

Short Communication

On the occurrence of *Obelia* medusa blooms and empirical evidence of unusual massive accumulations of *Obelia* and *Amphisbetia* hydroids on the Argentina shoreline

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ABSTRACT. Medusa blooms are a scarcely known phenomenon. For temperate, southwestern Atlantic waters, reports of such events are almost nonexistent. This research reports the analysis of a total of 1043 plankton samples taken from 1993 to 2006 and benthic samples collected by seasonal SCUBA diving since 1997 along the Buenos Aires coast. The medusa *Obelia longissima* was observed in very low densities and frequencies, except in October 2003, when a bloom of this species was detected. Soon afterward, two consecutive massive accumulations of *O. longissima* and *Amphisbetia operculata* colonies were detected on the coast by the inhabitants of Mar del Plata (38°00'S-57°32'W) and the coastal Mar Chiquita Lagoon (37°32'S-57°19'W) between March and April 2004. The colonies of both species were collected from the shoreline at low tide at both sites. The environmental factors of that period seemed to be particularly appropriate for promoting optimum growth conditions for these hydroid species. This paper reports and describes the mentioned abnormal phenomena, providing baseline information on these little-understood events.

Keywords: Cnidaria, Hydrozoa, Leptomedusae, bloom, Buenos Aires coast, southwestern Atlantic Ocean.

Bloom de la medusa *Obelia* y evidencia empírica de una inusual acumulación masiva de hidroides de *Obelia* y *Amphisbetia* en la línea de costa en Argentina

RESUMEN. Los blooms de medusas son un fenómeno escasamente conocido. En las aguas templadas del Atlántico sudoccidental, esta clase de eventos son casi inexistentes. Un total de 1.043 muestras de plancton de 1993 a 2006 fueron analizadas como también aquellas de bentos colectadas por SCUBA estacionalmente desde 1997 en la costa de Buenos Aires. Para la medusa *Obelia longissima* fueron observadas muy bajas densidades y frecuencias, con excepción de octubre de 2003 cuando un bloom de esta medusa fue detectado. Seguidamente, dos acumulaciones masivas consecutivas de colonias de *O. longissima* y de *Amphisbetia operculata* fueron detectadas sobre la línea de costa por habitantes de Mar del Plata (38°00'S-57°32'W) y de la laguna costera Mar Chiquita (37°32'S-57°19'W) entre marzo y abril del 2004. Las colonias de ambas especies fueron colectadas desde la línea de costa durante marea baja en ambas localidades. Los factores ambientales en ese período mostraron ser particularmente apropiados promoviendo las condiciones óptimas para el crecimiento de los hidroides de estas especies. Este trabajo reporta y describe el mencionado anormal fenómeno, dando información de base sobre estos eventos poco conocidos.

Palabras clave: Cnidaria, Hydrozoa, Leptomedusae, bloom, costa de Buenos Aires, Atlántico sudoccidental.

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The sudden appearance of medusae, with an apparently "abnormal" abundance of one or a few species (medusa blooms), is a common but as yet enigmatic

characteristic of gelatinous plankton life histories. These events are usually noticed and reported when massive appearances of conspicuous, stinging jellyfish

occur near the coastal zone, significantly and visibly affecting human activities such as tourism and fisheries (Haddad Jr. *et al.*, 2002).

The question of what a “normal” abundance value is for a particular species remains to be answered. It is quite difficult to properly define a dense concentration of organisms as a bloom. It is possible to accept that medusa blooms occur when the number of individuals of a species increases unusually. In fact, any additional concentration in the number of plankton individuals that surpasses the “average” could probably be considered to be “abnormal”, “irregular”, “unexpected”, or “exceptional” (Benovic & Lucic, 2001). However, some of the aggregations on beaches may not be the result of a true bloom, but that of the advection of a population by physical forces (Arai, 1992; Graham *et al.*, 2001). Consequently, of the hundreds of medusa species, only a few of them (e.g. Buecher, 2001; Malej, 2001 and information therein) are known as true producers of blooms; this identification is only possible when proper baseline information, such as long term monitoring, is available regarding the seasonal cycles and historical abundance values of these species.

If a medusa outbreak occurs some distance from the coast, it would surely pass unnoticed because long-term monitoring in oceanic waters is very uncommon due to the distances and high costs involved (Boero, 1991).

In the temperate southwestern Atlantic waters reports concerning these phenomena are almost nonexistent. The few reports of blooms or aggregations, as expected, regarded coastal and stinging species, specifically *Olindias sambaquiensis* Müller, 1861 (Limnomedusae) and *Liriope tetraphylla* (Chamisso & Eysenhardt, 1821) (Trachymedusae), locally known as “agua viva” and “tapioca respectively” (Mianzan & Zamponi, 1988; Mianzan *et al.*, 2000).

A bloom of *Obelia longissima* (Pallas, 1766), a very small Leptomedusae, was detected offshore during the austral spring of 2003 after analyzing a historical series of zooplankton samples collected since 1993. This bloom was followed by a huge shoreline accumulation of its benthic phase (hydroid colonies) a few months later. Shoreline aggregations of hydroids are very uncommon events that are rarely reported (e.g. Clare *et al.*, 1971) and usually involve a few clumps; these are less noticeable than coastal jellyfish aggregations.

It seems that the environmental factors in austral spring 2003 were particularly appropriate, providing optimum growth conditions for hydroid species, since

another larger shoreline aggregation of *Amphisbetia operculata* (Linnaeus, 1758) colonies occurred in the same area just a month later. This paper reports and describes those abnormal events involving two hydrozoan species off the Buenos Aires coast, Argentina (southwestern Atlantic Ocean).

Ten research cruises were performed along the Buenos Aires coast from the last week of October to the first week of November from 1993 to 2006. A total of 1043 samples were collected with a Pairovet plankton net (200 μ mesh) and analyzed. *Obelia* medusae were sorted and counted. Their densities were expressed as the number of specimens per cubic meter and their frequency as the percentage of samples with *Obelia* in the total analyzed samples.

Obelia longissima and *A. operculata* colonies were collected from the shoreline at low tide from Mar del Plata (38°00'S-57°32'W) to the coastal Mar Chiquita Lagoon (37°32'S-57°19'W).

Populations of both hydroids in the littoral outcrops from Mar del Plata and neighboring areas have been studied seasonally by means of SCUBA diving since 1997; beaches have been checked monthly since 1989 for the presence of clumps. Specimens were preserved in a 5% formaldehyde solution and they were deposited in the authors' collections (Departamento de Ciencias Marinas, FCEyN – UNMdP).

An offshore *Obelia* medusa bloom and an unusual massive shoreline accumulation of its benthic phase soon afterwards, followed by another hydroid shoreline accumulation of *A. operculata*, even larger than the previous one, are reported for the first time in the same area.

The *Obelia* medusa bloom was detected in October 2003. This medusa was found at very low densities and frequencies in the study area between 1993 and 2002. This abundance never surpassed 5 ind·m⁻³. Similar values were reported for *Obelia* spp. medusae around the world (Vannucci, 1957, 1963; Alvarino, 1968; Vannucci *et al.*, 1970; Goy, 1979; Bouillon, 1995; Pagès & Orejas, 1999; Palma *et al.*, 2007). However, the *Obelia* frequency was 4 times higher and its density 200 times higher in 2003 than during any previously recorded period. A high proportion of the *Obelia* were juveniles on these occasions. In the following years (2004-2006), the population decreased, but was still higher than the preceding ones (Table 1, Fig. 1).

Obelia species exhibit a typical leptolid life cycle consisting of a sessile colonial vegetative hydroid stage, a free-living sexual medusa stage, and a planula

Table 1. Number of specimens and density of *Obelia* sp. medusae found during the analyzed long-term monitoring (1993-2006). SE: standard error.**Tabla 1.** Número de especímenes y densidad de la medusa *Obelia* sp. encontrada durante el monitoreo a largo plazo (1993-2006). SE: error estándar.

| Year | Number of samples analyzed | Samples with medusae Number and frequency | Medusae per sample | Density (ind m ⁻³) | |
|-------|----------------------------|--|--------------------|--------------------------------|---------|
| | | | | Mean ± SE | Maximun |
| 1993 | 118 | 1 (0.85%) | 1 | 0.007 ± 0.006 | 0.81 |
| 1994 | 92 | 1 (1.09%) | 3 | 0.003 ± 0.005 | 0.97 |
| 1995 | 113 | 2 (1.77%) | 12 | 0.03 ± 0.03 | 5 |
| 1996 | 98 | 1 (1.02%) | 3 | 0.04 ± 0.04 | 3.8 |
| 1999 | 79 | 4 (5.06%) | 40 | 0.1 ± 0.04 | 3 |
| 2001 | 78 | 0 | 0 | 0 | 0 |
| 2002 | 109 | 6 (5.50%) | 11 | 0.06 ± 0.02 | 3.1 |
| 2003 | 108 | 25 (23.15%) | 3044 | 21.2 ± 15.8 | 1578.8 |
| 2004 | 114 | 14 (12.28%) | 39 | 0.16 ± 0.08 | 8.25 |
| 2006 | 134 | 35 (26.12%) | 278 | 0.98 ± 0.24 | 19.77 |
| Total | 1043 | | 3431 | | |

larval stage. Various nominal species of *Obelia* hydroids were reported for the Buenos Aires coast (Blanco, 1994; Genzano & Zamponi, 1997, 2003) but there is not way to recognize the medusae species and they are usually named *Obelia* spp. However; floating bits of *Obelia* hydroid colonies were also found in some samples along with medusae (Fig. 1). The comparison of these fragments with reference collections indicated that they corresponded to *O. longissima* and so it was possible to ascribe the medusae to this species.

Soon after the mentioned medusa bloom, two consecutive massive hydroid shoreline accumulations were detected by the coastal inhabitants of Mar del Plata and neighboring areas; this lasted for more than three months, from the end of February to the end of May 2004. The accumulation was particularly important in Mar Chiquita Lagoon (Fig. 2), a shallow coastal lagoon fed freshwater by a small river and seawater through a narrow southern part during semi-diurnal high tides.

Local residents manifested their worries over this unusual event, especially because of the persistent and unpleasant odor of the dead clumps. Local sport fishermen recognized two different kinds of what they called “marine grass”: a rare “brown marine grass” at the beginning, followed by a “yellow” one a month later. These colonies were so abundant that they adhered to the fishing lines, hindering sport fishing activities. The clumps also clogged fishing nets (Reta, pers. com.).

The first accumulation corresponded to *O. longissima* clumps that were found through the end of March 2004. The colonies were up to 17 cm tall, clearly larger and more densely ramified than any other colonies previously collected on the Buenos Aires coast (Genzano, 1994; Genzano *et al.*, 2002; Genzano & Zamponi, 2003) (Fig. 1).

Soon after, in April and May, a second huge accumulation corresponded to *Amphisbetia operculata* hydroids. The species was so abundant that some clumps were found rolling with the wind on the street next to the lagoon. This species inhabits the rocky sub-littoral outcrops (5-33 m depth). Ephemeral, no feed, and small reduced medusoids are released between May and January. A period of marked colony growth occurs at the end of spring and at the beginning of summer (Genzano *et al.*, 2002).

The presence of pelagic hydroid fragments or entire colonies in the water column and their later massive shoreline accumulation are rarely recorded (Clare *et al.*, 1971; Mills, 2001). Clare *et al.* (1971) reported the occurrence of “rolling colonies” of two hydroid species, *Sarsia tubulosa* (M. Sars, 1835) and *Tubularia larynx* (Ellis & Solander, 1786), on the shore of Morecabe Bay. Those colonies showed abnormalities (spherical forms) as a consequence of trophosome development in the plankton because chemical pollutants inhibited the larvae from attaching to the substrate. On the contrary, the analyzed *O. longissima* and *A. operculata* colonies did not show any signs of abnormalities. Whole trophosomes were detached and then accumulated on the shoreline, probably due to a

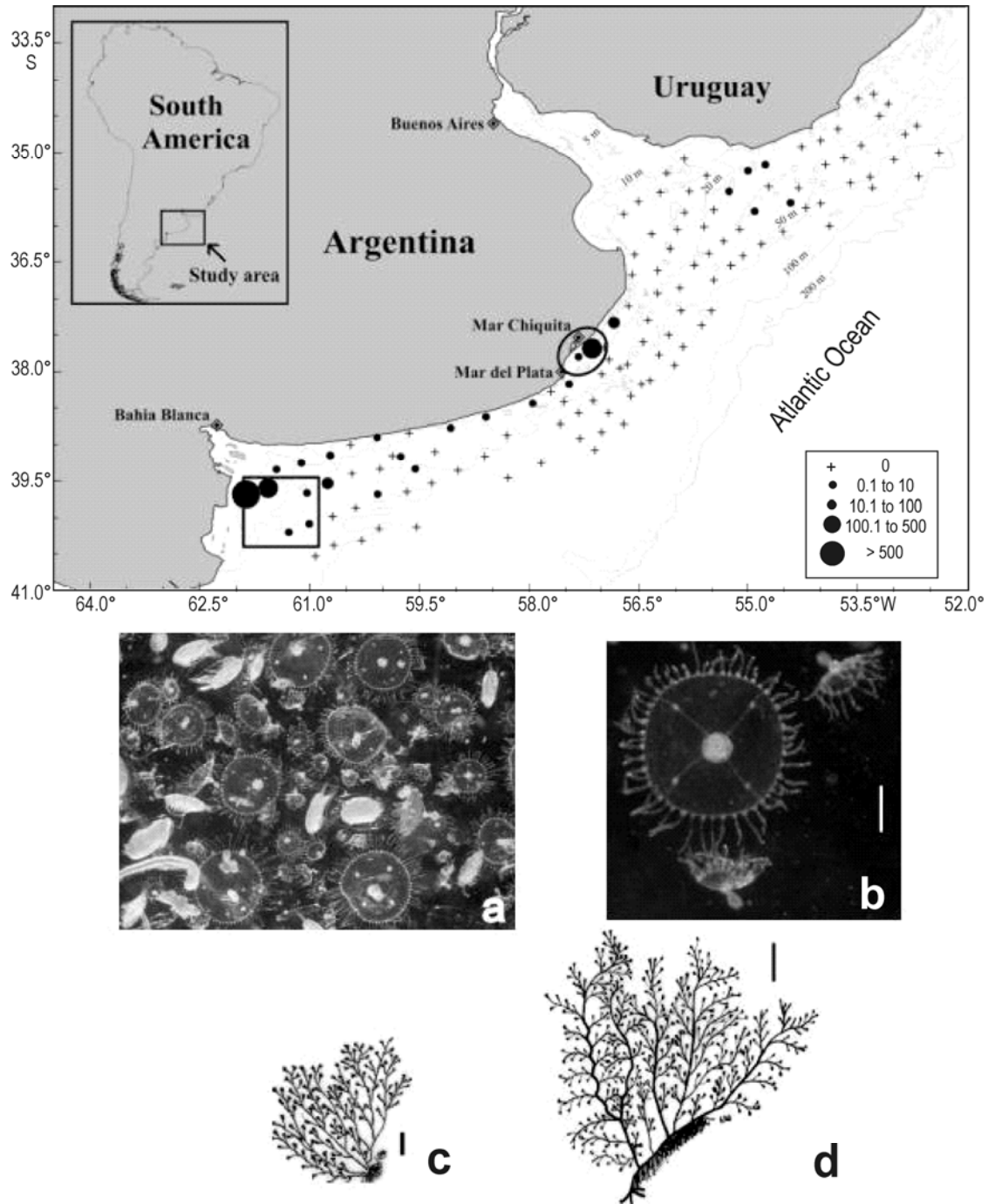


Figure 1. Distribution and abundance of *Obelia longissima* medusae during October 2003. The square indicates the area where bits of *O. longissima* hydroids were found in plankton samples. The circle indicates the area of shoreline accumulation. a) detail of zooplankton sample during *O. longissima* bloom, b) detail of *O. longissima* medusae, c) detail of *O. longissima* hydroids (normal colony from Mar del Plata Harbor), d) detail *O. longissima* colony from the shoreline accumulations. Scale for b, c and d represent 1 cm.

Figura 1. Distribución y abundancia de la medusa *Obelia longissima* durante octubre de 2003. El cuadrado indica el área de acumulación de hidroides de *O. longissima* encontrados en las muestras de plancton. El círculo indica las áreas de acumulación en la línea de costa a) detalle de muestras de zooplancton durante el bloom de *Obelia longissima*, b) detalle de la medusa *O. longissima*, c) detalle de los hidroides de *O. longissima* (colonia normal del puerto de Mar del Plata), d) detalle de colonia de *O. longissima* de la acumulación en la línea de costa. Las escalas para b, c y d representan 1 cm.

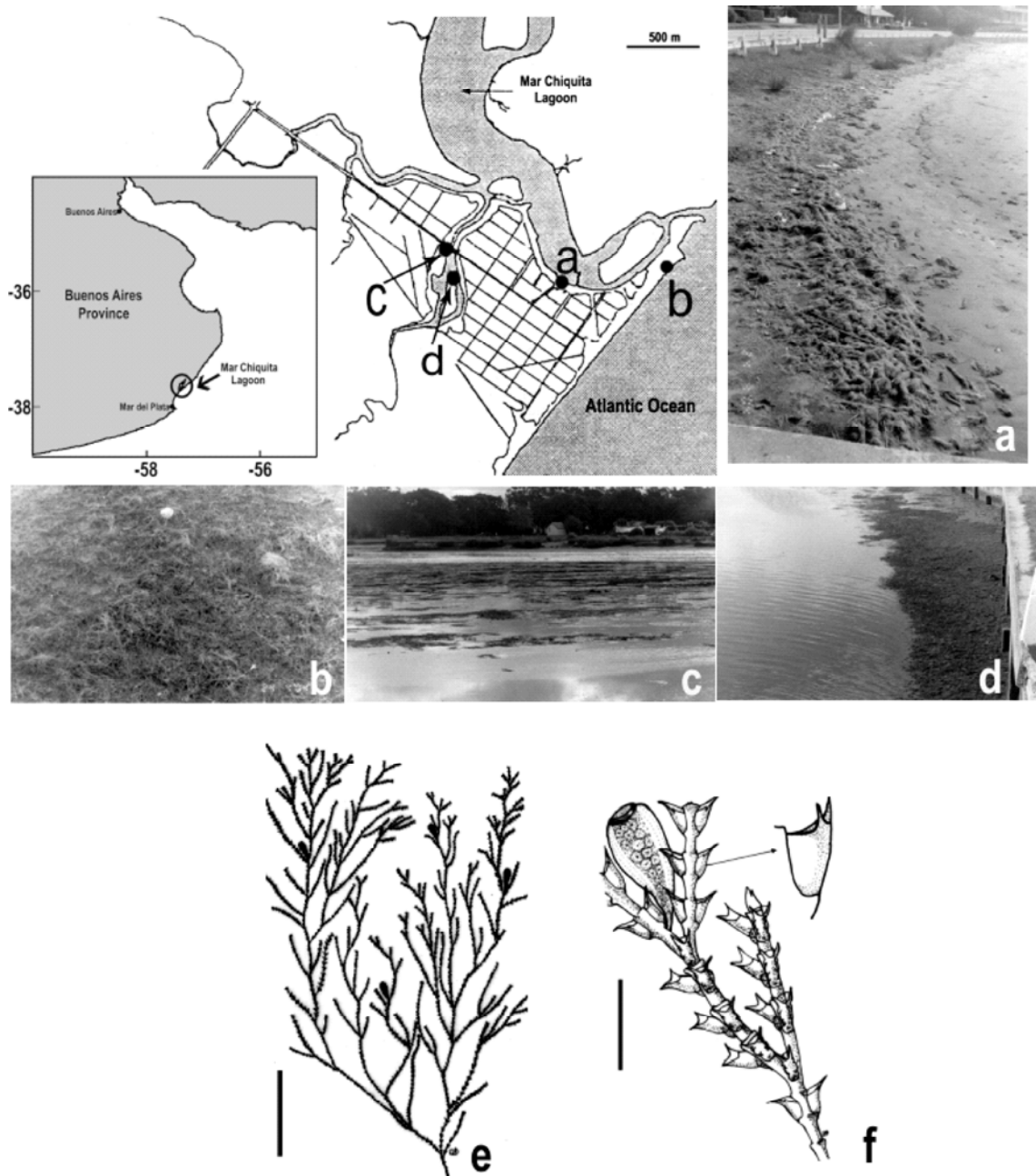


Figure 2. *Amphisbetia operculata* shoreline accumulations in Mar Chiquita Lagoon. a) to d) views during low tide of *A. operculata* shoreline accumulations in different places of the lagoon, e) and f) detail of *A. operculata* colony. Scale bar represent 5 mm for e) and 1 mm for f).

Figura 2. Acumulación en la línea de costa de *Amphisbetia operculata* en la laguna de Mar Chiquita. De a) hasta d) vistas durante la marea baja de la acumulación en la línea de costa de *A. operculata* en diferentes lugares de la laguna, e) y f) detalle de una colonia de *A. operculata*. La barra de escala representa 5 mm para e) y 1 mm para f).

massive settlement of planulae on an unsuitable substrate.

In general terms, under favorable conditions, hydroid colonies grow rapidly; exploit food items that may be highly diluted within the water mass with high

assimilation efficiencies (Coma *et al.*, 1995, 1999; Gili *et al.*, 1998; Genzano, 2005); form substantial biomasses; and reproduce. Larval production in metagenetic life cycles depends on the colony size and, hence, the number of gonothecae in which the medu-

sae stages are formed. Cornelius (1990) suggested that an average *Obelia* sp. colony has a potential production of 2000 medusae. Each female medusa could release about 20 eggs, for a potential production of 20,000 planulae (assuming that all the medusae survive to release gametes and half are male). Potential planulae production seems to be lower in *A. operculata* colonies. Only one medusoid is released from each gonotheca, giving a potential production of 400 medusoids and 1,000 larvae per colony, considering that a female contains four to five eggs (G. Genzano, obs. pers.).

Among the factors controlling hydroid reproduction, temperature is a critical one (Gili & Hughes, 1995 for a review). However, for some hydroids, there are many other factors that can induce unusual reproductive activity, such as the response to a deteriorating environment or hormesis (Stebbing, 1982; Cornelius, 1990), and it is now accepted that increased populations may be a consequence of human effects on coastal environments (Purcell *et al.*, 2007; Boero *et al.*, 2008). Consequently, it is necessary to improve the available databases documenting medusa blooms, as this will provide baseline information about these little-studied events.

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