The lobate ctenophore *Mnemiopsis leidyi* occupies coastal waters over a wide latitudinal range: 40°N–46°S (Harbison and Volkov, 1994; Mianzan, 1999). Although endemic only to the eastern coasts of the Americas, *M*. *leidyi* has successfully invaded the Black Sea (Shushkina and Musayeva, 1990; Shushkina and Vonogradov, 1991; Studenikina et al., 1991; Zaitsev, 1992) and, more recently, the Caspian Sea (Ivanov et al., 2000).

*Mnemiopsis leidyi* is a highly versatile planktonic predator (Waggett and Costello, 1999; Costello et al., 1999) with potentially high ingestion rates (Reeve et al., 1978; Kremer, 1979) that make it one of the most environmentally troublesome marine invaders (Harbison and Volkov, 1994).

As with other planktonic predators, accurate quantitative estimates of abundance and distribution are essential for understanding the trophic impacts of *M. leidyi*. Population estimates are typically based upon conventional net sampling of the water column [e.g. Burrell and Van Engel, 1976; Mutlu, 1999]. But how appropriate are these methods for quantification of *M. leidyi* distributions?

Direct visual observations throughout the water column via SCUBA of *M. leidyi* from waters near Puerto Madryn, Nuevo Gulf, Argentina (Figure 1), cast doubt on the suitability of conventional methodological approaches for field sampling of ctenophores in that region. Dense aggregations of *M. leidyi* were observed to form a concentrated layer within 1 m from the bottom (total water depth 5 m), with most ctenophores concentrated within 0.5 m from the bottom (Figure 2). During the time (13:00 h local time, 10:00 h GMT, 12 January 2002) of the most concentrated near-bottom ctenophore layers (average water temperature 20°C), few ctenophores were found near the surface.

Visual observations indicated that the location of the bulk of ctenophores within the water column varied. On several subsequent dives, the highest concentrations were found within a meter of the surface (Figure 3). At other times, the ctenophores appeared to be concentrated either near the bottom or at the surface, with relatively few individuals intermediate between the two depths. Local divers (R. Bebote Vera, personal communication) noted that distributions of *M. leidyi* in these waters are often characterized by such layered aggregations. Although environmental factors such as local tidal or wind patterns may influence the formation of these ctenophore aggregations, no definitive evidence currently exists to link aggregation formation with specific environmental variables.

This is the first report of direct visual observations of near-bottom aggregation formation by *M. leidyi*. However, results of other studies provide evidence that the phenomenon we report was not a unique occurrence, but instead may be an important and regular feature of *M. leidyi* distribution patterns in some locales. *Mnemiopsis leidyi* dominated the zooplankton biomass at a tidal mixing front off Valdés Peninsula, close to the sampling location.
of the present work. There *M. leidyi* represented 60% of the total organic carbon and was more abundant at the stratified zone of the front (Mianzan and Guerrero, 2000). The population was able to perform vertical movements of up to 70 m and, at times, the population was concentrated close to the bottom (H. W. Mianzan, unpublished data). Lobate stage *M. leidyi* can easily swim these distances on a daily or semidiurnal cycle. For example, an individual of 4 cm total length (lobes open) swimming at 0.65 cm s\(^{-1}\) (J. H. Costello, unpublished data) can traverse a 70 m vertical distance in 3 h. Wet biomass of *M. leidyi* in near-bottom (<10 m from substrate) samples at the tidal mixing front off Valdés Peninsula were as high as 700 ml per 10 m\(^3\) (Alheit et al., 1991). These bottom layers were dense enough to form a clear signal using a 38 kHz acoustic system (Alvarez Colombo et al., 2000). The potential trophic importance of near-bottom layers of *Mnemiopsis* is indicated by the presence of these ctenophores in the gut contents of a variety of demersal fishes from the Argentine continental shelf (Mianzan et al., 1996).

The generality of horizontal layer formation, particularly near-bottom layering, by *M. leidyi* remains unresolved. Since the formation of dense near-bottom aggregations by *M. leidyi* has not been reported from other geographical regions, this pattern may represent a localized, population-specific phenomenon. Alternatively, these patterns may be more widespread, but unnoticed, because conventional net sampling does not provide sufficient information on ctenophoran vertical distributions. If, as we observed at Puerto Madryn, the ctenophores are concentrated within a meter (often within 0.5 m) of the bottom, then conventional net tows would miss the chief mass of ctenophores. Even oblique net tows would need to place the net mouth, not the cod end, almost on the bottom in order to sample the near-bottom layer. Epibenthic sleds could be useful, but are not typically employed in ctenophore distribution studies. Therefore, if near-bottom ctenophore layer formations are common, biases inherent in conventional net sampling could limit quantification and reporting of these patterns.

Several alternative methodologies for sampling zooplankton distributions can quantify layers formed by gelatinous zooplankton. Acoustic methods are not routinely used to record distribution patterns of most gelatinous zooplankton but rather low-frequency acoustic systems have provided insight into gelatinous plankton distributions in the field. Population distributions of the salp *Inia zonaria* (Mianzan et al., 2001), the hydromedusa *Aequorea victoria* (Brierley et al., 2001) and the scyphomedusa *Aurelia aurita* (Munthe, 1996; Toyokawa et al., 1997) have been documented using common low-frequency (38–50 kHz) acoustic systems. Even ctenophores (*Pleurobrachia bachei*) have been recorded by acoustic methods (Mouger et al., 1998). Perhaps the most informative combination of quantitative methods involves directed...
net sampling guided by acoustic data. It was this approach that was used to assess dense near-bottom layers of *M. leidyi* south of the Valdés Península tidal front (Alvarez Colombo et al., 2000), and in the El Rincon area (Alvarez Colombo et al., 2003) of Argentina. Alternatively, direct observation by either SCUBA, as in this report, submersibles [e.g. (Mackie and Mills, 1983)] or remotely operated vehicles [e.g. (Davis et al., 1992)] can be used to locate and describe heterogeneous distributions of gelatinous zooplankton.

The choice of sampling methodology depends upon a variety of factors affecting specific study situations. However, vertical migration and the formation of near-bottom aggregations can affect abundance estimates as
well as our understanding of trophic interactions involving ctenophores. Therefore, whatever the sampling approach selected, studies of *M. leidyi* distribution and abundance patterns should consider the potential for near-bottom aggregations and vertical migration.

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