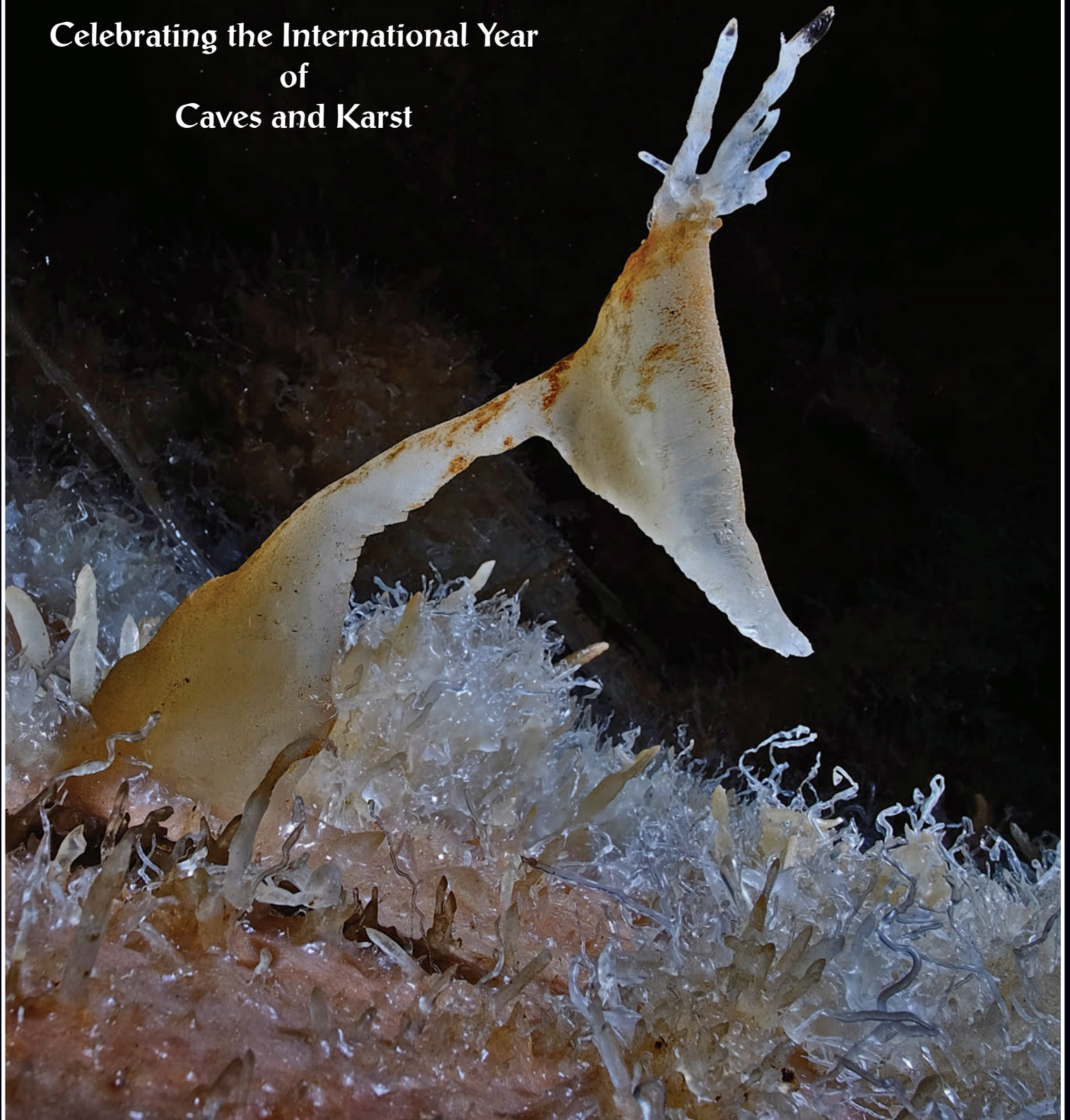


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# Puliamo il Buio 2020 – Let's Clean Up the Dark in Pertosa-Auletta Caves

*Rosangela Adesso, Simona Cafaro, Ferdinando Didonna, Francesco Maurano*

The Pertosa-Auletta complex is a karst show cave system located near the villages of Pertosa and Auletta, in the province of Salerno, Campania, Italy. This important karst site in southern Italy is protected within a national park, Parco Nazionale del Cilento, Vallo di Diano e Alburni. Pertosa-Auletta is included in the European Geoparks Network for its important geological and cultural heritage. In 1998, the park and several ancient Greek towns became a UNESCO World Heritage Site.

Although the cave receives routine maintenance, its management body, Fondazione MIdA (Musei Integrati dell' Ambiente), dedicated a day to evaluate conservation concerns that had escaped attention during the usual cleaning activities in cave. The goal was to identify new strategies and actions to enhance sustainable management of the show cave. Activities focused on mitigating trash left along the cave pathways and exploring methods to decrease future littering in the cave. The over-arching objective of this ongoing project is to safeguard and conserve the cave ecosystem.

Thanks to the help of twenty-eight speleologists (Fig. 1) from three different regions in the south of Italy (Campania, Basilicata, and Puglia) and seven speleological groups (Gruppo Speleo Alpinistico Vallo di Diano, Gruppo Speleo Melandro, Gruppo Speleologico Natura Esplora, Gruppo Speleo Archeologico Vespertilio, Centro Altamurano Ricerche Speleologiche, Gruppo Speleologico Castel di Lepre, Gruppo Speleologico CAI Napoli), together with MIdA staff, we were able to identify, document, and remove many objects left in the cave due to tourist activities. We accomplished meticulous trash retrieval and cleanup outside of trail boundaries and from the ravine where tourists pitched their unwanted items.

## Background

Puliamo il Buio— Let's Clean Up the Dark, organized by the Italian Speleological Society every year since 2005, is an initiative dedicated to the cleaning of underground environments throughout Italy. We provide documentation as evidence of the offenses, assess the danger and degree of damage, propose possible remedies to the public and local administrations, and coordinate the cave clean up events. Clean up the Dark follows the footsteps of international "Clean up the World" events, which are coordinated in Italy by the Legambiente Associazione (League for the Environment, a not-for-profit environmental association).

## The Site

Pertosa-Auletta is among the most important karst springs in southern Italy. Aspects of scientific importance include the karst phenomenon, hydrogeology, archeology, and speleo-biology. Pertosa-Auletta also constitutes a significant economic reality in the territory, being a tourist site since the middle of the last century. The main entrance to the karst cavity, located in the left bank of the Tanagro River, opens at 263 meters above mean sea level along the western slope of the Alburni Mountains.

Thanks to the efforts of many speleologists engaged in various exploratory campaigns, both the cave survey and the surface topographical survey are well defined. Initial exploration of the cavity and a first survey was carried out in 1924 by SME (Società Meridionale di Eletticità) to enable exploitation of water resources. In 1952, the IGM (Istituto Geografico Militare) did a precision survey of the entire cavity, with a first relief published by Lieutenant Dutto. Various survey and exploration expeditions conducted by the GS-CAI Napoli (Gruppo Speleo Club Alpino Italiano Napoli) acquired more details over time.

Grotte di Pertosa-Auletta extend for a total length of 3000 meters and are divided into three main branches (Fig. 2). The middle and southern branches are decorated with abundant speleothems and respectively show both paleo (fossil) and active (spring) sites. In the middle branch there is a short path open to the public.

Our cleaning activities took place in the tourist branch, represented on the plan map from point 1 to 5 (Fig. 2). About 800 meters long, this section is characterized by a succession of large rooms adorned with imposing speleothems and morphologies that cover the ground almost completely.

## The Program

The event was organized in five phases:

1. Present cave descriptions and guidelines for cleaning activities in the show cave.
2. Organize work groups and distribute forms to complete during cleaning activities (document typology, quantity, and collecting area of objects).
3. Conduct small group conversations on Sustainable Development Goals in Italian Speleology.
4. Perform cave cleaning activities in work groups.
5. Discuss data collections and final reports from each group.

## The Guidelines for Cleaning Activities in the Show Cave

- Collect all solid and liquid waste dispersed in the cave environment, especially those of organic origin (for example paper, cloth, etc.).
- Separate waste, if possible.
- Remember to thoroughly look in the ravine and niches of the rock.
- Always move with caution. Avoid damaging speleothems and surfaces.
- Always operate with safety first in mind.
- Use clean gloves and clothing.
- Catalog, photograph, and define quantities of all the found objects.
- Communicate with the managers and suggest solutions to minimize the phenomenon of the abandonment of materials (tourist trash) in the cave.
- Before the in-cave activity, reread the "Protocol for Minimum-Impact Speleology" by Val-Hildreth Werker and Jim C. Werker. See Minimum-Impact Caving Guidelines (<https://caves.org/conservation/cavingcode.shtml>).



Figure 1: 28 cavers who participated in the cleanup

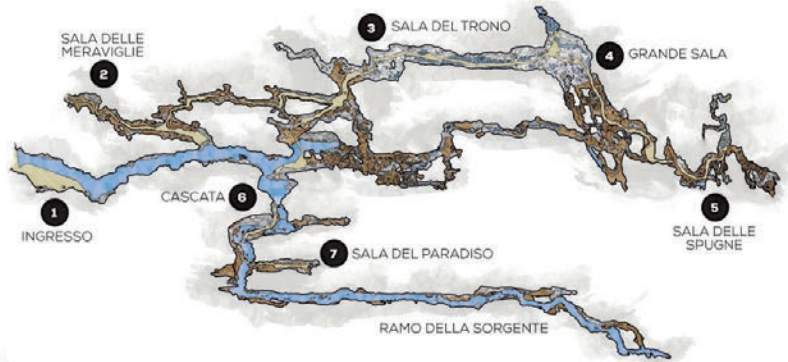


Figure 2: map showing the 3 branches of the cave

**Take with you:**

- gloves
- bags
- brush and dustpan
- rubbish pick-up stick, a tool with extension to reach off trail
- hammer, chisel, trowel (tools for carefully removing objects calcified into cave surfaces, after thoughtful inspection and do-no-harm evaluation)
- mini vacuum cleaner
- spray bottles with water, brushes with soft bristles, and sponges to catch excess water (when cleaning human impacts from cave surfaces)

**What Did We Find in the Cave?**

In all cave areas, we found remains of electrical cables, especially near the electrical and monitoring stations; some of these were calcified into cave surfaces (Fig. 3).

Numerous plastic objects were collected, in some cases covered by calcite (Fig. 4).

Other objects found: coins, clothing, light bulbs, corrugated pipes, nails, iron, chewing gum, electrical tape residues, old flashes ... (Fig. 5)

**Suggestions for Show Cave Management**

- Sensitize tourists (at the entrance!) about the abandonment of waste in the cave.
- The cave guides must collect waste along the walking paths.
- Plan at least two events per year for cleaning the underground environment.
- It is necessary to schedule reconnaissance of the lighting system. Verify the functioning of the lamps and remove or replace worn or degraded appliances.
- All waste produced from cave maintenance works must be transported outside of the cave environment.
- If work in the cave is carried out by external companies, it is necessary to remind the workers and supervisors of the absolute prohibition of abandoning waste.



Figure 3: electrical cable remnants calcified into surfaces

**The Sustainable Development Goals in Italian Speleology**

During the “Clean Up the Dark” day at Pertosa-Auletta, the Italian Speleological Society (SSI) organized a workshop to explore and understand global development issues, and to help us prepare for widespread promotion during the International Year of Caves and Karst 2021. We specifically discussed the relationships between show caves, speleology, and sustainable development goals.

The Sustainable Development Goals (SDGs) are 17 goals agreed upon by 150 international leaders from the United Nations Organization in September 2015. Each goal fits three overarching categories: to contribute to global development; to promote human well-being; and to protect the environment. The 2030 Agenda for



Figure 4: Plastic objects collected were often covered in calcite.



Figure 5: an old flashcube covered in calcite

Sustainable Development was approved with the definition of the 17 sustainable development goals and the 169 sub-goals, aimed at ending poverty, fighting inequality, social and economic development, and nature conservation.

Achieving the SDGs requires collaborations among governments, institutions, the private business sector, civil society, and citizens to ensure a better planet for future generations.

Based on 131 available indicators that allow coverage of 105 of the 169 SDG sub-objectives, Italy has currently achieved 12 of the 2030 objectives and our nation is close to accomplishing other objectives. For example, throughout Italy we have already achieved the targets for sanitation, access to clean electricity and fuels, and percentage of land area covered by trees (targets 6.3, 7.1 and 15.1). However, some challenges remain; Italy is still a long way off with objectives relating to teacher training, violence against women, and the national percentage of young people not in education, employment, or training programs (objectives 4.c, 5.2 and 8.6). However, the really big challenge is a knowledge-based transition to sustainable development.

The workshop was based on these 5 discussion points:

1. Formulate the way in which Italian Speleology contributes to the SDGs;
2. Identify common contributions to institutions and to the public;
3. Increase the visibility of the importance of karst and caves;
4. Improve the involvement of speleologists and increase the possibilities of support for protection actions;
5. Present the results on the occasions of the 70th Anniversary of the SSI and at events of the International Year of Caves and Karst 2021.

In particular, we identify the following goals within the SDGs to aid in formulating the ways in which Italian Speleology and caves contribute to the international Sustainable Development Goals.

### **SDG 3: To ensure health and well-being for all ages;**

Our focus group identifies that caves and speleology contribute to the goal through: speleotherapy, thermal baths in caves (Grotta Giusti <https://www.grottagiustispa.com>). Cave visits also can enhance physical health and mental balance for all ages.

### **SDG 4. Provide quality, equitable, and inclusive education and learning opportunities for all;**

Speleology contributes constantly to general public educational outreach and, in some cases, caving groups include education as part of their established objectives. Examples include: speleology courses (I-II-III level); guided excursions; museum collaborations; conferences/conventions; events (including speleo diversity events for people with disabilities); outreach campaigns, such as “The water we will drink” (<http://www.acquacheberremo.it/>); project planning (PON, POR, LIFE), schools/didactics projects, documentation and scientific study; cave cadaster/library/publications; stewardship outreach; participation in exhibitions/fairs; training events; all with total respect for gender equality.

### **SDG 6. Ensure the availability and sustainable management of water and sanitation facilities for all;**

Speleologists and cavers contribute constantly to: monitoring, surface and cave exploration; cave diving exploration and survey, hydrogeology studies; “Clean Up the Dark” actions (<https://www.puliamoilbuio.it/>). In many areas, cavers are the guardians of the underground and of the karst waters.

### **SDG 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all;**

Caves are also an important economic resource for tourism and valorization of the territory. Speleology assists this economic process and enhances balance in the sustainable conservation of natural and cultural resources. Moreover, speleology offers training for job opportunities in multiple disciplines including rope access integrated services, tree-climbing, internships in speleological sciences and resource management, work-study jobs, educational cave tour innovations in the outdoor sector, as well as tours to mines and museums.

### **SDG 13. Take urgent action to combat climate change and its impacts;**

Speleology contributes to monitoring climate changes. The speleological community is very sensible in promoting plastic-free, sustainable product use. Speleologists come

together from many scientific disciplines to cooperate in studies of the impacts of climate change in cave environments, fluctuations in spelean microclimates, documenting biodiversity variations, and investigating paleoclimatic and paleoenvironmental reconstructions from cave concretions.

### **SDG 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development;**

Speleologists investigate the importance of marine caves and coast monitoring, study marine bio-speleology, and promote citizen science contributions on marine caves and groundwaters (<https://phreatic.org/>).

### **SDG 15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss;**

Caves are ecosystems with relevant genetic diversity. Speleology contributes to the conservation of biodiversity through appropriate cave protection measures, regular monitoring, and official descriptions of new species. The bio-speleological research of the Italian speleological community and SSI advance the study of biodiversity in underground habitats (<https://animalidigrotta.speleo.it/>). SSI maintains a catalogue of the fauna in natural and artificial caves throughout Italy. As well, SSI supports the monitoring and protection of bat colonies, and advocates specific cave access protocols in collaboration with bat specialists.

For SSI, it is important to protect caves and cave life by including underground habitats in the environmental conservation laws of the European Community. Supporting the protection of these biotopes is often fundamentally based on the presence of bats that use cavities for hibernation; in fact, they are protected in accordance with Directive 92/43 / EEC of 21 May 1992 on the conservation of natural habitats and wild fauna and flora (Directive Habitat). If the caves are identified as HABITAT of Community Interest (tourist caves are excluded), and the species living in the caves are safeguarded based on their presence or absence in the Annexes of the Directive as species of community interest, the cave and its fauna are considered protected ecosystems.

SSI supports these protection initiatives by structuring regional cave registers that report protection status. These registers are a fundamental tool that competent authorities use in land and resource management of the territory (<https://speleo.it/catastogrotte/>).

### **SDG 17. Strengthen the means of implementing the objectives and renew the global partnership for sustainable development;**

In reading this document, we are contributing to the goals of partnerships for sustainable development. As SSI and the speleological community, we believe in meetings (national and international), relationships/partnerships with other speleological organizations, touristic cave associations, schools, public education services, national and regional Parks, and local authorities. An important moment for sharing these goals will be Speleo Kamaraton 2021 International Meeting of Speleology (<http://www.speleokamaraton.eu/>).

### **Advancing the United Nations Sustainable Development Goals**

The strength of the Italian speleological community vision is enabled by:

- The interconnected speleological community;
- Excellent experience and local knowledge;
- Trust and common goals.

These strengths must be used to promote the conservation of caves and karst in the broader perspective of the Sustainable Development Goals.

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