





calibrated by five vertical tows of the VMPS without nets before the UM-16-08 cruise.

Thirteen stations were occupied along the 110°E and 63.5°S transects for vertical sampling with the VMPS net ([Fig. 1](#)). Detailed sampling information is given in [Table 1](#).

### 3.2. IONESS

Macro-zooplankton and micro-nekton were collected using an IONESS with nine nets made of nylon bolting cloth with 335- $\mu\text{m}$  mesh and a frame opening of 1.44 m<sup>2</sup>. The IONESS sampling was carried out at eight layers with oblique tows with a multiple-net opening–closing system in the upper 400 m (Kitamura *et al.*, 2001).

The IONESS was deployed from the stern of the vessel and towed obliquely over predetermined depth intervals. Each of the nets was opened and closed sequentially by commands transmitted from an onboard deck unit through an armored cable to an underwater unit. A deployment consisted of an oblique down-cast from the surface to the maximum depth, and the opening and closing sequences through specific depth strata were undertaken during the up-cast.

Although there was a flow-meter (The Tsurumi-Seiki Co., Ltd., Yokohama, Japan) mounted outside the net-mouth opening to estimate towing distance, it was not used during this cruise because of a problem with the reliability of the flow-meter rotation due to rough sea conditions. In the present report, therefore, the volumes of water filtered ( $V$ , m<sup>3</sup>) by each net were estimated with the following equation, assuming a filtration efficiency of 100%:

$$V = D \times A, \quad (1)$$

where  $D$  and  $A$  are the towing distance (m) and the mean working filtration area (m<sup>2</sup>), respectively.  $D$  was calculated as

$$D = \sqrt{D_h^2 + D_v^2}, \quad (2)$$





















