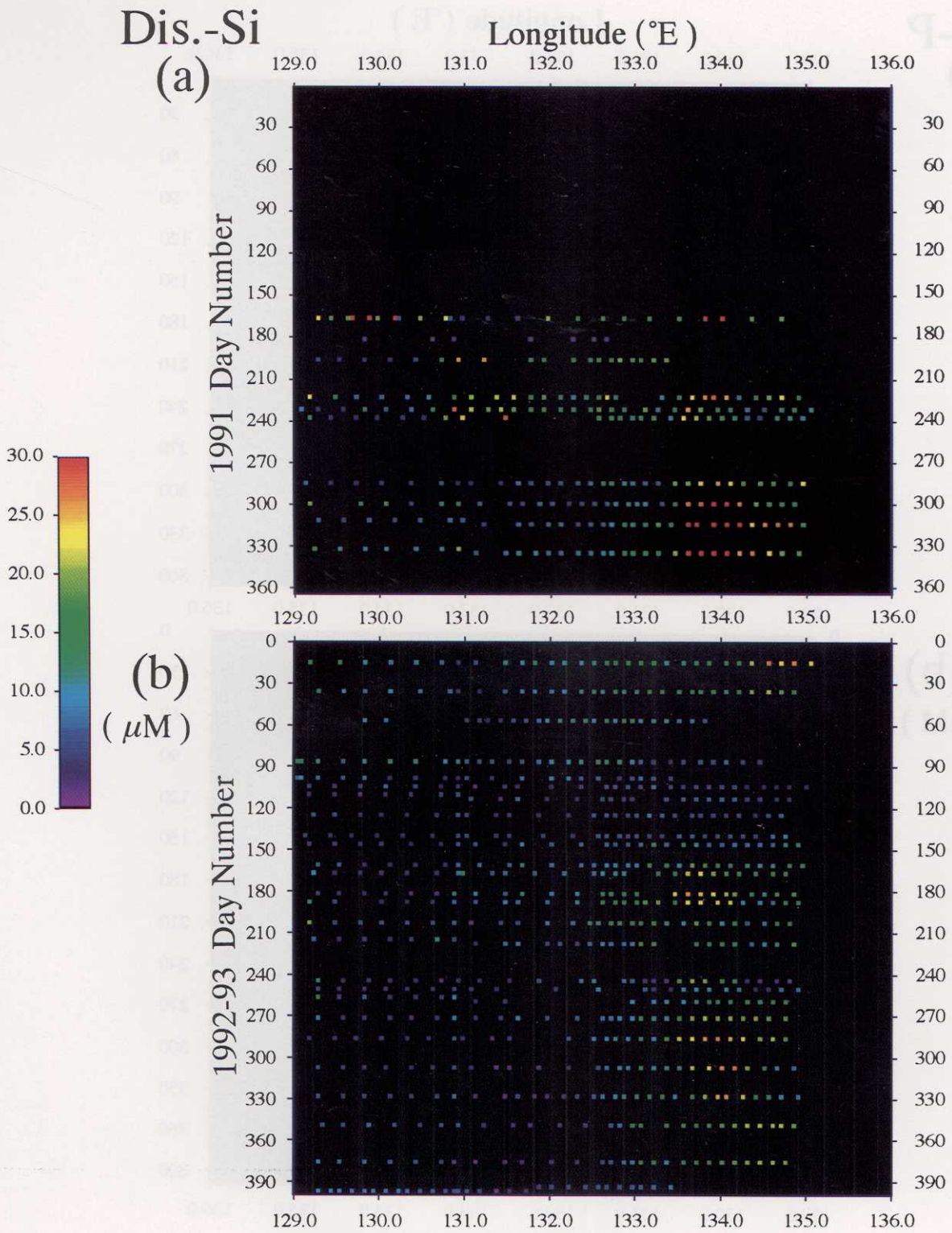

Fig. 13 Dissolved Si in 1991 (a) and in 1992+1993 (b).

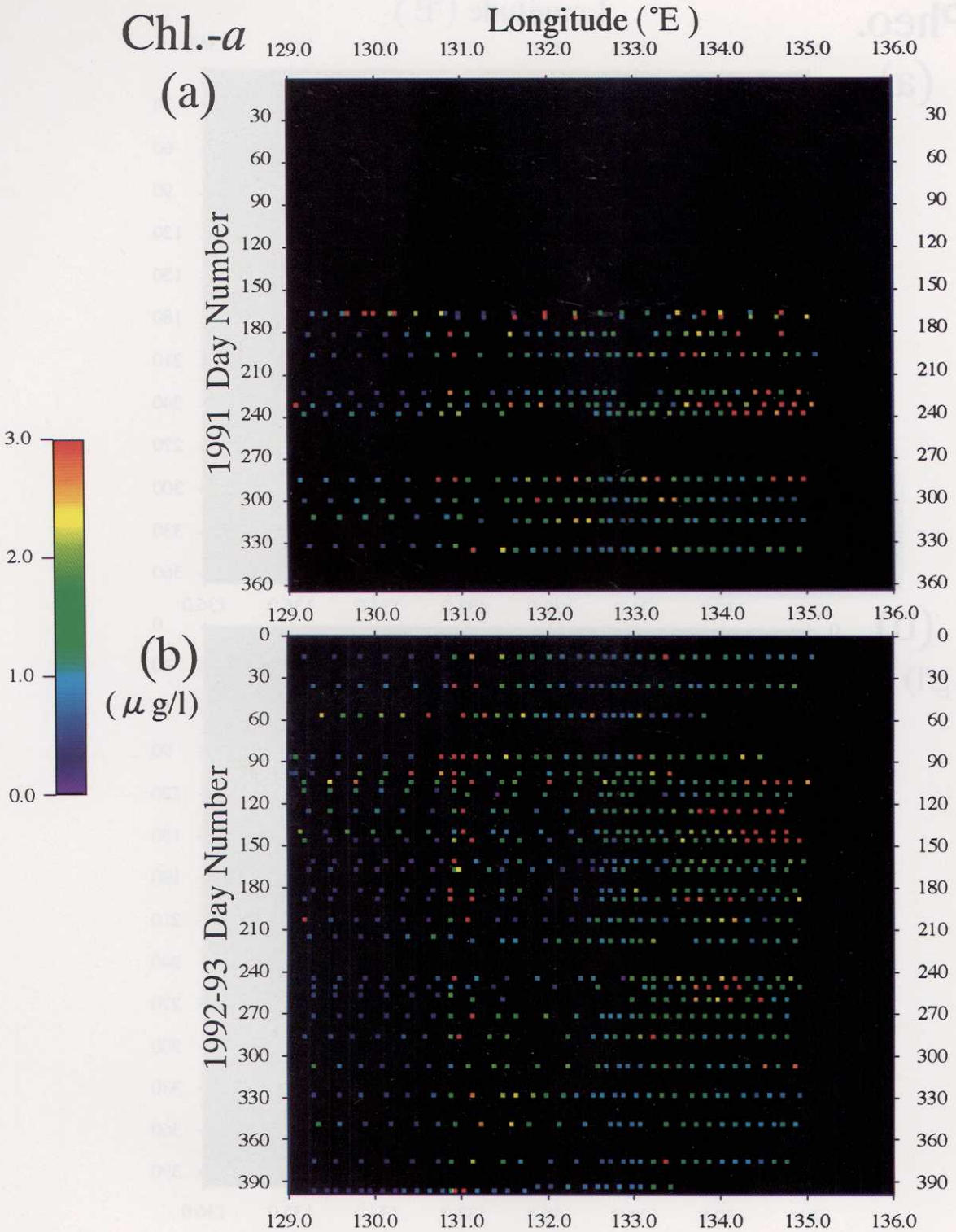

Fig. 14 Chlorophyll-a (μg/l) by analysis of acetone-extracts in 1991 (a) and in 1992+1993 (b).

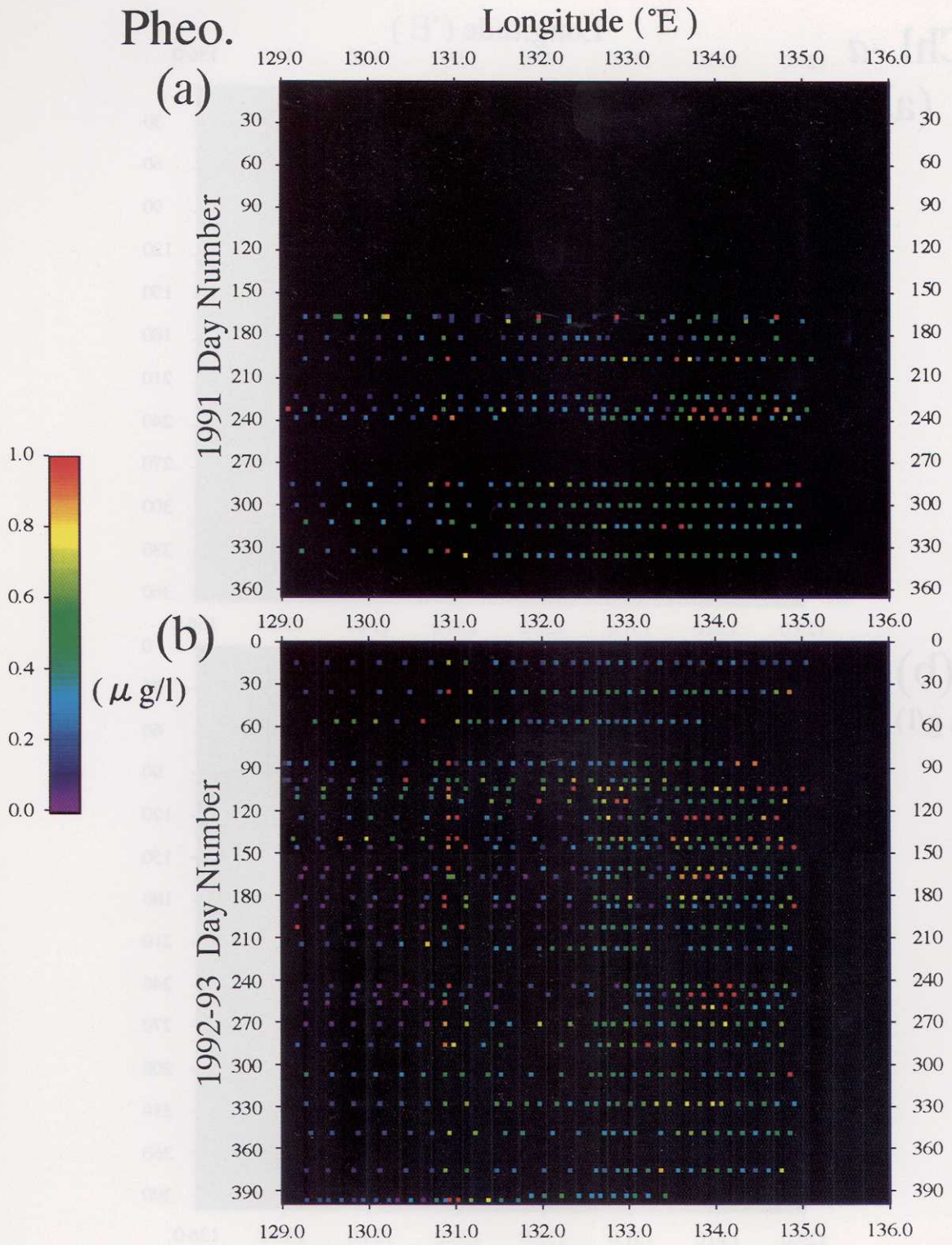

Fig. 15 Pheopigments (μg/l) by analysis of acetone-extracts in 1991 (a) and in 1992+1993 (b).

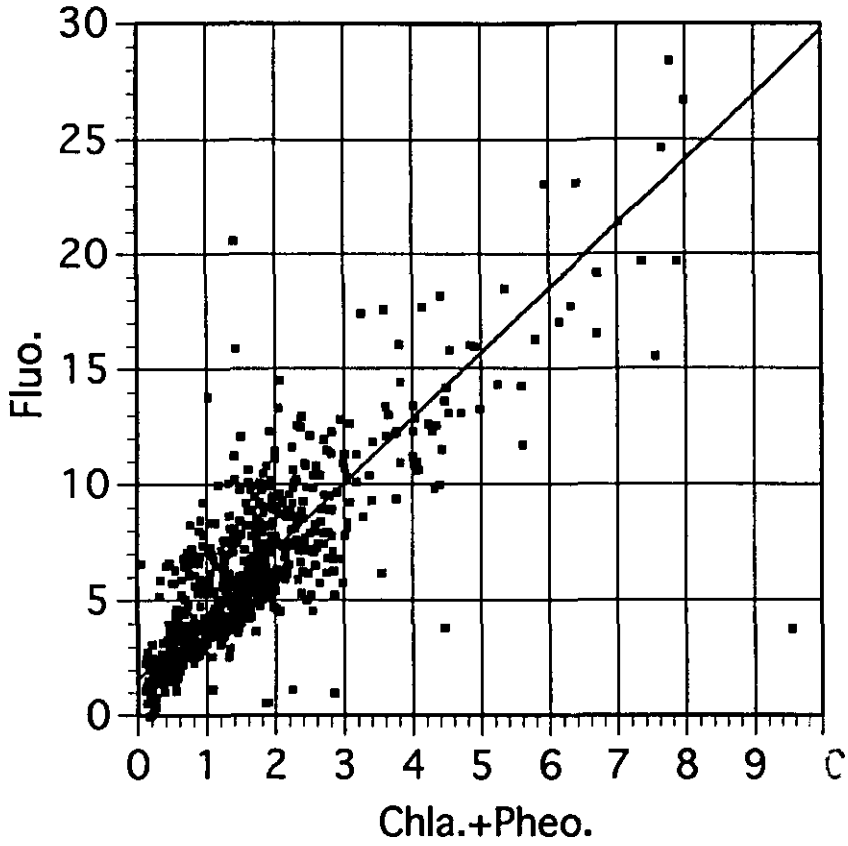

Fig.16 Regression of fluorescence intensity by a linear function f=2.82(*Chla*+*Pheo*)+1.60 of phytoplankton pigments concentrations. (Unit of fluorescence f is the concentration of equivalent fluorescein solution in mg/l, *Chla* and *Pheo* is the concentrations of chlorophyll-a and pheopigments, in μg/l).