



Marine and Life Sciences

Journal Homepage: <https://dergipark.org.tr/en/pub/marlife>



Histological description of the internal organs in smooth scallops (*Flexopecten glaber*) caught in Black Sea waters near Cape Shabla

Nelko Yordanov¹ • Galin Nikolov¹ • Elitsa Petrova-Pavlova² • Çiğdem Ürkü³

¹ Trakia University, Faculty of Agriculture, Stara Zagora, BULGARIA

² Agricultural Academy, Institute of Fish Resources, Varna, BULGARIA

³ Istanbul University, Faculty of Aquatic Science, Istanbul, TÜRKİYE

✉ Corresponding Author: curku@istanbul.edu.tr

Please cite this paper as follows:

Yordanov, N., Nikolov, G., Petrova-Pavlova, E., & Ürkü, Ç. (2023). Histological description of the internal organs in smooth scallops (*Flexopecten glaber*) caught in Black Sea waters near Cape Shabla. *Marine and Life Sciences*, 5(2), 62-66. <https://doi.org/10.51756/marlife.1330144>

Research Article

A B S T R A C T

Article History

Received: 20.07.2023

Accepted: 14.12.2023

Published Online: 25.12.2023



Keywords:

Cape Shabla
Flexopecten glaber
Histology
Internal organs
Smooth scallops

Assessing the possibility for cultivation of the smooth scallops (*Flexopecten glaber*) along the Bulgarian Black Sea coast requires a form one side very good knowledge of the biology of species, and from the other side internal organs and reproductive tissues, also the changes occurring during reproductive processes. Thus, the study aimed to investigate and evaluate the histological structure of the internal organs of the *Flexopecten glaber* caught in the Black Sea. Three samples were collected in June 2022 from commercial fishing in Black Sea waters near Cape Shabla. The shell length and weight of each mussel were measured and recorded. The study was carried out by making histological preparations of gonads and internal organs in adult smooth scallops. Histologically organs of smooth scallop showed that the tissues were in normal cytological condition. The microscopic analysis showed that the heart is located dorsal to adductor muscle. The kidneys are situated in the anterior margin together with gonads which cover the last one. Ventral to the gonad are attached pairs of gills. The histological structure of the gonads and internal organs of scallops was identified and described. The results of the current investigation expand the field of knowledge on the anatomy and histology of smooth scallops.

INTRODUCTION

The smooth scallop (*Flexopecten glaber*) is a Mediterranean edible marine bivalve that is distributed in the Black Sea. Initially, the smooth callop in the Black Sea was considered to be a distinct subspecies, but recent data have shown it to be identical to Mediterranean populations and belong to the Pectinidae (Bondarev, 2020). Inhabits coastal areas with sandy or stony bottom substrates with depths of up to 40 meters (Mendo et al., 2016).

In the Bulgarian Black Sea waters, *Flexopecten glaber* is not very evenly distributed and according to previous reports, it probably disappeared in the second half of the last century. In June 2020, as a result of dredging activities in the Mangalia area (close to the Bulgaria border), three living specimens of *F. glaber* were found at 25 meters depth (Filimon, 2020). In

2021, an adult population of them was found along the Bulgarian Black Sea coast during marine monitoring surveys (Todorova et al., 2022). This species has the potential to be exploited for human food and aquaculture, considering their spat is easy to collect on artificial substrates (Marčeta et al., 2016).

The assessment of the possibility of farming *F. glaber* along the Bulgarian Black Sea coast requires a from one side very good knowledge of the biology of species, and from the other side internal organs and reproductive tissues, also the changes occurring during the reproductive processes. Thus, the study aimed to investigate and evaluate the histological structure of the internal organs of *F. glaber* caught in the Black Sea.

MATERIALS AND METHODS

During the commercial fishing which was performed along the Bulgarian Black Sea coast three smooth scallops (*F. glaber*) were collected close to the Cape Shabla as bycatch. The biometric measurements were undertaken with a digital caliper (nearest 0.1 mm) including anterior-posterior length (L), dorsal-ventral length (W), the distance between two valves (D), total weight (TW), wet weight of the soft parts (WWSP), the weight of shell (WS) (Table 1). Biometrically, (L, W, D, TW, and WWSP) values of the smooth scallops (SS) examined in this study (n=3) was determined 40.21; 39.41; 10.25; 8.7296; 3.1907; 5.5389 for SS₁, 36.40; 36.06; 9.89; 7.2120; 2.9658; 4.2462 for SS₂ and 54.68, 49.10, 16.14, 18.9040, 8.4919, 10.4121 third species respectively. In the field, the material for the histological study of smooth scallop samples was fixed in 10% neutral buffered formalin and later processed by standard histological technique. All samples were dehydrated with a graded series of ethanol, cleared in xylene, and embedded in paraffin wax. Paraffin blocks were cut (4-5 µm) with a microtome (Leica RM2125, Germany) and stained with hematoxylin (Sigma- Aldrich-HHS16) and eosin (Merck 109844, Merck KGaA, Germany) (H&E) (Roberts, 2012). Slides were examined under a light microscope (Olympus BX51) equipped with a digital camera (Olympus DP72).

RESULTS AND DISCUSSION

In this study, adult scallops have fully formed and their anatomy has a similar form and structure described by other authors (Beninger and Le Pennec, 2016; Revkov et al., 2021). Histological analysis of the heart, mantle, kidney, and gonad are present in the figures below (Figure 1-4) with all samples

demonstrating the normal cytological state of analyzed tissues.

The main function of the scallop mantle is a secretion of the shell but also has other several key functions, such as sensory, respiratory, etc (Beninger and Le Pennec, 2016). The scallop mantle is a complex, multi-tasked organ composed of an internal epithelium that contains the following cells: columnar epithelium (CE), adipocytes (AC), and myocytes (MC) (Figure 2a). The middle mantle includes hemocytes (HC) and is covered with cilia columnar epithelium (CE) (Figure 2b).

In the center is situated the adductor muscle. The heart is located dorsal to him, while kidneys are situated in the anterior margin together with gonads which cover the last one (Figure 3). Ventral to the gonad are attached pairs of gills (Beninger and Le Pennec, 2006).

It is known that smooth scallops (*Flexopecten glaber*) are simultaneous hermaphrodite species with rapid sexual maturation (Marčeta et al., 2016). The sexing of pectens like as a bivalve mollusc cannot be accomplished based on gonad color but the development phase of pectens like as a bivalve mollusc could be identified by microscopic inspection (Sühnel et al., 2010; Beninger and Le Pennec, 2016). The analyzed smooth scallops were predominantly in the initial spawning stage. In female gonads, follicles appeared. The pedunculated (i.e., young) oocytes were situated close to follicle walls, while mature oocytes occupied the center of the follicle (Figure 4a). The abundance of mature oocytes was equal to those attached to the wall. The male gonad was in a stage of active spermatogenesis and the gonadal acini, which are irregularly bulb-shaped structures contained mature spermatozooids (Figure 4b).

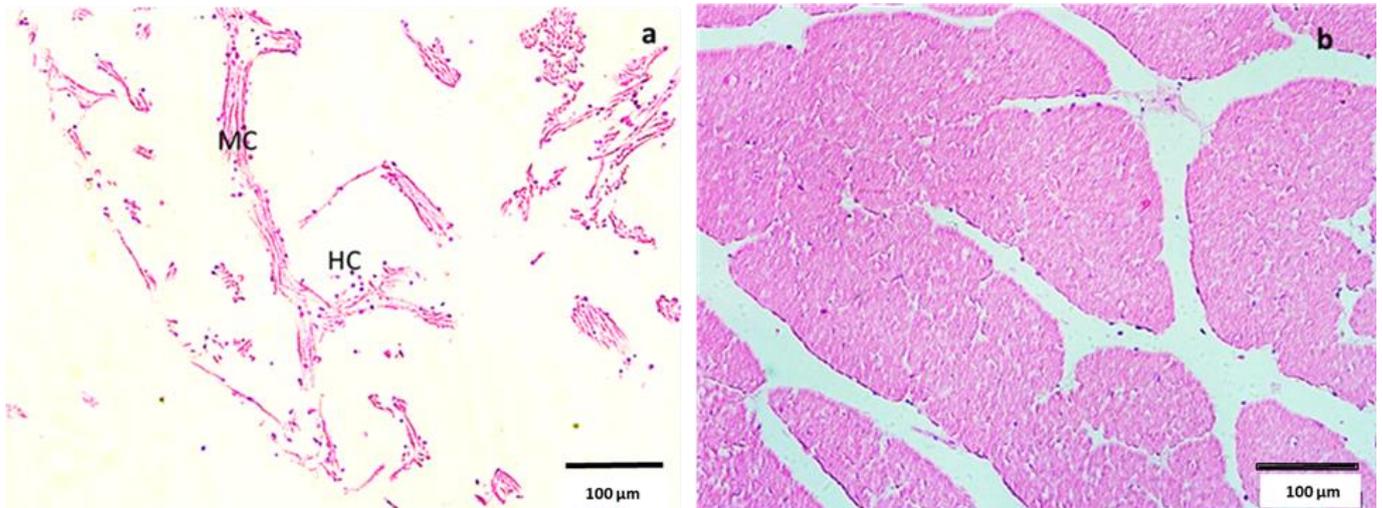


Figure 1. Frontal section of the ventricle portraying branched cardiac myocytes (MC) and hemocytes (HC) (a), sagittal section of adductor muscle (b) (H&E)

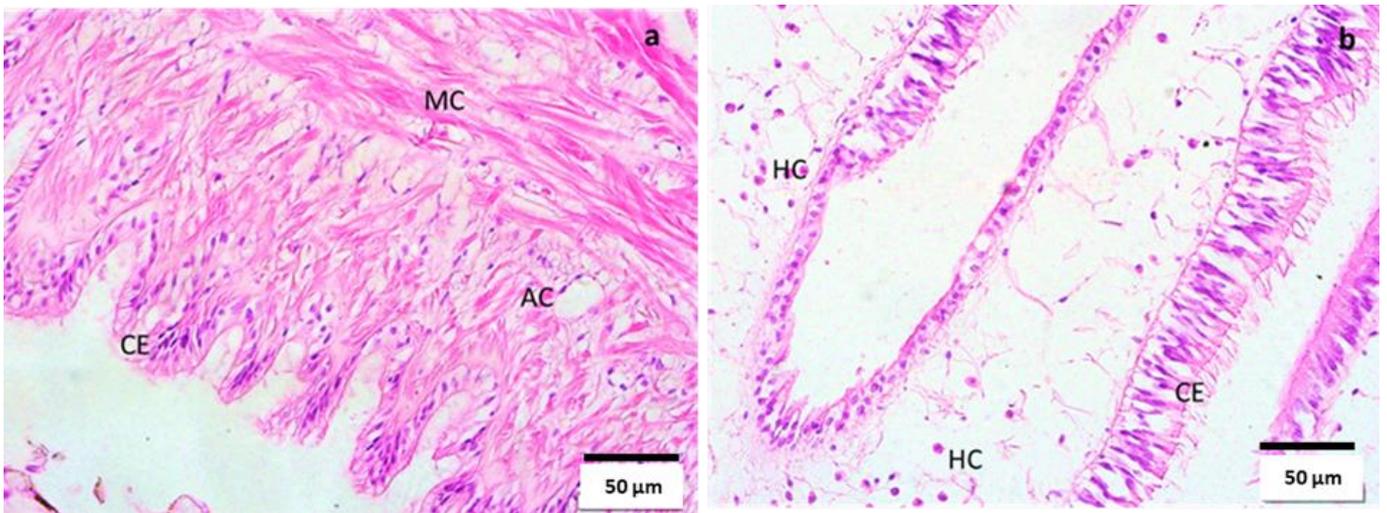


Figure 2. Transverse section of the ventral epithelium of the base of the mantle edge showing columnar epithelium (CE), myocytes (MC), and adipocytes (AC) (a), middle mantle including hemocytes (HC) and covered with cilia columnar epithelium (CE) (b) (H&E)

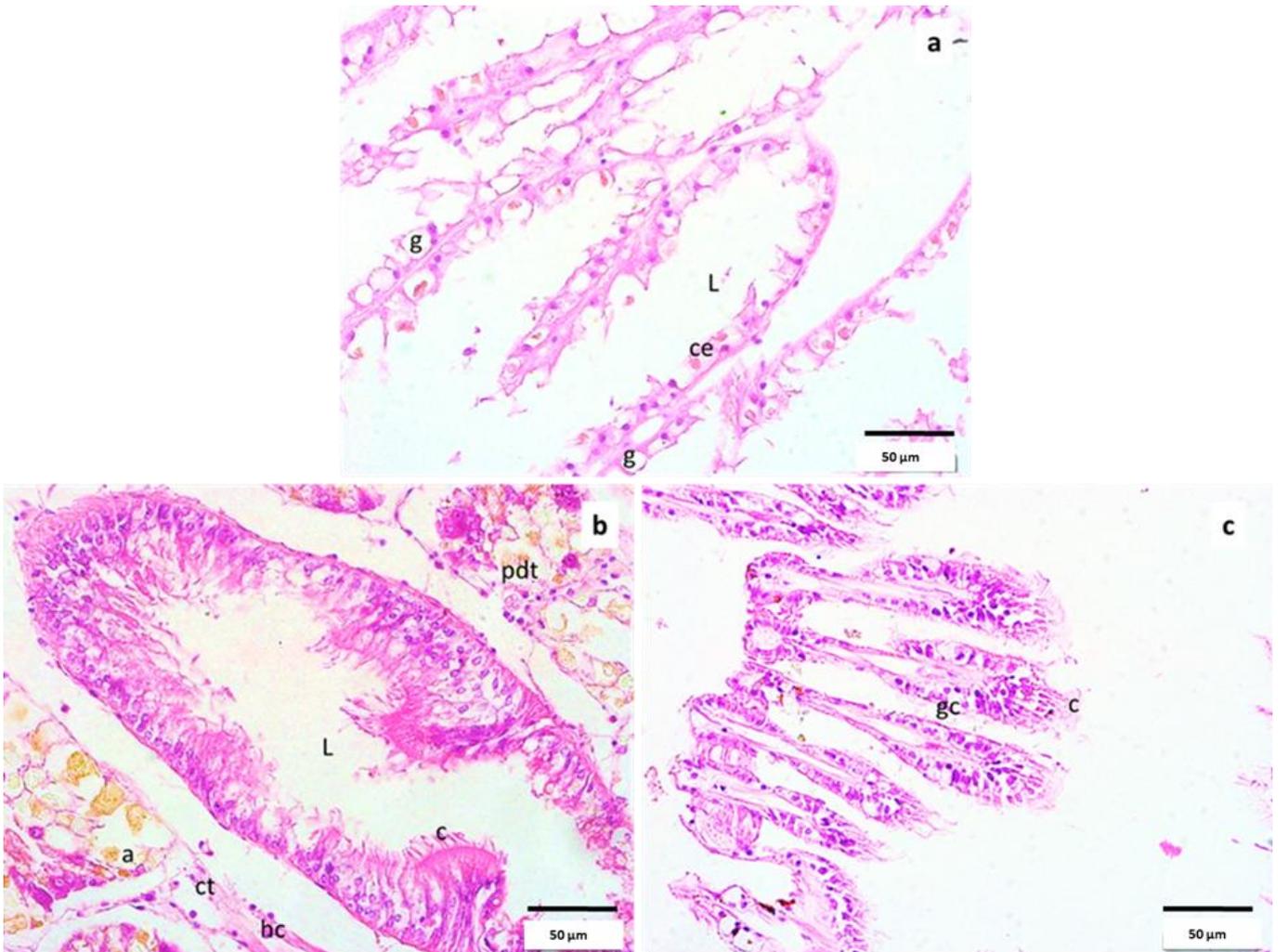


Figure 3. Histological section of the kidney tubules containing cubic epithelium (ce), showing vacuolated gland (g) cells (a), secondary digestive tubule (b), and gills covered with cilia (c) (H&E). (L: lumen, pdt: primer digestive tubule containing adipocyte-like digestive cells, gc: goblet cell, ct: connective tissue, hc: hemocyte cell)

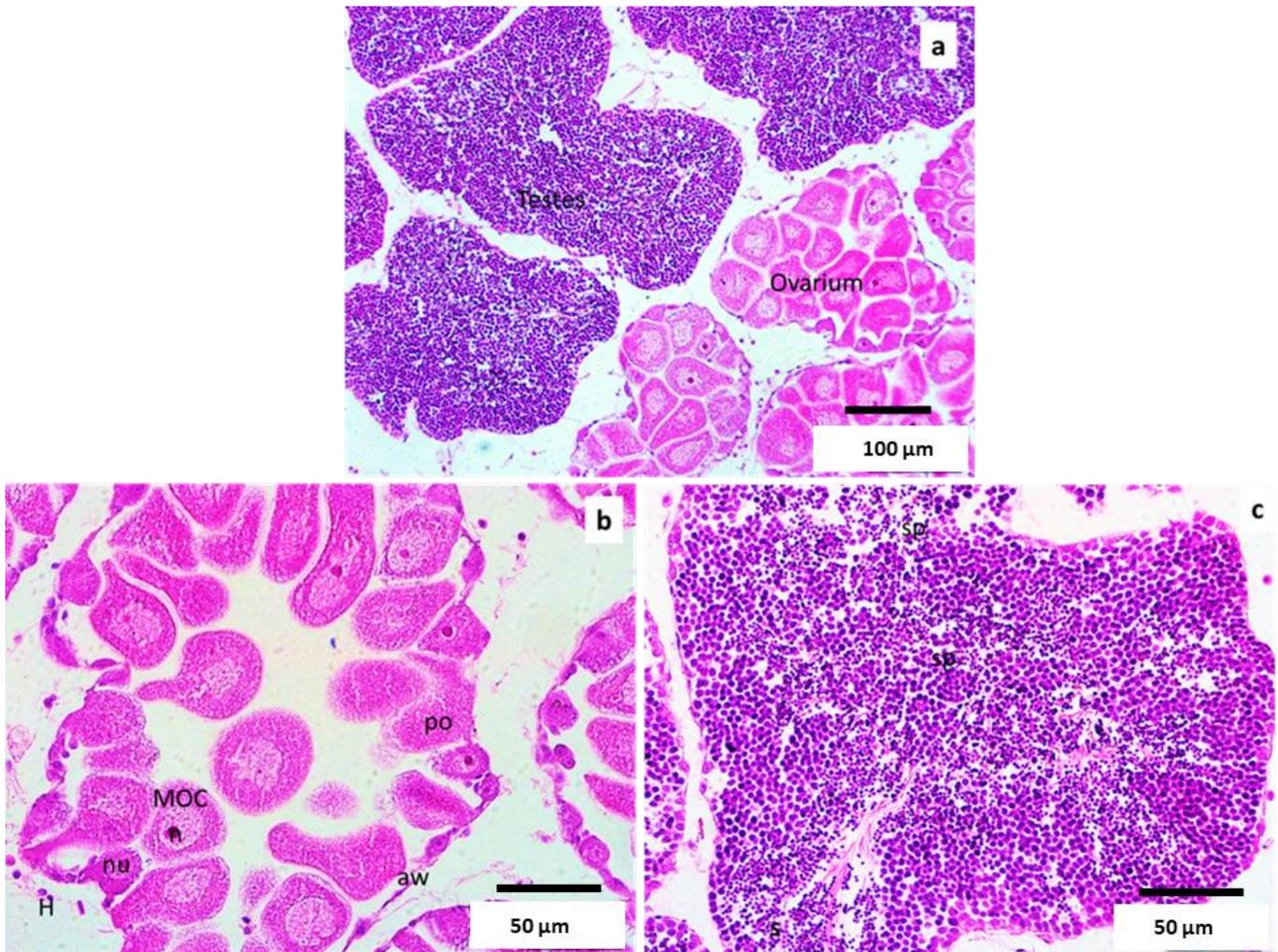


Figure 4. Gonad histology of hermaphrodite *Flexopecten glaber* (a) transverse section of ovary (b) and testes (c) (Spawning stage) (H&E) (MOC: mature oocyte, n: nucleus, nu: nucleolus, po: pedunculated oocyte, sp: spermatocytes, s: spermatids, aw: acinus wall)

CONCLUSION

The current study carried out a baseline description of the anatomy and histological of smooth scallops (*Flexopecten glaber*) along the Bulgarian Black Sea coast and was not designed as a trial. Considering previous studies, the number of samples used is sufficient for histological studies. However, increasing the sample size regarding the morphometric structure of this creature is among our goals in future studies. In addition, since it is a rare species, the data in the present study is very valuable. They have shown that the histological characterizations of the reproductive organs are similar to other species in the genus *Pecten*. In conclusion, further investigations should be performed to ascertain how environmental and climatic factors influence their growth and reproduction.

COMPLIANCE WITH ETHICAL STANDARDS

Authors' Contributions

Authors contributed equally to this paper.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

The authors declare that formal consent is not required for this type of study.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

- Beninger, P. G., & Le Pennec, M. (2006). *Scallop structure and function*. In: Sandra, S.E., Parsons, G.J. (eds.), *Developments in aquaculture and fisheries science*. Elsevier, 35, p. 123-227. [https://doi.org/10.1016/S0167-9309\(06\)80030-X](https://doi.org/10.1016/S0167-9309(06)80030-X)
- Beninger, P. G., & Le Pennec, M. (2016). *Scallop structure and function*. In: Sandra, S.E., Parsons, G.J. (eds.), *Developments in aquaculture and fisheries science*. Elsevier, 40, p. 85-159. <https://doi.org/10.1016/B978-0-444-62710-0.00003-1>
- Bondarev, I. P. (2020). New data on the morphological variability of the shell of *Flexopecten glaber* in the Black Sea. *Ruthenica, Russian Malacological Journal*, 30(2), 103-113. [https://doi.org/10.35885/ruthenica.2021.30\(2\).4](https://doi.org/10.35885/ruthenica.2021.30(2).4)
- Filimon, A. (2020). First record of *Flexopecten glaber* from the Romanian Black Sea shelf. *Revista Cercetări Marine-Revue Recherches Marines-Marine Research Journal*, 50(1), 186-191. <https://doi.org/10.55268/CM.2020.50.186>
- Marčeta, T., Da Ros, L., Gabriella Marin, M., Francesca Codognotto, V., & Bressan, M. (2016). Overview of the biology of *Flexopecten glaber* in the North Western Adriatic Sea (Italy): A good candidate for future shellfish farming aims? *Aquaculture*, 462, 80-91. <https://doi.org/10.1016/j.aquaculture.2016.04.036>
- Mendo, J., Wolff, M., Mendo, T., & Ysla, L. (2016). *Scallop fishery and culture in Peru*. In: Sandra, S.E., Parsons, G.J. (eds.), *Scallops*. Elsevier, 1089-1110. <https://doi.org/10.1016/B978-0-444-62710-0.00028-6>
- Revkov, N. K., Pirkova, A. V., Timofeev, V. A., Ladygina, L. V., & Schurov, S. V. (2021). Growth and morphometric characteristics of the scallop *Flexopecten glaber* (Bivalvia: Pectenidae) reared in cages off the coast of Crimea (Black Sea). *Ruthenica, Russian Malacological Journal*, 31(3), 127-138. [https://doi.org/10.35885/ruthenica.2021.31\(3\).3](https://doi.org/10.35885/ruthenica.2021.31(3).3)
- Roberts, R. J. (2012). *Fish pathology*. 4th edition, Wiley-Blackwell, UK
- Sühnel, S., Lagreze, F., Bercht, M., Ferreira, J. F., Carneiro-Schaefer, A. L., Magalhães, A. R. M. & Maraschin, M. (2010). Sexual stages of the female portion in the scallop *Nodipecten nodosus* (Linné, 1758) and astaxanthin quantity in each stage. *Brazilian Journal of Biology*, 70(3), 651-658. <https://doi.org/10.1590/S1519-69842010000300024>
- Todorova, V. R., Panayotova, M. D., Bekova, R. I., & Prodanov, B. K. (2022). Recovery of *Flexopecten glaber* (Linnaeus, 1758)(Bivalvia: Pectinidae) in the Bulgarian Black Sea waters: Recent distribution, population characteristics and future perspectives for protection and commercial utilization. *Acta Zoologica Bulgarica*, 74(3), 437-444.