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The roman fishpond of Ventotene (Latina, Italy)

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Introduction

The present study of Ventotene's Roman Fishpond began in the winter of 2004, when the *Soprintendenza per i Beni Archeologici del Lazio* carried out a season of field research with the purpose of collecting more evidence on this important complex: the fishpond's remains are indeed still perfectly preserved, and its original plan is easy to read. In order to understand how the fishpond's pools was filled with sand and sediments across the centuries, the field work included a series of test trenches realized with the help of a water dredge, and a general review of the plan of the entire complex'. The writers' ultimate goal was to reach a better understanding of the fishery's technical and structural features[1].

The fishpond is located on the north-western area of the island, at the extremity named Punta di Terra. It was part of a large residential complex that, in antiquity, covered the entire promontory. The structures of this sector of the large maritime villa have almost completely disappeared, both on the sea front, due to quarrying activities and to the erosion of the coastline, and on the eastern side, due to the military fortifications of Bourbon age[2]. Based on the length of the preserved wall remains, it appears that the Roman architectural complex extended to an area larger than 1 ha. A series of terraced rooms, built in *opus reticulatum*, starting from the Bourbon tower and oriented north-south, slowly declining towards the sea, follow and regularize the morphology of the promontory (fig. 1)[3]. The last terrace opened directly onto the fishery, over the internal pools which were carved into the tuff rocks. A recent excavation trench, carried out in 2002 immediately to the east of the lighthouse, uncovered a series of rooms in *opus reticulatum*, with ground levels ca. 4 m lower than the

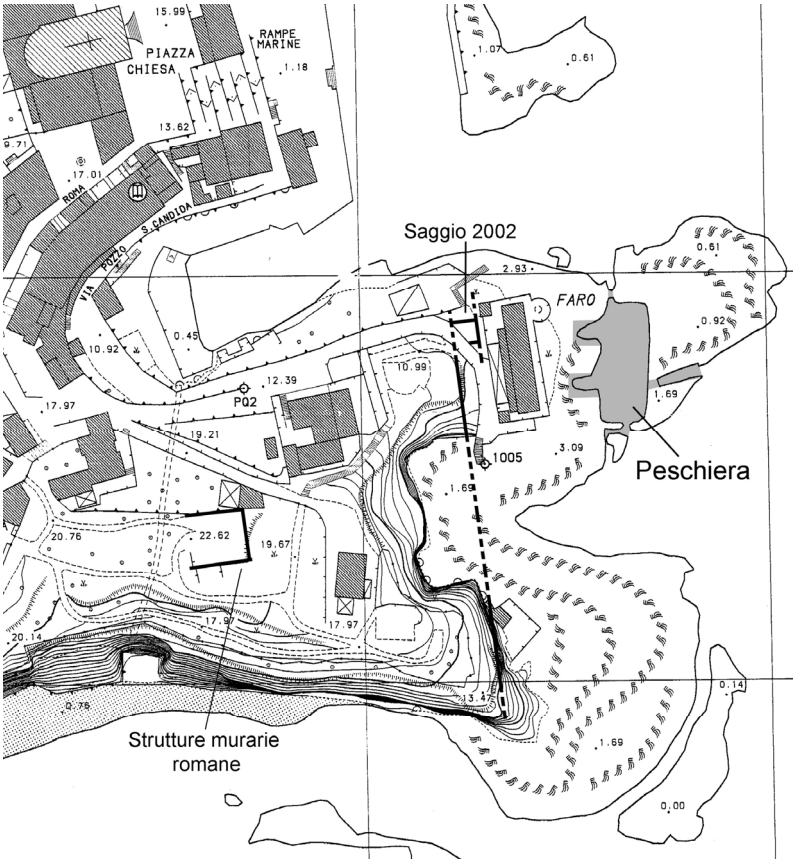


Fig. 1. Topographic positioning of the Roman structures in the area of Punta di Terra (graphic rendering: S. L. Trigona).

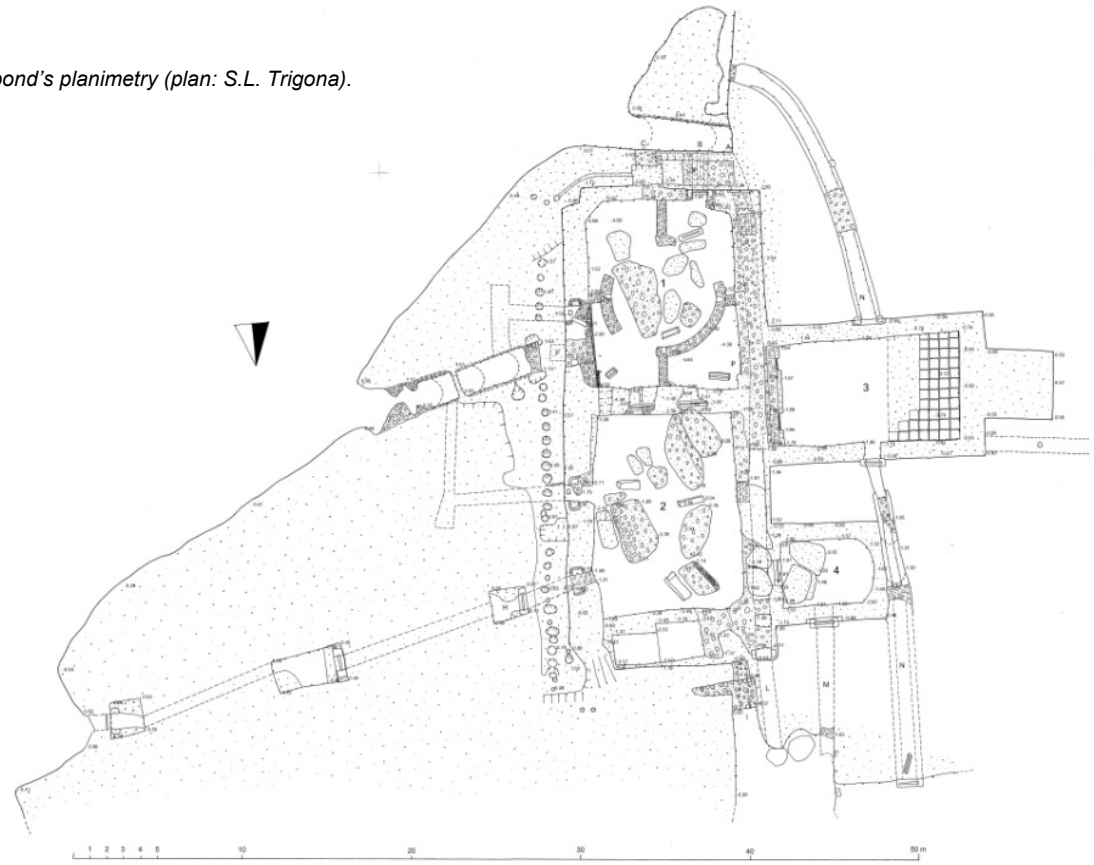
[1] The authors would like to thank the company Teknomar, in particular Mr. Gaetano Donnabella and his underwater technical operators, who have provided the necessary technical support. A particular thank goes to Mr. Salvatore Schiano Di Colella, who, with his deep knowledge of the island and its history, provided important and precise information during the excavation.
[2] The Bourbons had their fortifications strategically built between the basin of the Roman harbor and Cala Nave (DE ROSSI 1999a: 65, Figs. 9-10).
[3] DE ROSSI 1986:194-198. Regarding the topography of Ventotene in Roman age see also: DE ROSSI 1999b: 154-156.

modern road, matching the levels of the fishpond's upper vaults (fig. 2). Eventually, the excavation trench of vat n. 3 showed a lower level partially formed by the collapse of the storage rooms at the upper level, and large concrete blocks have been found in the fillings of the external pools. The excavation yielded frescoes' fragments, numerous glass mosaic *tesserae*, slabs and small slabs of marble, fragments of tuff, concrete, and *opus reticulatum.* These finds provide quite precise information to the rich decoration of the fishery and upper rooms. Ceramic material found during the excavation consists of bricks (particularly *tesserae* for *opus spicatum*), and amphora sherds. It is also interesting to notice that only *sigillata africana* was used as tableware, a fact that allows us to date these deposits to the Late Imperial age, providing evidence of Ventotene's uninterrupted inhabitation until at least the sixth century A.D.[4]

Fig. 2. Detail of the structures in opus reticulatum *found in the 2002 excavation trench.*

The creation of this building complex, which is evidently connected to the widespread diffusion of luxurious *villae maritimae* of Late Republican time[5], can be analyzed in the general plan of construction

Fig. 3. Fishpond's planimetry (plan: S.L. Trigona).



[4] The attested shapes are the types *Atlante* I, Tav. XIII.14, in *sigillata africana A* dated between the end of the first and the first half of the second century A.D., and *Atlante* I, Tav. XLVII.11 and XLII.2 in *sigillata africana D*, typical shapes of the second half of the fourth century and full sixth century A.D.

[5] See D'ARMS 2003: 51-57, 331-345 for more information regarding the historical and archaeological documentation on the lavish villas in Campania belonging to the rich Roman *piscinarii*.

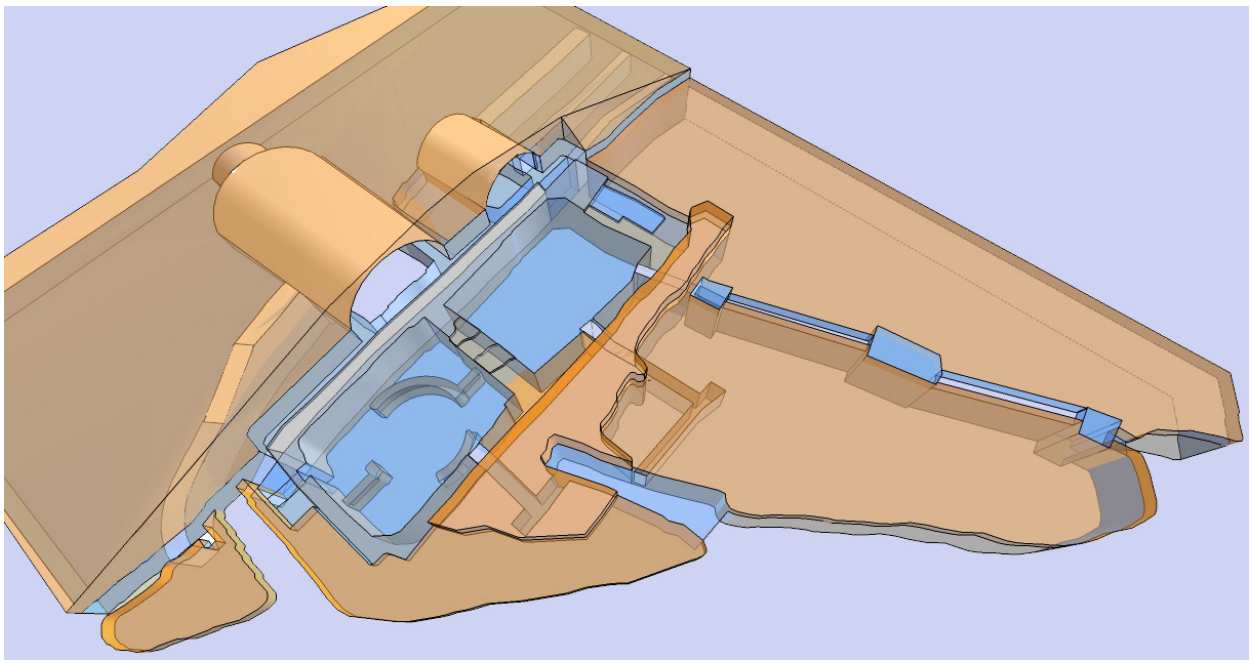


Fig. 4. Axonometric projection of the fishpond seen from SE (graphic rendering: F. Pittiglio).

activities on the island at the time of Augustus. It may represent the area destined to host the *triclinia* and *solaria* of the so-called Villa of Julia at Punta Eolo[6]. Based on historic and topographic interpretation of the organization of the settlement, it is possible to hypothesize that Ventotene, like other small islands such as Capri, Ponza, Pianosa and Giannutri, was the private property of the emperor[7]. Therefore, all the domestic structures and the necessary infrastructures on the island were built following a clear architectonic and functional pattern conceived in a well-planned, coherent way.

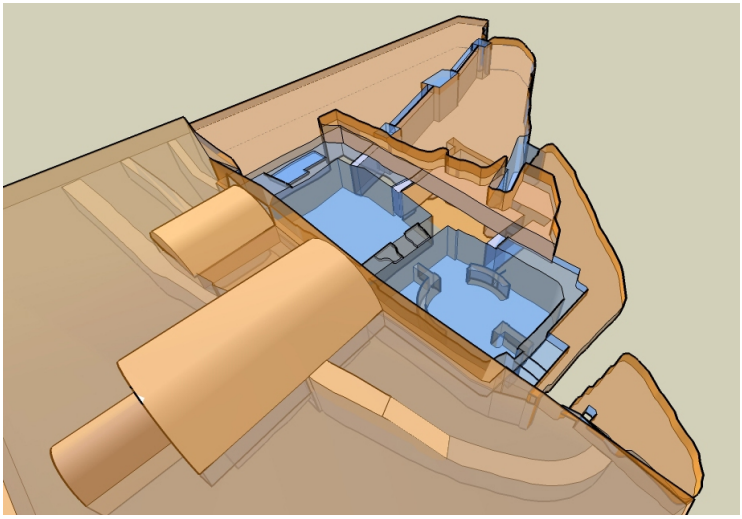


Fig. 5. Axonometric projection of the fishpond seen from the SW (graphic rendering: F. Pittiglio).

A new map and interpretation of Ventotene's fishpond

The instrumental mapping, done using a total station, allowed for a new, planimetric reading of the entire complex of the fishery in Ventotene. Many details pertaining to the building techniques, which had passed unnoticed or had been misunderstood during the previous studies, were recorded (fig. 3)[8]. This new plan of the complex shows, remarkably, the exact correlation between the archaeological data and the information provided by ancient treatises. The fishery, indeed, seems to have been planned and built according to the tradition of technical and engineering concepts initiated in the first half of the first century B.C. and transcribed approximately a century later in Columella's *De re rustica*[9].

[6] DE ROSSI 1999a: 30.
[7] LAFON 2001: 234-237.
[8] The first and only archaeological field work study so far published on the Roman fishery of Ventotene is by SCHMIEDT (1972: 181-197). More recent studies and catalogs are still based on Schmiedt's former work: VV.AA. 1986: 198-201, GIACOPINI, MARCHESINI, RUSTICO 1994: 121-122, HIGGINBOTHAM 1997: 179-184, and DE ROSSI 1999a: 27-29.
[9] It is not possible to accept Higginbotham's conclusions (1997: 10) that the literary descriptions of *piscinae* are hypothetical projects scarcely attested by archaeological remains. This scholar's point of view is due probably to the lack of detailed and recent studies regarding the technology used to build fisheries, which could provide, as Ventotene does, more accurate data on the Roman technology applied to fish farming.

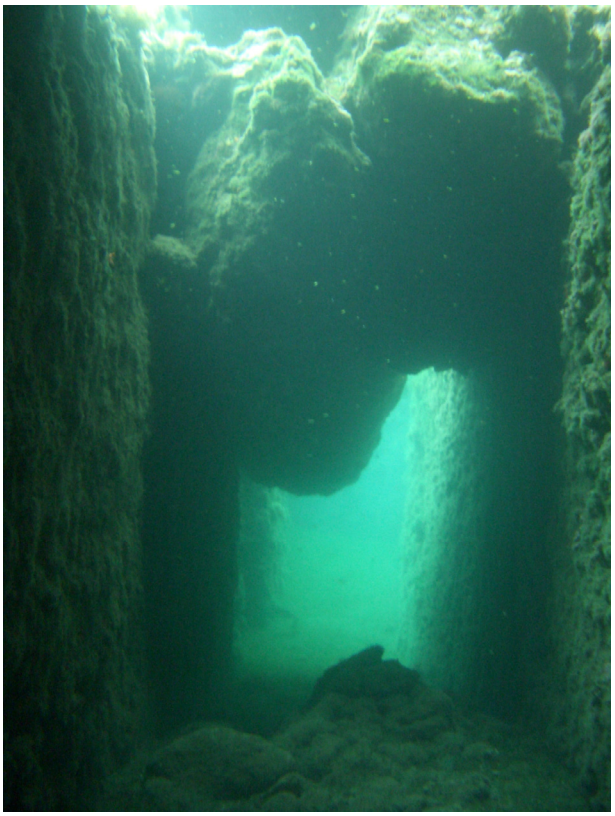


Fig. 6. Detail of the entrance to vat 1, canal B.

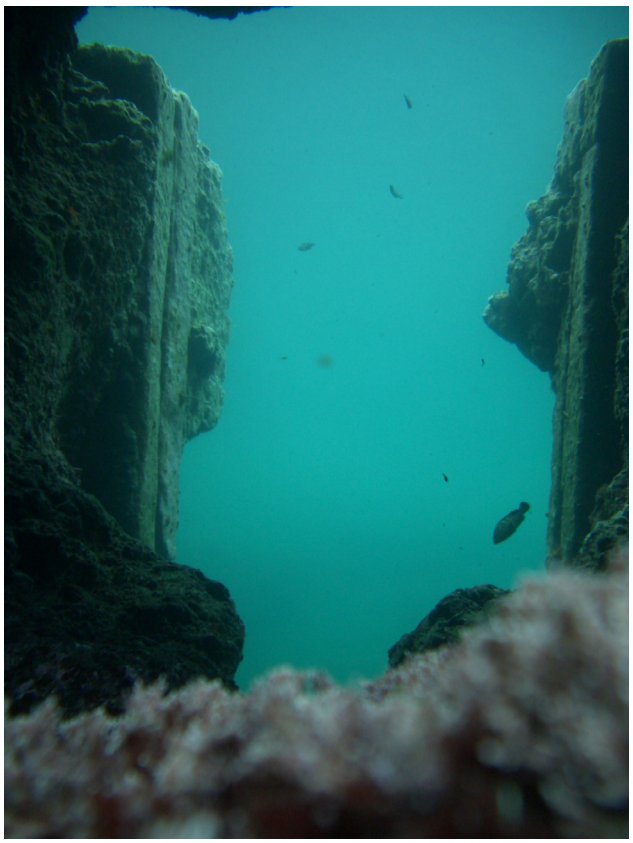


Fig. 7. Detail of the central section of canal A-L seen from the North.

The structure is almost entirely built using the technique called *ex petra excisa*, being carved into the rocky platform. This building technique was extremely complex, and has rare parallels found mostly in the smaller Tyrrhenian islands and on the Campanian coast[10]. The plan is compact and divided in four areas: two inner vats covered with vaults (vats 3-4), and an external basin divided by a section in the middle (vats 1-2, figs. 4-5). This division in areas, that Varro describes when he makes a parallel between the *piscinae loculatae* and the painters' palette (*De re rust.*, III, 17, 2), is a common feature of the Roman fisheries, where several species and sizes of fish were raised together[11].

The tunnels for the water flow represent the most remarkable discovery of the field work. They are arranged to create a grid connecting each pool and the sea to the north, east, and south. In particular, the external vats (vats 1-2) show an extremely complex system of water circulation: numerous tunnels with sluice gates open on all the four sides, while the inner vats (vats-3-4) are fed on three and two sides, respectively (fig. 6). Columella describes clearly how this system of water circulation was essential to prevent water stagnation, when he writes: *Itineraque… omni lateri piscinae dari convenit. Facilius enim vetus summovetur unda, cum quacumque parte fluctus urget per adversa patet exitus.* (COLUM., *De re rust.*, XVII, 3)[12]. The two external vats are also separated from the inner ones by canals A-L, partially built using concrete in its western shoulder and vault. This canal connects all sections of the fishery, and provides the means of moving fish from one vat to the other (fig. 7)[13]. The external vats had also a double connection with this longitudinal canal, which was built with openings shielded with a lead grid to keep the fish in but

[10] For the distribution of this type of fisheries, that ancient sources describe as *rarissimae* (COLUM. *De re rust.*, XVII, 1), see LAFON 2001: 167-177.

[11] Archaeological parallels can be found in the Fishery 1 in Nettuno, characterized by a regular division of the vats in squared rooms. Another fishery, called "La Banca" near Torre Astura, is a good parallel for the dimensions of the external vats. "La Banca" fishery dates, such as the Fishery 1 in Nettuno, between the end of the first century B.C. and the beginning of the first century A.D. (See HIGGINBOTHAM 1997: 131-135, 140-143).

[12] The construction of these tunnels represents the earliest technical challenge the builders of *piscinae* had to overcome. See the passage, already quoted, from VARRO (*De Re Rust.*, III, 17, 8-9), that show how the *pisinarii* colleagues of M. Lucullus, in the second quart of the first century B.C., were blaming him for not using this important device in his installations.

[13] This system of independent connections between vats is widespread in fisheries having vats divided by circular and trapezoidal walls. One of the earliest examples of this technical expedient comes from the so-called Lucullus' Piscina at Circeo, dating to the first half of the first century B.C. (See HIGGINBOTHAM 1997: 24-25, 153-157).

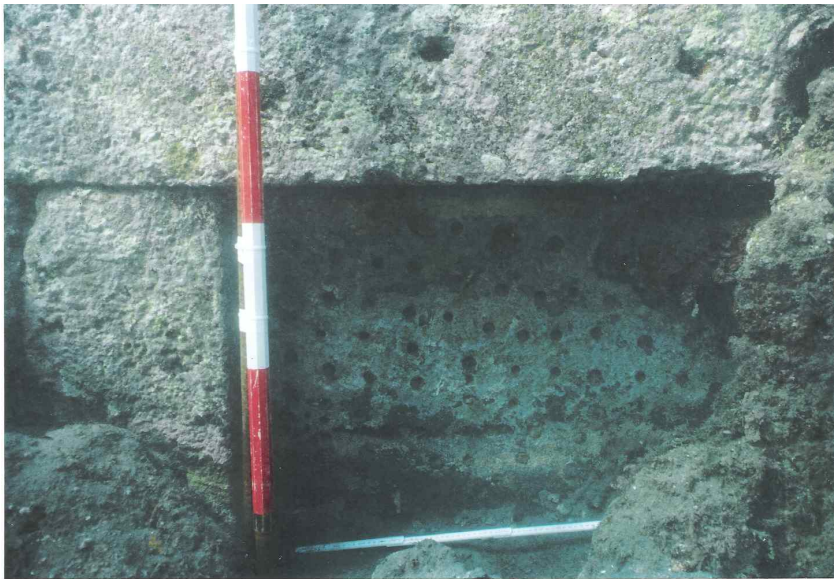


Fig. 8. Detail of the opening with a lead grid (P), in the NW corner of vat 1.

catch and raise it if fishing nets had been previously placed at the vats' bottom (fig. 9)[16]. The two tunnels to the south (D and G), on the other hand, represent an extraordinary and, until present, unique example of bent-tunnels. Columella expressly recommended this design in order to have some protection against the winter storms: "*Oportebit autem nonnullis locis moles intercidi more Maeandri parvis sed angustis itineribus, quae quantalibet hiemis saevitia mare sine fluctu transmittant*" (*De re rust.*, XVII, 11). The two staggered inflowing tunnels indeed originate from a single central vaulted tunnel. They follow a similar, T-shaped path, interrupted by expansion chambers, and at the end of their course they join the two external vats. Such a technical expedient seems to be the result of a change of plans carried out while the building works had already started, since a cavity is visible inside vat 1 (F), in correspondence with the prosecution of the external canal, suggesting that the original plan incorporated a direct connection with the sea (fig. 10).

However, these technical devices proved inadequate to protect the fishery from the force of the waves, and a series of structural changes was required to reduce the water intake. In order to solve this problem, an inner circular basin made of concrete was built at the centre of vat 1, and connected with perpendicular wall segments to the surrounding walls. This inner division of the vats, which is also visible in similar, lozenge-shaped forms in several other fisheries, was used to improve the architectural features of the building and, allow water circulation[14]. Apertures open on the socle, close to the exit shutters, were used probably to transfer fish (fig. 8)[15].

A remarkable engineering effort is evident in the eastern water tunnels, which face the open sea. Several technical expedients that have not been noticed in other fisheries were put in place in order to break the force of the waves that otherwise would have caused serious damage to the external pools. A first water tunnel (H) to vat 2 is interrupted in its underground course by three small quadrangular vats placed at regular intervals, each one with its own shutter. This technical expedient not only broke the force of the waves and let the water flush out algae and sand, but probably also allowed fish to enter into the tunnel during the reflux of the tide, blocking it in the vats when the water level was lower, making it easy to

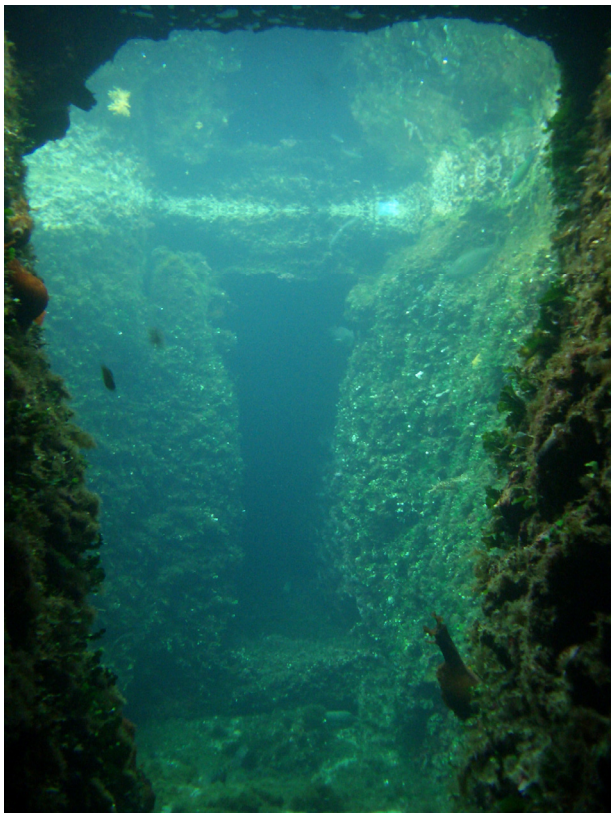


Fig. 9. Detail of canal H's central decanting vat.

[14] Only the exit shutter of vat 1 (P) is preserved, while into the adjacent vat a patch made of concrete, that was put in place later in time, indicates that a similar opening was also present.

[15] The hypothesis that these upper openings could be submerged at least during high tide (the medium excursion rate can be quantified in ca. 40-45 cm) might provide evidence to reconstruct the ancient sea level. Until present, the height of the socle, at least 20 cm above the maximum level of the high tide, has been considered the best evidence available. (See SCHMIEDT 1972: 196-197, LAMBECK *et al.* 2004: 4-5, and ANZIDEI *et al.* 2004: 116-117). A methodological critique against this calculation system has been made by RUSTICO 1999: 53.

[16] A quite similar parallel can be found in the fishery of La Saracca on the coastline near Nettuno. The long tunnel of water intake has a similar system of triple-shutter locks with intermediate vats for water expansion and decanting. (See PICARRETA 1997: 68-74).

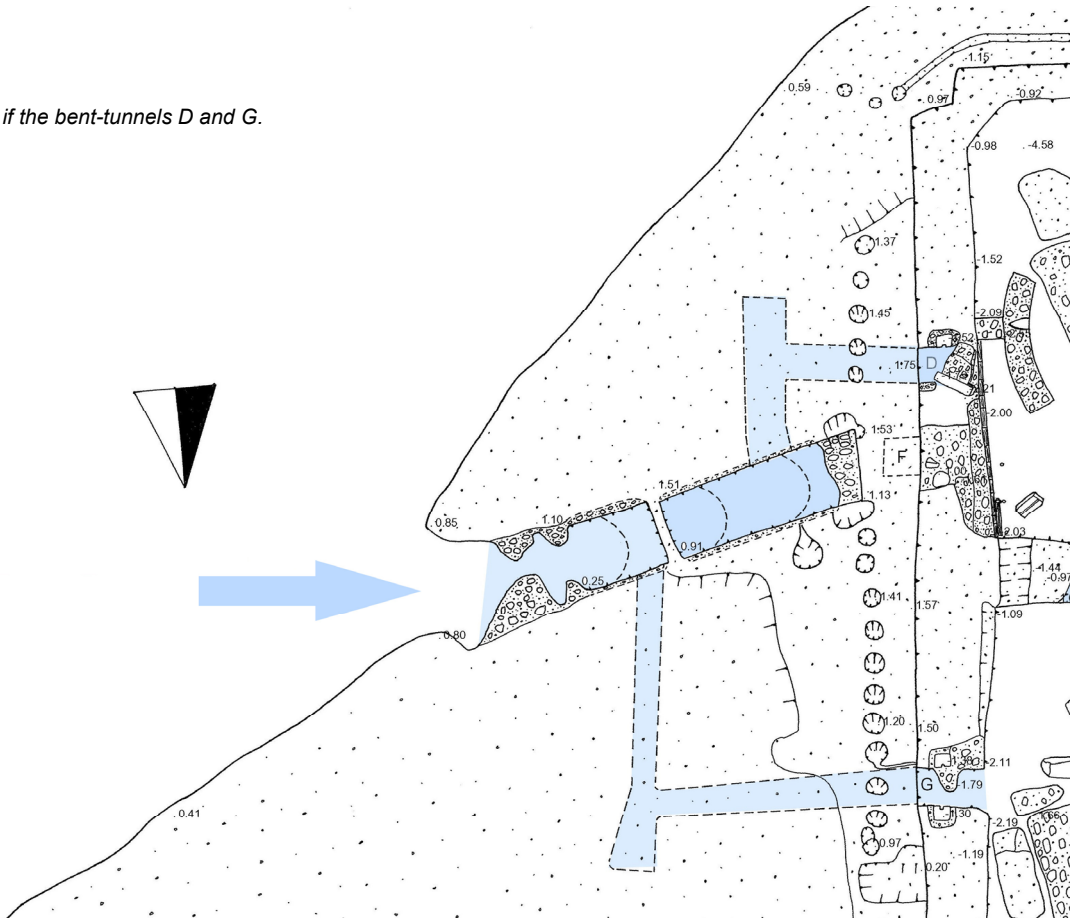


Fig. 10. Detail if the bent-tunnels D and G.

probably, to support a wooden platform and to create protected niches for the fish to shelter[17]. It is clear that this feature was not part of the original plan for this fishery, since the southern connecting partition is placed against the patch inside the tunnel C (fig. 11), and partition O closes one of the quadrangular niches of the corresponding wall. The niches create a series of cellae arranged in two rows and carved into the lower portion of the wall, which, based on ancient literary sources, recreate a natural habitat similar to a den (fig. 12)[18]. To serve the same purpose neckless amphoras were also inserted into the concrete of the circular basin, in correspondence with the beginning of the connecting partitions[19].

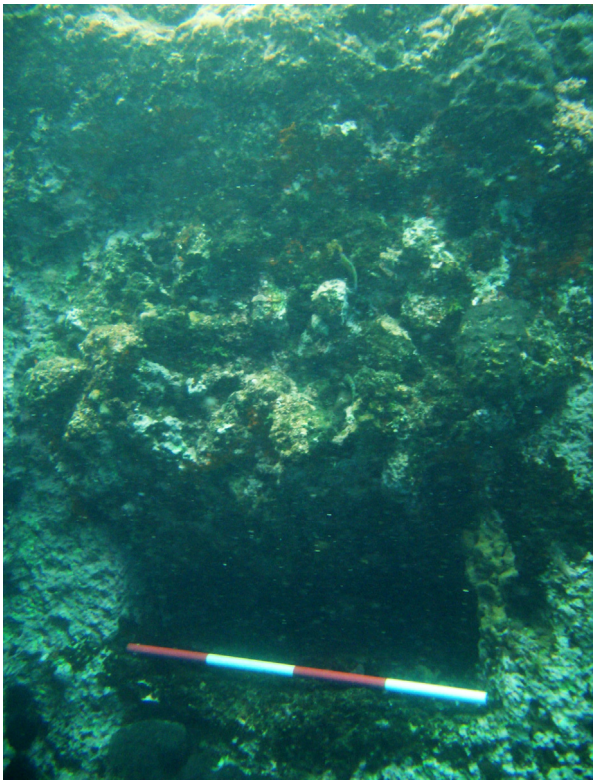
In order to further reduce the internal currents, all the western entrances of the external vats (D-G-H) were sealed with concrete. Concrete blocks were also used for the extension connecting the vats 2 and 3 with the longitudinal canal A-L, and canal C on the southern side of vat 1 (fig. 13). The wooden frame used for this rebuilding was discovered in situ during the excavation. This frame is made of strong vertical planks assembled with mortise-and-tenon joints. Its bulkhead is supported by horizontal connecting joists and by a series of poles (*stipites*), which are fixed in notches carved on the external side of the concrete casting and are connected with planks placed on the inside (fig. 14). Two L-shaped dowels were also found in the excavation trench. Based on their dimensions, they would have been nailed to the horizontal joists, probably to fix them securely to the external poles and to the internal planks (fig. 15)[20].

[17] HIGGINBOTHAM 1997: 24.

[18] There are two levels of quadrangular niches (width. 40-57 cm, height 11-18 cm, depth 19-21 cm). Probably in antiquity they were protected on their front side, that closely remind of Columella's prescriptions, particularly the passage in which he criticizes the building of deep recesses causing the water to stagnate, and he suggests "*similes velut cellae parietibus excavare, ut sint quae protegant refugientis ardorem solis, et nihilominus facile quam conceperint aquam remittant*" (*De re rust.*, XVII, 5-6), see HIGGINBOTHAM 1997: 25-26.

[19] The use of amphoras inside walls as receptacles or dens can also be observed in the fishery of Grotta di Tiberio in Sperlonga, and in the so-called Lucullus' Piscina at Circeo, see *Itticultura*: 37.

[20] These dowels show the only riveting (nails, or more likely iron pins fixed with mortar) on the components of the wooden frame, of which the horizontal and vertical elements probably were kept in tension by fastenings. See, for a similar assembly system, the harbor of Baiae (MINIERO 2001: 32-33). The use of wooden frames and caissons for underwater foundations, first developed for military harbors, was also adopted in several maritime fisheries (see *Itticultura*: 61-62). The fishery of Santa Severa provides a close parallel (PELLANDRA 1997: 24-25; FELICI 1998: 308). A system of vertical wooden planks was used also in the construction of the dock in Ponza (GIANFROTTA 2002: 72).



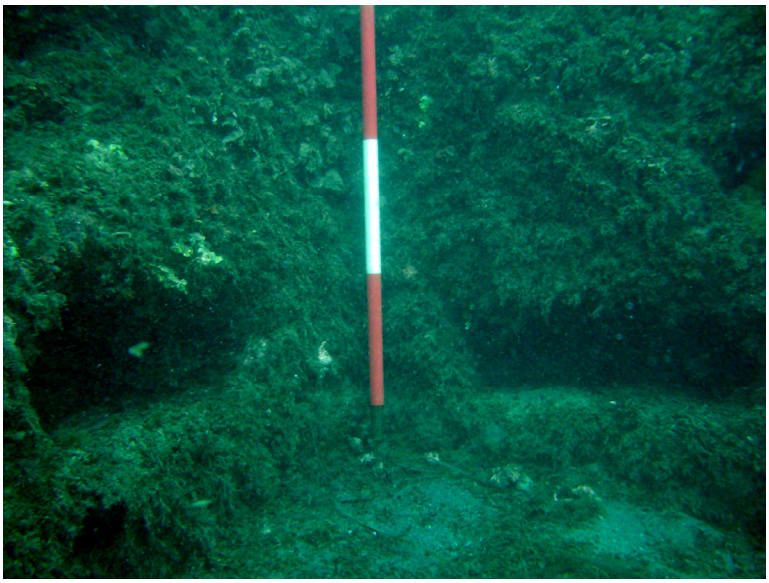


Fig. 12. Detail of the cellae in the SW corner of vat 1.

Fig. 11. Detail of the concrete patch of canal C, clearly visible on the fishpond's external side.

All these technical expedients and the rebuilding of the water intake system attest to the careful planning and design involved to make the fishery work properly, since it received water only from the sea. The possibility that fresh water was used and mixed to the sea water (*aquatio*) to lower the temperature and salinity of the fishpond, has to be excluded. No remains of inflowing canals have been found, and, most importantly, the lack of fresh water springs on the island would have made this impossible, particularly during the summer months when fresh water was best suited to lower the temperature and salinity inside the fishpond[21].

The original floors of vats 1 and 3 were uncovered during the excavation, along with a series of strata with few or no data of interest: in vat 1 the strong internal currents have deeply affected the deposits, completely mixing the archaeological material. The floor of the external vat (vat n.1), is made of tuff (SE, NE and NW corners), located at an average depth of – 4.50 m, at ca. – 3.50 m in relation to the upper level of the socle measured at a medium depth of -1.00 m. The internal vat (vat n.2) is, on the other hand, shallower with depths of -3.70 m and -3.00 m from the socle, its average depth is – 0.70 m. Based on these measurements, it also appears that in this instance the builders followed Columella's technical guidelines. Columella indeed writes that, for maritime fisheries, the depth of the vats has to be 9 Roman feet (2.66 m) below sea level, recommending also to make the tunnels converge at a depth of 2 Roman feet (0.60 m), which also matches the depth of the tops of the lateral tunnels (-1.54 m, -0.84 m from the socle)[22]. Subtracting the depths at the level of the socle of the vat's floor and of the tunnels' top to the measurements Columella provides, it is possible to get a quite constant value of ca. 0.30 m,a number that testifies to the care of the fishery's designer in following the dimensions provided by the treatises, and represents, probably, the minimum value of the socle immersion (fig. 16)[23].

[21] For this hypothesis see DE ROSSI 1986: 198-200, HIGGINBOTHAM 1997: 180-182, and *Itticultura*: 121-122. The tunnels coming from sector N can not, for obvious reasons, be connected with the aqueduct, and the end of the deepest tunnel of vat 3 (O) has no exit. The water volume of the fishery, is ca. 1650 m^3, and the proportionate daily intake required to achieve a minimal mixing of fresh water would not be compatible with the scarce resources of the island, acquired solely from seasonal rainfall. The same authors, regarding the system of water resources of the island, think that "considering the modern average rainfall in the Pontine Islands -between 65 and 72 cm per year- it is evident that the water resources had to be used with extreme care" (DE ROSSI: 134).

[22] "*Sin autem locus ubi vivarium constituere censemus pari libra cum aequore maris est, in pedes novem devodiatur piscina, et infra duos a summa parte cuniculis rivi perducantur …*" (*De Re Rust.*, XVII, 4).

[23] This constant difference, because matches Columella's values, might help to determine the ancient sea level in Ventotene. According to these data, and considering that some variations due to coastal erosion are possible, the sea level should have been ca -1.04 m lower at the time than it is at present. For a calculation based on the level of the socle, that in antiquity had to be above sea level to function, see LAMBECK *et al.* 2004: 5-11 and ANZIDEI *et al.* 2004: 116-117. The authors hypothesize an ancient sea level respectively of -1,35 m and -1,50±0,20.

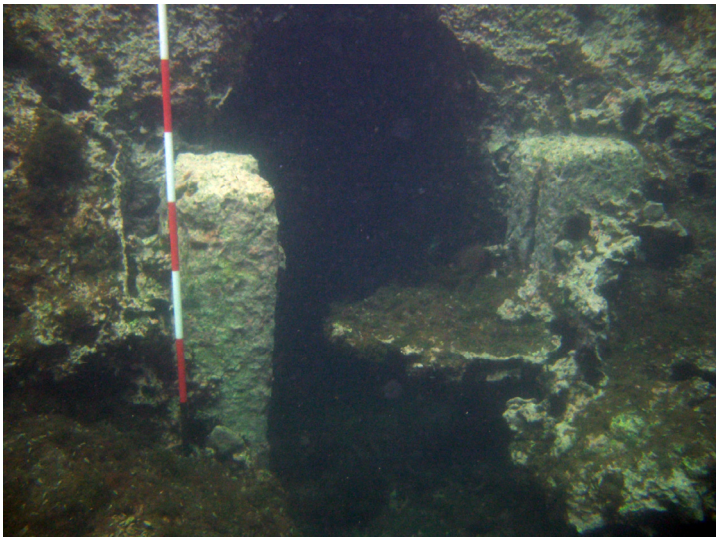


Fig. 13. Detail of the concrete blocks' remains from canal G, at the entrance of vat 2.

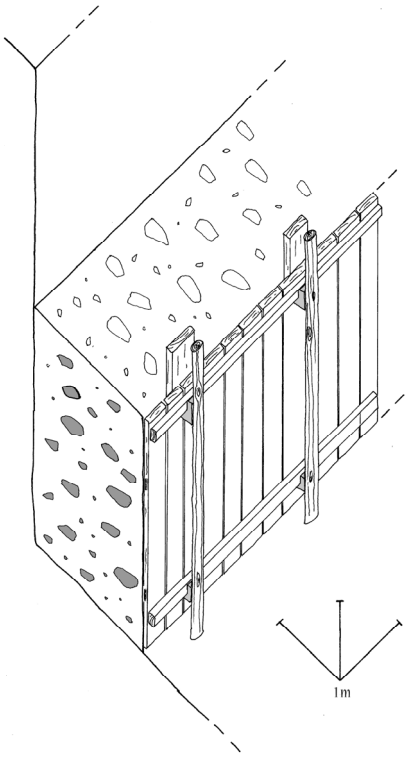


Fig. 14. Axonometric projection of the wooden frame discovered on the E side of vat 1 (graphic rendering: S.L. Trigona).

Vat 3, compared to the others, shows some architectonic features that do not correspond to the functions of a fishery, and that lead to the assumption that this place served a double purpose. The vat ends in a quadrangular apse where some remains of plaster are still preserved, and a torus at the springing of the vault is also visible. This flat cornice made of stucco continued along the vat's walls, where there are traces of the supporting nails (fig. 17). The floor of the vat is also covered with squared terracotta tiles measuring 0.60 m x 0.60 m (bipedal). All these features suggest that this sector of the fishery was constructed and decorated with particular attention to the details (fig. 18)[24].

Fig. 15. Detail of a L-shaped dowel.

Conclusions

A special care to the architectonic features of a fishery, to its decoration, along with similar technical solutions and a similar planimetry can be found in fisheries built with both open and closed vats. Archaeological parallels from Latium and Campania include the fishery of Ponza[25], those of Villa Nicolini and of Agrippa Posthumous' villa in Sorrento[26], the fisheries of Capo Capo Miseno[27] and of Tiberius' villa in Sperlonga. All these parallels are struc-

[24] Terracotta tiles were also found in the fishery of La Banca in Nettuno, in the exedra built inside one of the vats (see PICARRETA 1997: 67-68; *Itticultura*: 97-98). Another example of a similar floor has been found in the fishery of Santa Marinella (PELLANDRA 1997: 30). It is noteworthy the large presence, in this vat, of mosaic tesserae made of glass. Probably they were used to decorate the niche on the exedra, that has a parallel in the nymphaeum of Grotta Azzurra in Capri (GIANFROTTA 2002: 87, n. 31).

[25] GIANFROTTA 2002: 75-88.

[26] MINGAZZINI, PFISTER 1946: 103-104, with a first partial list of the fisheries dug in the rock (43-44).

[27] BENINI 2001: 53-55. In this instance it needs to be noticed that the vaulted vat has a niche at its end and a cornice in correspondence with the attachment of the circular vault.

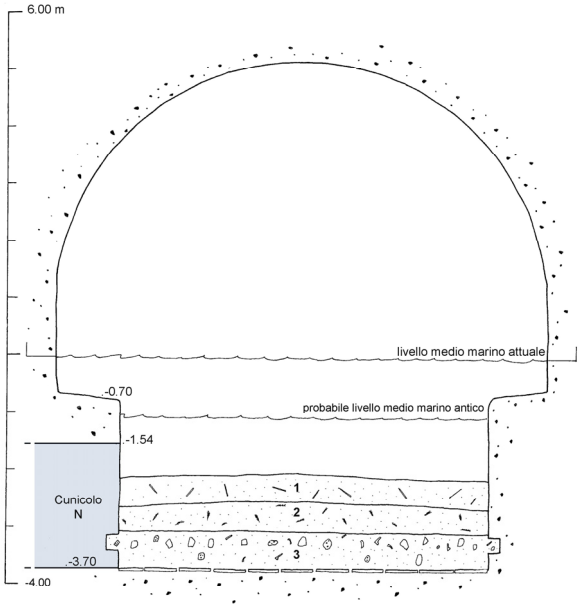


Fig. 16. Longitudinal section of vat 3 showing the vat's stratigraphy and the quotes of water inflow from the later canals (graphic rendering: S.L. Trigona).

Fig. 17. View of the quadrangular apse and of the tunnel (O) of vat 3.

tures that, even if built with sophisticated technical solutions that make them fully functional, have lost the original productive function in favor of aesthetic features that make them become luxurious places of *otium* for the residence of some members of the imperial élite. Usually, fisheries of this type were built as part of complex structures of the large imperial maritime villas, called *praetoria*, and had features typical both of *ninfea* and *triclinia*: rooms built partially underground, in strict connection with the vats full of delicious fish, and decorated with a series of statues, that could offer beautiful scenery for banquets gladdened by theatrical representations[28]. A passage from Seneca describes well these *triclinia-aquaria* in which the fish swam and were caught directly in banqueting rooms, because a mullet could not be considered fresh if it did not die in the hands of the table-companions[29].
As a final remark, the discovery inside vat 2 of a statue of a man wearing a toga with *capsa* does not have parallels among the sculptural decorations of underground *nymphaea*, that typically include themes such as Homeric groups or representations of individual deities, better suited to the decoration used for this type of rooms. The context of discovery, inside the external northern vat, seems to indicate that the statue might have fallen into the vat from one of the terraced upper rooms, and the subject represented could have an ideological connection with the function of the villa as a place of political exile that Ventotene assumed at the beginning of the Augustan age, reminding the villa's visitors of the high social status and political connections of its Imperial owners (fig. 19)[30].

[28] The presence of scenic effects Gianfrotta hypothesizes in Ponza's fishery (GIANFROTTA 2002: 87), particularly for what concerns the little pits located at the sides of the niche at the end of room A, could receive confirmation in Ventotene due to the presence of the blind tunnel O, that opens up on the bottom of vat 3 in a similar position.
[29] LAFON 2001: 308-313.
[30] The recovery of this life-sized headless statue has been possible only in June 2008, with financial support of ProMare, Inc. The statue is undergoing conservation prior to its archaeological study. Therefore, the chronology of the statue remains

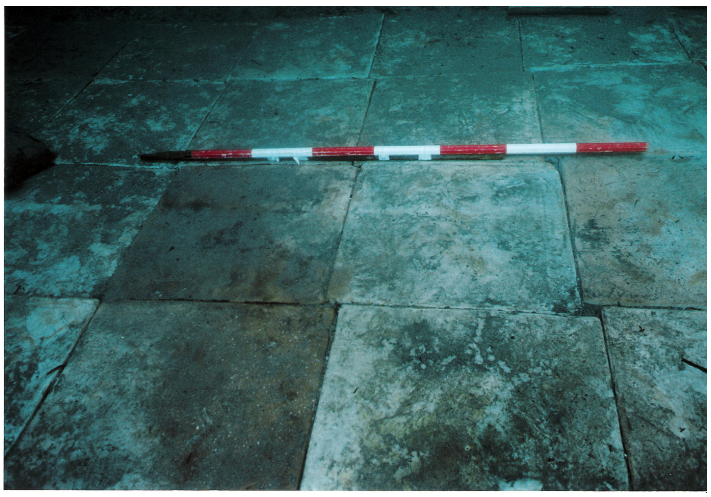


Fig. 18. Detail of vat 3's floor, made of terracotta tiles.

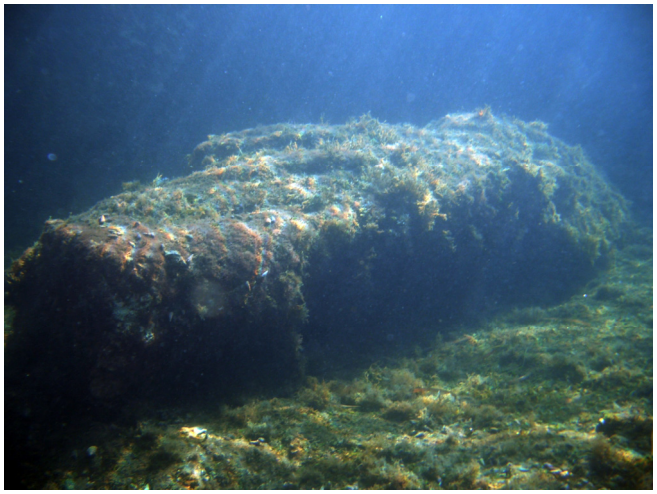


Fig. 19. The statue before its recovery.

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undetermined, and it is not possible to contextualize this artifact in the topography and history of the island of Imperial age. For more information regarding the use of Ventotene as a place of exile for the members of Augustus' family, see DE ROSSI 2000.