



# What is left behind when the lights go off? Comparing the abundance and composition of litter in urban areas with different intensity of nightlife use in Mar del Plata, Argentina



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## ABSTRACT

Nightlife activities represents an important source of urban litter; the latter often being left behind or abandoned in public places and streets. Mar del Plata is a very important city on the Atlantic coast of Argentina and is the main tourism destination in the South Atlantic region of South America. However, few studies on urban litter related to nightlife activities have been conducted in the area. Here we assessed (i) the abundance and composition of litter, and (ii) the spatial and temporal variations of its abundance, diversity, richness and evenness in urbanized areas with different intensity of nightlife activities from April 2008 to March 2009. An overall of 13,503 items were counted. Around 92% of the total litter was comprised by cigarette butts, papers and plastics. We found significant spatial differences in the abundance of litter between sampling sites, with the greatest amounts of litter at the Alem site followed by the Hipólito site (both with an intensive nightlife activity) compared with the Chauvin site (a quiet high-income neighborhood). The composition of litter of the Alem and the Hipólito sites was relatively similar and both sites differ with respect to the Chauvin site. Cigarette butts, papers, and plastics were the items that contributed most to the dissimilarity between sampling sites. The diversity of litter was the single community parameter that significantly differed from the other seasons. We discussed the potential effect of nightlife activities on the amounts and quality of urban litter in the city of Mar del Plata.

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## 1. Introduction

Human activities in urban areas create litter such as bottles, plastic, paper wrappings, newspapers, shopping bags, and cigarette butts and packets, among others, which is often left behind or abandoned in public places. This litter can be referred as littering behavior (Armitage and Rooseboom, 2000). Where intense human activities concentrate, such as in urban centers, higher amounts of litter are expected to accumulate in streets and other public spaces (Arafat et al., 2007; Chapman and Risley, 1974). Population increase, urbanization and tourism activities have created an impact on several cities of Europe and South America that have to deal in modern days with a booming amount of wastes, including litter

(Kousis, 2000; Medina, 2002). Litter will remain in the streets and public areas until it is either removed by the local authority or it is transported by the winds and/or storms water runoff into the drainage system; in the latter case reaching coastal marine and/or freshwater areas (Armitage and Rooseboom, 2000; Williams and Simmons, 1999). In consequence, while is aesthetically distasteful and results in unhealthy living conditions, it can cause environmental hazards to wildlife and humans (CDCP, 1997; Novotny et al., 2011; Register, 2000; Slaughter et al., 2011). For example, organic litter that is dumped indiscriminately in the streets contributes to flooding, creates rodent vectors, breeding habitat for insects and promote the spread of diseases (Zurbrügg, 2002). Further, litter that reaches the sea by the sewage system affects marine wildlife through entanglement and the ingestion of plastic litter (Bugoni et al., 2001; Mallory et al., 2006).

Taking into account that almost half of the Earth's human population lives in urban areas (50% worldwide, 80% in industrialized countries), urban nature is an important issue for recreation and the well-being of urban residents and users (Matsouka and Kaplan, 2008; Vandruuff et al., 1995). Not surprisingly, one goal in urban

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development is to avoid mono-functional areas and instead aim for a mix of daytime and nightlife activities in certain districts or areas (Begg, 2002; Crewe and Beaverstock, 1998). This means placing different venues (i.e. stores, cafes, restaurants, amusement arcades, movie theaters, and other type of business and housing) side by side. This is attractive to many people because it livens up the street, but it also creates conflicts when families living in the city have to co-exist with others that use it as an entertainment center until the early hours of the morning (Nørgaard and Børresen, 2008). Nightlife activity represents an important source of urban litter in several cities around the globe. The majority of the studies were conducted in Europe and North America (Bianchini, 1995; Crivello, 2011; Grazian, 2009; among others), with an important asymmetry on with what is known for other regions, including in South America. In order to create healthy and pleasing environments for residents and users, knowledge of the effects that humans have on urban ecosystems is imperative (Niemele, 1999).

Mar del Plata (38° 00'S, 57° 33'W), located 404 km south of Buenos Aires on the Atlantic Ocean, is the most populated coastal city of Argentina (619,000 inhabitants; CIEM, 2013). The city is truly multifunctional in that it supports a wide range of industries, including tourism, fishing, cereal crop storage, and sport industries. Mar del Plata receives between 2 and 3 million tourists during the summer months (December–March) (Bouvet et al., 2005), and offers a variety of daytime – mainly massive beach tourism – and also nightlife activities – chiefly gastronomic and after-dinning options – throughout the year (CIEM, 2013). As such, it has recently been selected as the leading touristic destination on the Argentina's Atlantic coast (Trip Advisor, 2013). As many other big cities, Mar del Plata has an intensive nightlife activity with a wide variety of venues located by district or area (e.g. the area of Alem and Hipólito Yrigoyen streets known for their quantity of restaurants, pubs and nightclubs; the area of Constitución street known for its discotheques). Littering is influenced by location, the time of day, the type of item being littered and whether the person dropping the litter is alone or in a group, among other factors (Wever et al., 2010; Williams et al., 1997). However, information about the amount and composition of litter in cities is scarce locally and even rare when it refers to peoples' activities linked to nightlife activities.

The creation of a local strategic plan in 2002 (Municipal Bylaw 14,957) triggered a number of domestic actions, including land-use planning and urban development, among others in Mar del Plata. Despite the progress achieved, issues relating to the effects of urban littering have only been partially addressed and need urgent attention. In order to contribute to local planning and urban design initiatives concerning nightlife activities in Mar del Plata, the present study was designed to assess (i) the abundance and

composition of litter, and (ii) the spatial and temporal variations of its abundance, diversity, richness and evenness in areas with different intensity of nightlife activities.

## 2. Materials and methods

### 2.1. Study area, sampling methodology and classification of litter

Three urban sites, Alem, Hipólito Yrigoyen and Chauvin, were selected at Mar del Plata for the study (Fig. 1). Site Alem covers an approximately six-block area and is located in close proximity to its harbor and a major seaside resort, and it includes a commercial street that has a variety of clothing shops, restaurants, pubs, nightclubs and other entertainment venues in it. The accumulated (official) accommodation capacity for overall restaurants, pubs, nightclubs and entertainment venues at this site is around 3000 persons (authors, pers. comm.). Site Hipólito Yrigoyen (hereinafter Hipólito) is located near the city council of Mar del Plata and its central district business area. This site, which also covers an approximately six block area, includes a commercial street with a number of restaurants and pubs on it, and has an overall (official) accommodation capacity of around 1035 persons (authors, pers. comm.). While site Chauvin has opposite characteristics; it is a quiet residential, high-income that has no tall buildings or commercial and industrialized zones in it.

Two transects were surveyed in each area monthly from April 2008 to March 2009. Each transect (sampling unit) was about 1425 m<sup>2</sup>, comprising (the same) three blocks long (87 m each and the 12 m in between) and the sidewalk (4 m) plus 1 m of curb wide (see Seco Pon and Becherucci, 2012). Each transect was covered once by the same observer, to count and classify all visible litter during the early morning (07:00–10:00 h local time; –3 GMT). Litter was not collected or weighted but was classified into eleven groups according to its composition: cardboard, paper, plastic, glass, metal, wood, cable, cloth, cigarette butts and cigarette boxes and other articles (e.g. Styrofoam, electronic appliances, car parts, etc.).

### 2.2. Statistical analysis

We calculated the following indices for each sampling unit: litter abundance, richness (S, total number of items), diversity Shannon (H') (Shannon and Weaver, 1963) and evenness (J') (Pielou, 1969).

We used a two-way ANOVA to test the effects of sampling sites and seasons on the mean abundance of litter and the mean litter "community parameters" (S, H', and J'). Comparisons among means

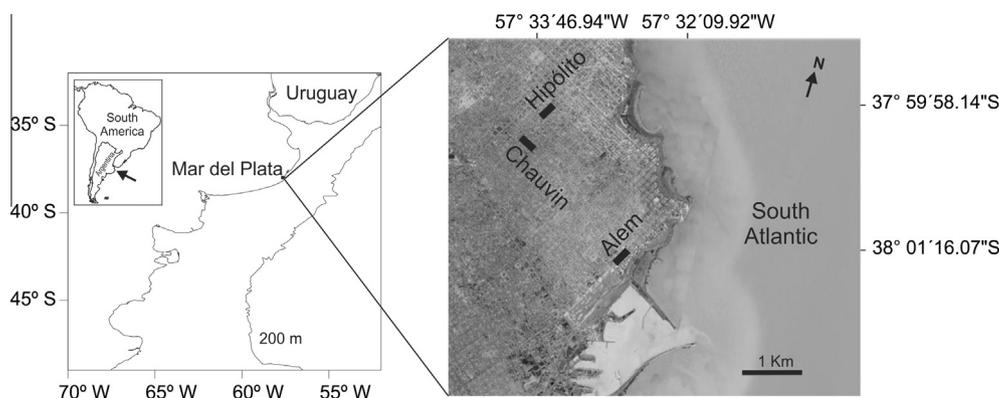


Fig. 1. Map showing the location of the three study sites (Alem, Hipólito and Chauvin) in the southeast of Argentina. The inset shows the location of Mar del Plata city. Image taken from Google Earth™.

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