The Contribution of Historical Sources in the Reconstruction of the Nin 1 Original Hull Form

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Based on the information provided by Vjekoslav Kolanović from Privlaka, in 1966 Zdenko Brusić discovered the first medieval boat in Nin (Nin 1). Two years later, thirty meters away, he found another one (Nin 2). These two vessels, filled with stones and apparently scuttled in front of the entrance to the inner Nin lagoon *(Fig. 1),* lay at a depth of only 1.5 – 2 m. Already during the documentation campaign in 1969 *(Fig. 2)*, it was shown that they did not possess a classic ship structure, characterized by a central keel. Instead, a keel plank was placed on the bottom, and along its edges, two thin and almost parallel bilge keels were attached.

Fig. 1 The arial view of Nin (photo: courtesy of the Nin Tourist Board)

Fig. 2 Discovery of the ship Nin 1 (photo: Z. Brusić)

Fig. 3 Ship Nin 1 in the Museum of the Heritage of Nin (photo: R. Mosković)

Thanks to the efforts of the research leader, and the support of the conservator Božidar Vilhar and his associates, both boats were successfully recovered in 1974. The action lasted ten days, and consisted of recovery of frames, planks and other elements of the ship's structure. The boat Nin 1 was preserved in a total length of 6.68 m and a maximum width of 1.46 m. At the time of discovery, 26 frames were recorded, which included 3 bow frames, 19 frames composed of floor timbers and futtocks and 4 stern floor timbers, but their total number had decreased by 5 floor timbers and 7 futtocks by the time of recovery. The planking consisted of 75 separate pieces, 2-2.8 cm thick, while the keel plank was slightly thicker. The stem was attached to the keel plank, and it was assumed that a similar element had once existed in the stern of the ship. The dimensions of the mentioned bilge keels, made of 2-3 pieces of wood, were 5 x 5 cm in cross section.

The arrival of Pope John Paul II in Croatia in 1994 encouraged the construction of the first boat based on the Nin finds, which was made by master Čedomir (Ćiro) Burtina in a small private shipyard in Betina. A few years later, another boat was built. It should certainly be emphasized that these are not faithful replicas of medieval finds, but boats inspired by the reconstructions proposed in the Museum of Nin Antiquities *(Fig. 3)*, where the boats are on display. The shipbuilder was consciously left free to make them in the traditional way, primarily due to insufficiently studied shipbuilding skills of medieval masters from Nin, but also as a pioneering experience in trying to make floating replicas based on archaeological finds.

We know that around the 14th century, when the two boats were built, in the small shipyards the shipwrights used two methods for their skeleton-first construction. One method was the so-called method "by eye", an empirical system based on the builder's experience, which involved the use of a few templates (*sagome*), the knowledge of simple proportional rules, and long ribbands (*maistre*), which enclosed and defined the shape of the hull. The other method was more organized, thanks to the use of moulds (*sesti*) and tablets on which geometric reduction rules, already known in the Mediterranean at least since the Middle Ages, were applied.

The manuscript of Venetian origin called *Libro di navigar*, dating back to the mid-14th century and the oldest seafaring manuscript in the world found up to now, supports this proposal. It demonstrates how already at the time geometric construction methods were known. They were used up to the Early Modern period to calculate the floor timber narrowing (*partison delle corbe*), floor timber rising (*stella*), and the widening and sliding mould of the futtocks (*ramo e scorer del sesto*). These methods were used in both large ships and in small boats of about ten meters, with thirty frames (*Libro di navigar*, c. 18r-18v). *(Figs. 5 and 6)*

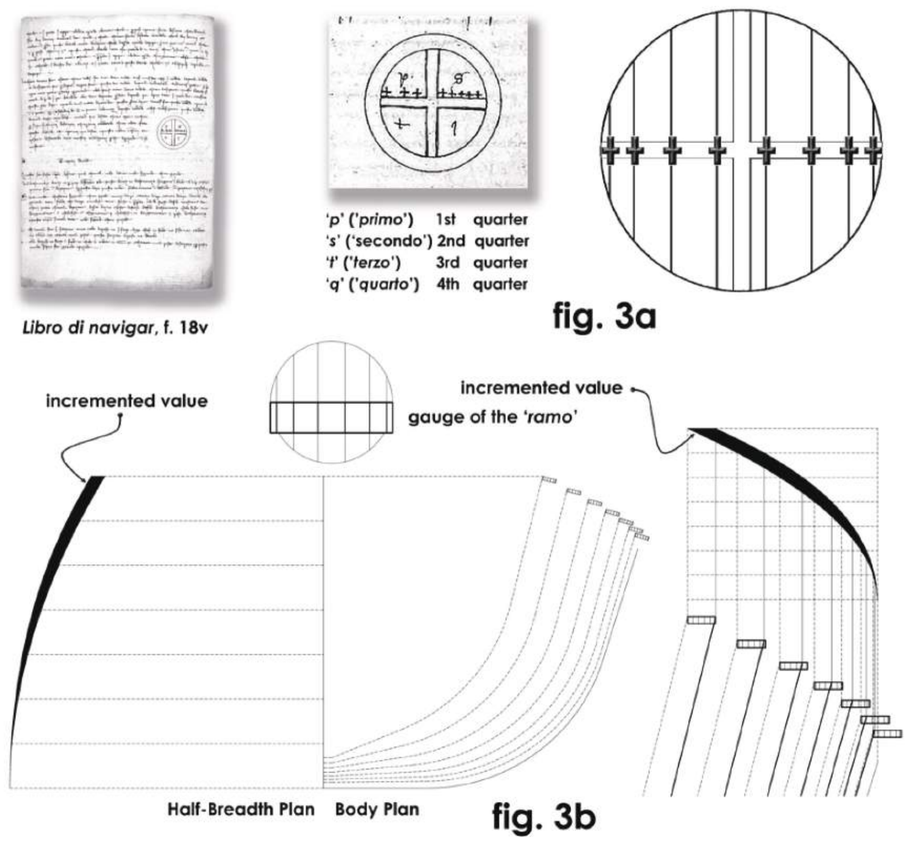


Fig. 7 Drawings after Bondioli 2017: 220.

In the study on the reconstruction of the original forms of the ship Nin 1, we made use of the drawings made in 2019 by the shipwright Stanko Kuštera, rather than the archaeological drawings carried out at the time of the field research, which did not appear to be completely reliable. On the basis of this information, a comparison with written sources was attempted. In the first place, it immediately emerged that the use of the geometric method of the circle did not appear to have been used to obtain a sinusoidal widening in the upper parts of the hull *(Fig. 7)*. In fact, as already highlighted by Mauro Bondioli, this enlargement causes a slightly different inclination of the side of the hull *(Fig. 8),* a feature that does not appear in the documentation on disposal. Nor does any system appear to have been used for the floor timber rising (*stella delle corbe)*. Instead, it seems that the geometric method of the half circle (*mezzaluna or mezzotondo*) – sinusoidal curve – was used to progressively reduce the floor timbers narrowing *(Fig. 9)*. In any case, it is evident that the various sections of the skeleton are generated by the same profile as the master frame and other floor timbers, according to a rational method *(Figs. 10–12)*.

Fig. 4 *Libro di navigar*, c. 18v.

Fig. 5 *Libro di navigar*, c. 26r.

Fig. 6 Detail of the *tolela* method (tablet or circle).

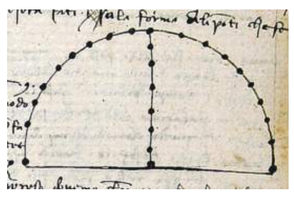


Fig. 8 Detail of the method of *mezzaluna or mezzotondo* (half circle – sinusoidal curve).

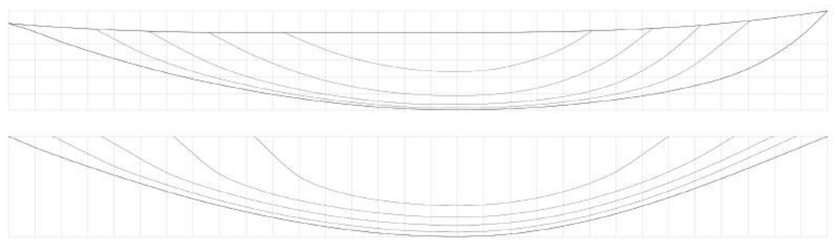
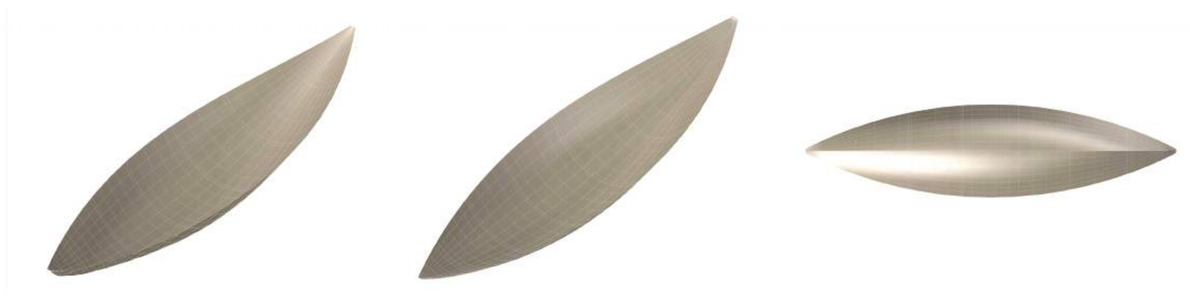


Fig. 9 Hypothetical hull lines (drawing: M. Bondioli).



Figs. 10-11 Perspectives views of the 3D reconstruction (model: M. Bondioli).

Fig. 12 Bottom view of the 3D reconstruction (model: M. Bondioli).

REFERENCES

Bondioli, M. 2017. The Libro di navigar. A new treatise on Venetian shipbuilding from the 14th century. In J. Gawronski, A. van Holk, J. Schokkenbroek (eds.), Ships and Maritime Landscapes. *Proceedings of the Thirteenth International Symposium on Boat and Ship Archaeology, Amsterdam 2012*. Barkhuis Publishing, Eelde: 220.

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