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UTILITY AND LIMITS IN THE USE OF HISTORICAL MARINE BIODIVERSITY DATASETS: A CASE STUDY IN THE GULF OF NAPLES

UTILITÀ E LIMITI NELL'USO DEI DATA SET STORICI DI BIODIVERSITÀ MARINA: UN ESEMPIO NEL GOLFO DI NAPOLI

Abstract *- Utility and limits in the use of historical marine biodiversity datasets, for past reconstruction and recent evaluation of marine biodiversity and local ecological conditions, is here presented giving an example in the Gulf of Naples. The examined area is one of the better known of the entire Mediterranean sea due to historical observation on marine diversity since the last decade of the XIX century, mainly by Salvatore Lo Bianco and later by Ugo Moncharmont and his "Archivio", both operating at the Stazione Zoologica A. Dohrn of Naples. These datasets proved to be very useful to relocate rare species or track the occurrence of alien taxa. However, the spatial and temporal fragmented observation, the recent changes in the taxonomy, and the difficulty to relocate geographic toponyms, make it sometimes impossible to compare recent patterns from previous historical situations, as in the given example of the evaluation of the industrial impact of the iron factory Italisider in the Bagnoli area.*

Key-words: *Marine biodiversity, species check-list, Gulf of Pozzuoli, Tyrrhenian Sea.*

Introduction – Historical marine biodiversity databases represent a useful tool to assess the status of diversity of marine geographic areas (e.g. alpha, and gamma diversity) or compare different zones and ecosystems (beta diversity) at a given time. They may also represent an important baseline reference for comparisons of biogeographic and ecological data of past conditions in respect to recent environmental patterns, often observed after some anthropogenic disturbances. In addition, the need to identify species that can be used as bio-indicators for climate and environmental changes, including alien species, have increased the importance of such databases.

In this contribution we present a synthesis of the utility and limits of the use of historical marine biodiversity datasets for past reconstruction, and recent evaluation of biodiversity and distribution of marine species and habitats, giving some examples in the Gulf of Naples (GoN). The GoN, due to its highly complex seabed geomorphology and diversified substrates and environmental conditions at medium and small scale, is a hot-spot of marine species and habitat diversity, and represents historically one of the most studied areas worldwide. The area in fact is one of the better known of the entire Mediterranean Sea due to available historical observation on marine diversity dating from the last decades of the XIX century, since Naples was hosting the first academic teaching of Zoology in Italy, held by various famous marine zoologists (e.g., Poli, Delle Chiaje, Costa) (Salfi, 1961), and not least due to the foundation of the Stazione Zoologica of Naples (SZN) by Anton Dohrn in 1872 (Groeben, 1985; De Masi, 1990). At the SZN in particular, stimulated by the founder Dohrn, a deep knowledge of the local flora and fauna started with the compilation of the famous monographic series: "Fauna und Flora des Golfes von Neapel", and with the seminal work of Salvatore Lo Bianco (1860-1910) (Lo Bianco, 1909). Later Prof. Ugo Moncharmont (Napoli 1913-Napoli 2000) summarized the whole information of Lo Bianco and other marine zoologists in a series of paper cards named "Archivio Moncharmont" (A.M.) (Gambi *et al.*, 2013).

The "Archivio Moncharmont" – Prof. Ugo Moncharmont (U.M.) has been collaborator and consultant for the Zoology Department at the Stazione Zoologica in Naples from 1956 to 1970, and the most relevant steps of his long career have been synthesized both in Chieffi (2003) and Gambi *et al.* (2013). As a consultant at the Stazione Zoologica, Moncharmont was acting as a supervisor of the scientific collections and identification of animal material for the systematic and zoological needs of SZN guest scientists and for the Museum. The "Archivio Moncharmont" (A.M.) consists of 5389 cards on animal species, hand-written by U.M. and compiled mainly between 1960 and 1968 (with additions and updating until 1985). It is organized in alphabetic order by species names and represents about 4650 marine animal species belonging to 24 phyla (Gambi *et al.,* 2013). Each card, electronically acquired by the SZN as pdf, has been inserted in an electronic database (Excel and Access), and is often consulted for various research purposes. In the A.M. each species has been scored in using both the "original" name (very often changed and/or synonymised) and the current valid name. For each taxon the record/card includes a short description of the species, often with a hand-drawing or a picture of the organism, information about the habitat and site of collection and a short synthesis of previous historical records (Fig. 1). When information was available, data on the biology and reproductive periods are also included, often reporting the data from Lo Bianco (1909) or other Authors. Finally, bibliographic notes are often included with a comprehensive retrospective to past records based on historical literature (e.g., Lo Bianco, Cavolini, Costa, Panceri, Delle Chiaje, Bellini, Poli, Claparède), or on more recent Authors acting in Naples at the time of U.M. (e.g., Salfi, Cognetti, Sarà).

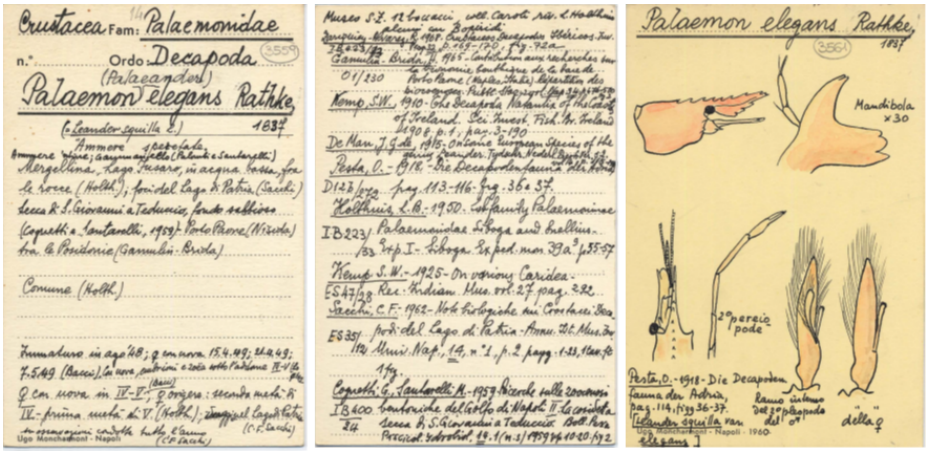

Fig. 1 – Example of a card of a species of a decapod crustacean."Archivio Moncharmont", card 3559-3561.
Esempio di scheda di una specie di crostaceo decapode. "Archivio Moncharmont", scheda 3559-3561.

The A.M. represents a paradigmatic example of integration between historical data and information, of current research on biodiversity and ecology of marine fauna. It is a bridge of data to fill the gap between the historical and pioneering natural history studies of the marine biota in the GoN and the actual, modern ecological marine research performed on this key marine area.

Applications and limitations – The A.M. has been useful in recent times to relocate some rare species in the GoN (e.g., the lancet *Branchiostoma lanceolatum* (Pallas, 1778); or *Glossobalanus minutus* (Kowalevsky, 1866)) (Fig. 2), or to confirm the reproductive biology of some species (e.g., *Scoletoma impatiens* (Claparède, 1868)) (Messina *et al*., 2005), or the occurrence of a habitat forming species in the shallow sandy bottoms, such as the polychaete *Mesochaetopterus sagittarius* (Claparède, 1870) (Guglielmo *et al.,* 2006), or to assess the past status of a thermophilous species, the

scleractinian *Astroides calycularis* (Pallas, 1766), showing a recent increase related to climate change.

It was also useful to track the occurrence of alien species in the GoN, since there are reported the first alien taxa (today considered as cryptogenic) recorded in the GoN, such as the polychaetes *Hydroides dirampha* Morch, 1863 (dated 1870) and *H. elegans* (Haswel, 1883) (dated 1888), and the first record in the Mediterranean of the alien damsel fish *Abudefduf vaigiensis* (Quoy & Gaimard, 1825) (today considered a species' complex) (dated 1954). The last record of an alien taxa in the A.M. is the heterobranch mollusc *Bursatella leachi* Blainville, 1817 (dated 1985).

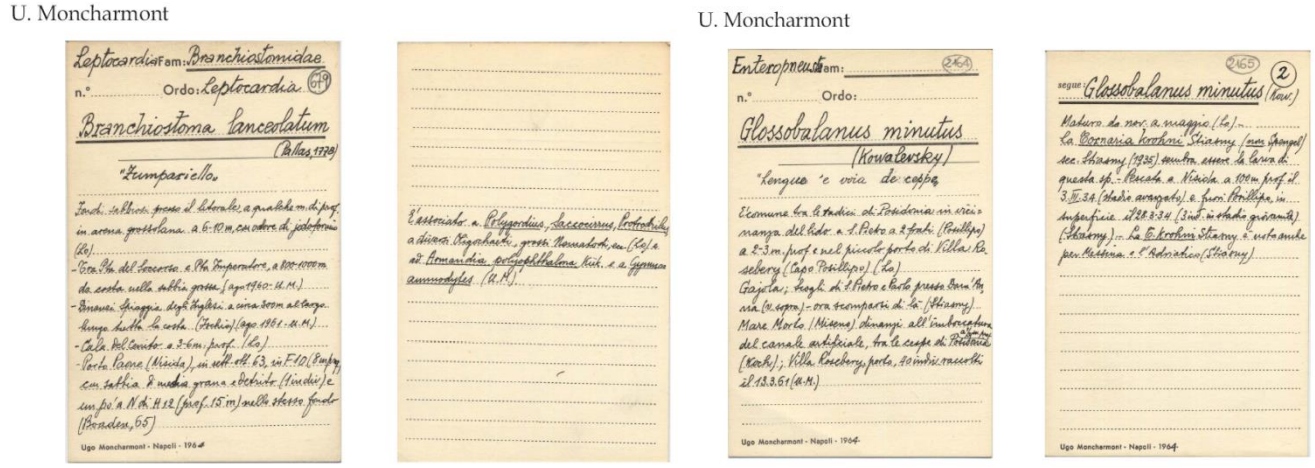

Fig. 2 - The A.M. cards of two rare species, the lancet, *Branchiostoma lanceolatum* (left), and *Glossobalanus minutus* (right). "Archivio Moncharmont", card 679, 264, 265.
Le schede dell'A.M. di due specie rare, l'anfiosso, Branchiostoma lanceolatum *(sinistra), e* Glossobalanus minutus *(destra). "Archivio Moncharmont", scheda 679, 264, 265.*

However, some limits and biases in the use of the A.M. and other historical sources are evident. The lack of quantitative data is generally the rule in these datasets, or is given in a qualitative and general way such as: rare, uncommon, common, frequent. The taxonomy of many species included in the A.M. has been recently updated, often with the description of new taxa (e.g., for polychaetes see Giangrande *et al.,* 2021), or the difficulty to relocate ancient names of toponyms within the GoN to track detailed species' occurrence, or often the location records are too general (e.g., Gulf of Pozzuoli, Capri Island, Ischia island) to allow a detailed georeference of the taxa.
In the framework of the strategic project ABBaCO, aimed at assessing the impact of the iron factory (Itasider) in the Bagnoli Bay (Gulf of Pozzuoli), one of the WP was to reconstruct the past biodiversity of the area and to map the past habitat and ecosystems, to highlight differences with the actual pattern and ecological conditions, as well as to have a baseline for future restoration activities (Gaglioti *et al.,* 2020). Therefore, we entirely relied on the information present in the A.M. and other historical literature. The Gulf of Pozzuoli resulted the best studied and known area, and the most diverse within the GoN (possibly due to its proximity to the Stazione Zoologica). A total of 915 benthic species and fishes was recorded: 156 were reported for the pre-industrial period (before the opening of the iron factory in Bagnoli in 1910), 409 were reported during the industrial period (1911-1991), and 449 for the post-industrial period (1992 to present); 52 taxa are common between the pre-industrial and industrial, 13 are common between pre-industrial and post-industrial, 40 between industrial and post-industrial, while only 6 species are common to all three periods (Gaglioti *et al*., 2020). Due to the high fragmentation in the records, both spatially and temporally (with very

few quantitative evaluations), it was impossible to give insights on the time evolution of habitat or even single species. Even when the data were arranged with a different time frame (changing the period intervals), or the species were grouped by taxonomic higher entities (e.g., genera, families) or functional groups (e.g., habitat former), the results were not clear to highlight a historical evolution of marine animals/communities in the area related to the industrial impact (Gaglioti *et al.,* 2020).

Conclusion – Notwithstanding the above synthesized limits and biases, the A.M. still represents a mine of precious information and we have just scraped its surface. The utility of this dataset could be improved in the frame of a dedicated project, to address some of the critical points such as:
-taxonomic update (synonymies, update of species names or species no more valid etc.), and evaluation of new species recently described;
-homogenization and actualization of site and geographic names and bio-ecological information on the individual species;
-evaluation of the heuristic content of the data cards to assess what is based on past references and historical data, and what relies on original *de visu* analysis and collection at the time U.M. operated at the Stazione Zoologica;
-integration of the A.M. with the actual biodiversity and distribution data of marine animals in the GoN (comparison with other check-lists and databases available at local and larger geographic scale).

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