

GLIMPSES INTO THE BIODIVERSITY OF SFÂNTU GHEORGHE, TULCEA COUNTY

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Abstract

A field trip carried out in July 2023 reveals some aspects of natural biodiversity in Sfântu Gheorghe, a locality from Tulcea County placed in the Danube Delta Biosphere Reserve. During the observation period, the following fish species were noticed at the shore of the Black Sea: Abramis brama, Callionymus risso, Cyprinus carpio, Esox lucius, Engraulis encrasicolus, Gymnammodytes cicerelus, Ophidion rochei, Pomatoschistus minutus and Trachurus mediterraneus. Of them, only for four species were given data upon the total length (cm) and total weight (grams), taking into account the number of specimens and the quality of preservation. Among the invertebrates gathered from the vegetation, were registered: gastropods (Cepaea hortensis, Helicella sp., Planorbis corneus), spiders (Agelena sp., Araneus diadematus, Argiope bruennichi, Cheiracanthium sp., Tetragnatha sp.) and insects, mainly from Orthoptera order. In addition, the preliminary study of the coastal flora of the Sfântu Gheorghe indicated a total of 74 plant species, belonging to a number of 37 families. Some of the species are included in the categories of rare species.

Key words: Black Sea, Danube Delta, Sfântu Gheorghe, species, vegetation.

INTRODUCTION

The Danube Delta Biosphere Reserve is a protected area at national and international level, and over time it has been designated as a Ramsar site, it has been inscribed on the UNESCO World Heritage list and in two main categories of the Natura 2000 network (Sites of Importance Community - SCI and Special Avifaunistic Protection Areas - SPA).

It was stated that Danube Delta represents a true amphitheater of biodiversity, being characterized by a large number of ecosystems, herbaceous and woody plants species, invertebrate and vertebrate animals (Olaru & Dicu, 2022).

A typical fishermen village from a protected natural area, Sfântu Gheorghe community is focused mainly on fishing and tourism (Bozagievici et al., 2011).

Situated on the coastal strip in the south of the delta, Sfântu Gheorghe supports a large variety of habitats, such as sandy beach, vegetated dunes, dunes with grass cover, salt marshes,

meadows, woods and canals with water vegetation (de Vries et al., 2017).

This place from the S-E of Romania is known to have numerous important plant species included in the Red List of the Danube Delta and, considering human activities, the reason for the study was related to the succession of flora and vegetation on the verge of extinction.

Regarding the insect diversity, in the specialist literature, there are few observations upon the Odonata fauna from the surroundings of Sfântu Gheorghe Village (de Vries et al., 2017).

Moreover, concerning fisheries, it is known that the community of Sfântu Gheorghe is based mainly on anadromous migratory fish including Pontic shad, sturgeon, as well as small species such as sprat and anchovy (Marin et al., 2017).

This article aims to contribute to the data about some components of the biodiversity that can be found in the vicinity of the Sfântu Gheorghe, considering the huge potential of this important touristic location of the Danube Delta Biosphere Reserve.

MATERIALS AND METHODS

The data included in this report were collected in July 2023, during a personal field trip that took place in Sfântu Gheorghe, Tulcea County. Most plants and invertebrates were gathered by hand pulling and an entomological net, respectively, mainly from the meadows (collecting points with geographic coordinates 44.893172 N, 29.616194 E; 44.892067 N, 29.611279 E; 44.890950 N, 29.616630 E). Arthropods were preserved and identified according to the protocol mentioned in previous research (Stavrescu-Bedivan et al., 2018).

For the systematic classification of the cormophyte, the *Illustrated Flora of Romania* was used (Ciocărlan, 2000).

The genera within the Kingdom *Plantae*, were noted alphabetically, with the corresponding order and family names given in parentheses, and the vernacular names were given in accordance with online data bases such as *Global Biodiversity Information Facility*, *Plants For A Future* and *World Flora Online*.

After a storm, fish specimens (including still fresh or already dead individuals) could have been captured by hand, near the shore of the Black Sea, identified and photographed.

Regarding the ichthyofauna species mentioned herein, the scientific name and classification were given according to FishBase database (Kottelat & Freyhof, 2007; www.fishbase.se).

Some fish individuals were measured for total length (TL, in cm) and weighed (TW=total body weight, in grams) to the nearest 1.0 mm and 0.1 g, respectively.

RESULTS AND DISCUSSIONS

I. Fish inventory

Teleost fish species identified on the shore of the Black Sea during this survey (Figure 1) are: *Abramis brama* (Linnaeus, 1758) (Freshwater bream); *Callionymus risso* (Lesueur, 1814) (Risso's dragonet); *Cyprinus carpio* Linnaeus, 1758 (Common carp); *Engraulis encrasicolus* (Linnaeus, 1758) (European anchovy); *Gymnammodytes cicereus* (Rafinesque, 1810) (Mediterranean sand eel); *Esox lucius* (Linnaeus, 1758) (Northern pike); *Ophidion rochei* (Müller, 1845) (Roche's snake blenny); *Pomatoschistus minutus* (Pallas, 1770) (Sand

goby); *Trachurus mediterraneus* (Steindachner, 1868) (Mediterranean horse mackerel).

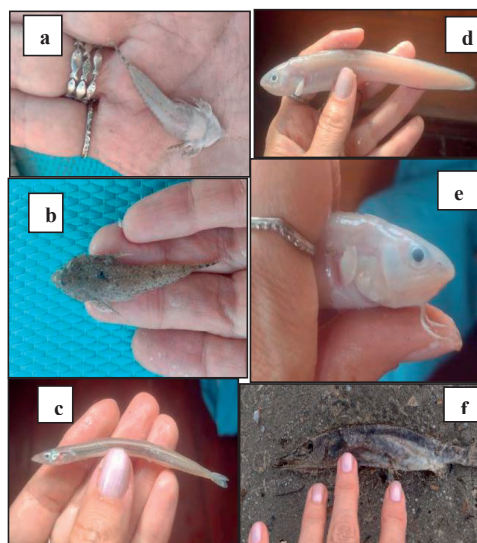


Figure 1. Some fish species identified in Sfântu Gheorghe, Tulcea county (July 2023):

a,b. *Callionymus risso*; c. *Gymnammodytes cicereus*; d, e. *Ophidion rochei*; f. *Esox lucius*

Ophidion rochei (Müller, 1845) (Roche's snake blenny) is an endemic species that lives in the demersal areas of the Mediterranean Sea and the Black Sea. It generally prefers sandy, shallow areas not exceeding 150 m deep (Kéver et al., 2012; Othman et al., 2020). Data on the biology and distribution of the species are scarce, as the fish is nocturnal and hides in the sand during the day. In the specialized literature, *O. rochei* was reported on the Romanian coast from Capul Midia to Mangalia (Niță et al., 2022), but new data showed that the species was also found in Sfântu Gheorghe (iNaturalist). In July 2023, four individuals belonging to this species were measured (TL ranging from 11 to 14 cm, with TW values from 7.22 to 13.46 g).

Gymnammodytes cicereus (Rafinesque, 1810) is a common species in the basins of the Mediterranean Sea, the Black Sea, the Sea of Marmara, the Baltic Sea along the European shores of the Atlantic Ocean, but it has also been reported in Morocco, Angola and Senegal (Afonso et al., 2013; Sánchez et al., 2017). The Mediterranean sand eel is a betopelagic fish, which hides in the sand during the day and actively searches for food at night. In Catalonia,

the breeding period has been estimated to extend from November to February, and in mid-December, individuals that have reached their first maturity can be found (Sánchez et al., 2017). Data regarding the reproduction of the species in the Black Sea basin are insufficient. It is assumed that this would end in mid-February-beginning of March (Daban & İşmen, 2020; Niță et al., 2022).

Callionymus risso (Lesueur, 1814) Risso's dragonet is a demersal fish that inhabits Romanian coastal areas. It is quite widespread in the Mediterranean Sea region, including the Adriatic Sea, the Aegean Sea, the Marmara Sea, as well as the Black Sea. It was very rarely observed in the Eastern Atlantic, more precisely in the west and south of Portugal (iNaturalist; Niță et al., 2022; Bănăduc et al., 2023). In present survey, four specimens belonging to *C. risso* were measured (TL ranging from 4 to 4.5 cm, TW from 0.6 to 0.96 g).

Trachurus mediterraneus (Steindachner, 1868) Mediterranean horse mackerel is a pelagic and migratory species that occurs in large shoals in the Bay of Biscay region and up to the coastal area of Mauritania, including the Mediterranean Sea. In the region of the Black Sea, the Sea of Azov and the Sea of Marmara, the subspecies *T. mediterraneus ponticus* is found (Kutsyn, 2021). Schools of Mediterranean horse mackerel migrate north to spawn and feed when the water reaches 13-14°C. They appear on the Romanian coast in the spring, between April and May (Yankova, 2011; Yankova, 2013; Păun et al., 2020; Niță et al., 2022).

Moreover, six specimens of *Engraulis encrasicolus* (with TL ranging from 6 to 9.5 cm and TW from 1.43 to 8.5 g) were registered during personal observations in this field trip.

Engraulis encrasicolus (Linnaeus, 1758) is a small fish (about 10-15 cm average length) of the *Engraulidae* family. It is found in the coastal waters of the eastern Atlantic from Norway to South Africa, being reported from the east coast of Africa. The species is also found in the Mediterranean Sea, the Black Sea and the Sea of Azov, with specimens having crossed the Suez Canal and the Gulf of Suez. In the Black Sea, the European anchovy adapts to fresh and brackish water conditions, characteristic of estuaries and coastal areas. It lives in large groups and migrates according to the season and the

availability of food. It is an economically important species (Horton & van der Lingen, 2019). European anchovy has been already registered in Sfântu Gheorghe seaside sample station (Nicolae et al., 2018).

Pomatoschistus minutus (Pallas, 1770) Sand goby is a species of the family *Gobiidae* distributed from the north of Scandinavia to the Mediterranean Sea, the neighboring areas of the Eastern Atlantic, the Black Sea, the Baltic Sea. It prefers the benthic way of life, in salty waters, but it can be found in fresh waters, on sandy or muddy bottoms, or even in ecotones where the substrate is hard, at depths of 30-40 m (Salgado et al., 2004; Niță et al., 2022; Jensen et al., 2023). Two individuals (TL = 4 cm, TW = 1.3 g; TL = 4 cm, TW = 1.42 g) were registered in July 2023 in Sfântu Gheorghe.

Regarding the conservation status of the nine fish species identified on the Romanian coast (according to the IUCN - International Union for Conservation of Nature), for two species there are Data Deficient (DD) for the evaluation of the conservation status - *Ophidion rochei* and *Gymnammodytes cicerelus*, and a species (*Cyprinus carpio*) is classified as Vulnerable (VU). The remaining six species identified on the Romanian coast are Least Concern (LC).

II. Invertebrate inventory

During the study period, the following invertebrate taxa were noticed, identified and photographed in the meadows of Sfântu Gheorghe:

Phylum Mollusca

Cepaea hortensis (O.F. Müller, 1774) (Gastropoda: *Helicidae*), White-lipped snail; *Helicella* spp. (Gastropoda: *Geomitridae*); *Planorbarius corneus* (Linnaeus, 1758); (Gastropoda: *Planorbidae*), Great ramshorn.

Phylum Arthropoda

Subphylum Chelicerata

Agelena sp. (Arachnida: *Araneae*); *Araneus diadematus* Clerck, 1758 (Arachnida: *Araneidae*);

Argiope bruennichi (Scopoli, 1772)

(Arachnida: *Araneae*) (Figure 2 a);

Cheiracanthium sp. (Arachnida:

Cheiracanthiidae);

Tetragnatha sp. (Arachnida: *Tetragnathidae*).

Subphylum Hexapoda

Aeshna spp. (Odonata: *Aeshnidae*);
Calliptamus italicus (Linnaeus, 1758)
 (Orthoptera: *Acrididae*), Italian locust;
Carpocoris mediterraneus (Tamanini, 1958)
 (Hemiptera: *Pentatomidae*), Red shield bug;
Cicadella viridis (Linnaeus, 1758) (Hemiptera:
Cicadellidae), Green leafhopper;
Coccinella septempunctata (Linnaeus, 1758)
 (Coleoptera: *Coccinellidae*), Seven spotted lady
 beetle (Figure 2 b);
Decticus verrucivorus (Linnaeus, 1758)
 (Orthoptera: *Tettigoniidae*), Wart-biter;
Doclostaurus maroccanus (Thunberg, 1815)
 (Orthoptera: *Acrididae*), Moroccan locust;
Emmelia trabealis (Scopoli, 1763)
 (Lepidoptera: *Noctuidae*), Spotted sulphur
 (Figure 2 c);
Pyrrhocoris apterus (Linnaeus, 1758)
 (Hemiptera: *Pyrrhocoridae*), Firebug;
Podagrica sp. (Coleoptera: *Chrysomelidae*);
Tettigonia caudata (Charpentier, 1842)
 (Orthoptera: *Tettigoniidae*), Eastern Green
 Bush-Cricket;
Tropinota (Epicometis) hirta (Poda, 1761)
 (Coleoptera: *Cetoniidae*), Apple Blossom
 Beetle.



Figure 2. a. *Argiope bruennichi*; b. *Coccinella septempunctata* on *Cynanchum acutum*; c. *Emmelia trabealis* on *Althaea officinalis*

III. Floristic inventory

The total identified species during this survey are included in 37 families: *Alismataceae* 1; *Amaranthaceae* 1; *Apiaceae* 3; *Asclepiadaceae* 1; *Asteraceae* 11; *Betulaceae* 1; *Butomaceae* 1; *Chenopodiaceae* 2; *Convolvulaceae* 2; *Cyperaceae* 2; *Dipsacaceae* 1; *Eleagnaceae* 2; *Fabaceae* 3; *Geraniaceae* 1; *Hydrocharitaceae* 1; *Juncaceae* 4; *Lamiaceae* 1; *Linaceae* 1; *Lythraceae* 3; *Malvaceae* 1; *Menyanthaceae* 1; *Nymphaeaceae* 2; *Phytolaccaceae* 1; *Plantaginaceae* 2; *Plumbaginaceae* 1; *Poaceae* 6; *Polygonaceae* 3; *Portulacaceae* 1; *Potamogetonaceae* 1; *Ranunculaceae* 2; *Salicaceae* 3; *Salviniaceae* 1; *Scrophulariaceae* 1; *Solanaceae* 1; *Tamaricaceae* 1; *Trapanaceae* 1; *Typhaceae* 1.

A floristic checklist was provided for vascular flora of Sfântu Gheorghe, as follows:

1. *Achillea millefolium* L. (Asterales: *Asteraceae*), Yarrow;
2. *Aeluropus litoralis* (Gouan) Parl. (Poales: *Poaceae*);
3. *Agropogon litoralis* (Sm.) C.E. Hubbard (Poales: *Poaceae*);
4. *Agrostis stolonifera* L. (Poales: *Poaceae*), Creeping bent;
5. *Alisma plantago aquatica* L. (Alismatales: *Alismataceae*), European water plantain;
6. *Alnus glutinosa* (L.) Gaertner (Fagales: *Betulaceae*), Common alder;
7. *Althaea officinalis* L. (Malvales: *Malvaceae*), Marshmallow;
8. *Artemisia annua* L. (Asterales: *Asteraceae*), Sweet sagewort;
9. *Atriplex litoralis* L. (Caryophyllales: *Amaranthaceae*), Grass-leaved orache;
10. *Berula erecta* (Hudson) Coville (Apiales: *Apiaceae*), Cutleaf waterparsnip;
11. *Butomus umbellatus* L. (Alismatales: *Butomaceae*), Flowering rush;
12. *Calystegia sepium* (L.) R.Br. (Solanales: *Convolvulaceae*), Hedge bindweed (Figure 3 a);
13. *Carduus* sp. (Asterales: *Asteraceae*);
14. *Carex* sp. (Cyperales: *Cyperaceae*);
15. *Cichorium intybus* L. (Asterales: *Asteraceae*), Common chicory;
16. *Cirsium alatum* (S.G.Gmelin) Bobrov (Asterales: *Asteraceae*);
17. *Convolvulus persicus* L. (Solanales: *Convolvulaceae*);

18. *Consolida regalis* Gray (Ranunculales: *Ranunculaceae*), Forking larkspur;
19. *Cynanchum acutum* L. (Gentianales: *Asclepiadaceae*);
20. *Cynodon dactylon* (L.) Pers. (Poales: *Poaceae*), Bermuda grass;
21. *Daucus carota* L. (Apiales: *Apiaceae*), Wild carrot;
22. *Dipsacus fullonum* L. (Dipsacales: *Dipsacaceae*), Fuller's teasel;
23. *Eryngium maritimum* L. (Apiales: *Apiaceae*), Sea Holly;
24. *Elaeagnus angustifolia* L. (Elaeagnales: *Elaeagnaceae*), Russian olive;
25. *Eleocharis palustris* (L.) Roemer et Schultes (Cyperales: *Cyperaceae*), Common spikerush;
26. *Geranium* sp. L. (Geraniales: *Geraniaceae*);
27. *Glycyrrhiza glabra* L. (Fabales: *Fabaceae*), Liquorice;
28. *Hordeum bulbosum* L. (Poales: *Poaceae*), Bulbous barley;
29. *Hydrocharis morsus-ranae* L. (Hydrocharitales: *Hydrocharitaceae*), European frog-bit;
30. *Hyppophae rhamnoides* L. (Rosales: *Elaeagnaceae*), Sea buckthorn;
31. *Juncus conglomeratus* L. (Junciales: *Juncaceae*), Common rush;
32. *Juncus littoralis* C.A.Meyer (Junciales: *Juncaceae*);
33. *Juncus maritimus* Lam. (Junciales: *Juncaceae*), Sea rush;
34. *Juncus subnodulosus* Schrank (Junciales: *Juncaceae*), Blunt-flowered rush;
35. *Lactuca tatarica* (L.) C.A.Meyer (Asterales: *Asteraceae*), Blue lettuce;
36. *Leontodon autumnalis* L. syn. *Scorzoneroidea autumnalis* (L.) Moench (Asterales: *Asteraceae*), Fall dandelion;
37. *Leymus sabulosus* (Bieb.) Tzvelev. (Poales: *Poaceae*), Mammoth wild rye;
38. *Limonium bellidifolium* (Gouan) Dumort. - (Plumbaginales: *Plumbaginaceae*), Matted sea-lavender (Figure 3 b);
39. *Linum austriacum* L. (Linales: *Linaceae*), Asian flax;
40. *Lythrum virgatum* L. (Myrtales: *Lythraceae*), Wand loosestrife;
41. *Lythrum tribracteatum* Salzm. ex Spreng. (Myrtales: *Lythraceae*);
42. *Lythrum salicaria* L. (Myrtales: *Lythraceae*), Purple loosestrife;
43. *Nuphar lutea* (L.) Sm. (Nymphaeales: *Nymphaeaceae*), Yellow water lily;
44. *Nymphaea candida* J. Presl (Nymphaeales: *Nymphaeaceae*);
45. *Nymphoides peltata* (S.G.Gmel.) O. Kuntze (Asterales: *Menyanthaceae*), Fringed water lily;
46. *Ononis spinosa* L. (Fabales: *Fabaceae*), Spiny restharrow (Figure 3 c);
47. *Periploca graeca* L. (Gentianales: *Asclepiadaceae*), Silk vine;
48. *Petasites spurius* (Retz.) Reichenb. (Asterales: *Asteraceae*);
49. *Plantago lanceolata* L. (Plantaginales: *Plantaginaceae*), Buckhorn;
50. *Plantago maritima* L. (Plantaginales: *Plantaginaceae*), Sea plantain;
51. *Phytolacca americana* L. (Caryophyllales: *Phytolaccaceae*), American Pokeweed;
52. *Polygonum graminifolium* Wierzb. ex Heuff. (Polygonales: *Polygonaceae*);
53. *Polygonum aviculare* L. (Polygonales: *Polygonaceae*), Prostrate knotweed;
54. *Populus nigra* L. (Salicales: *Salicaceae*), Black poplar;
55. *Portulaca oleracea* L. (Caryophyllales: *Portulacaceae*), Common purslane;
56. *Potamogeton pusillus* L. (Najadales: *Potamogetonaceae*), Small pondweed;
57. *Pulicaria dysenterica* (L.) Bernh. (Asterales: *Asteraceae*), Meadow false fleabane;
58. *Ranunculus circinatus* Sibth. (Ranunculales: *Ranunculaceae*), Fan-leaved water-crowfoot;
59. *Rumex aquaticus* L. (Polygonales: *Polygonaceae*), Red dock;
60. *Salicornia europaea* L. (Caryophyllales: *Chenopodiaceae*), Glasswort;
61. *Salix fragilis* L. (Salicales: *Salicaceae*), Crack willow;
62. *Salix viminalis* L. (Malpighiales: *Salicaceae*), Basket willow;
63. *Salvinia natans* (L.) All. (Salviniales: *Salviniaceae*), Floating watermoss;
64. *Scolymus hispanicus* L. (Asterales: *Asteraceae*), Common golden thistle (Figure 3 d);
65. *Senecio vulgaris* L. (Asterales: *Asteraceae*), Common fireweed;
66. *Solanum dulcamara* L. (Solanales: *Solanaceae*), Climbing nightshade;
67. *Sonchus arvensis* L. (Asterales: *Asteraceae*), Field milk thistle;
68. *Stachys* sp. (Lamiales: *Lamiaceae*);

69. *Suaeda maritima* (L.) Dumort. (Caryophyllales: *Chenopodiaceae*), Seablite;
 70. *Tamarix ramosissima* Ledeb. (Tamaricales: *Tamaricaceae*), Saltcedar;
 71. *Trapa natans* L. (Myrtales: *Trapanaceae*), Water chestnut;
 72. *Trifolium angulatum* Waldst.et.Kit. (Fabales: *Fabaceae*), Angled clover;
 73. *Typha latifolia* L. (Typhales: *Typhaceae*), Broadleaf cattail;
 74. *Verbascum banaticum* Schrad. (Scrophulariales: *Scrophulariaceae*).

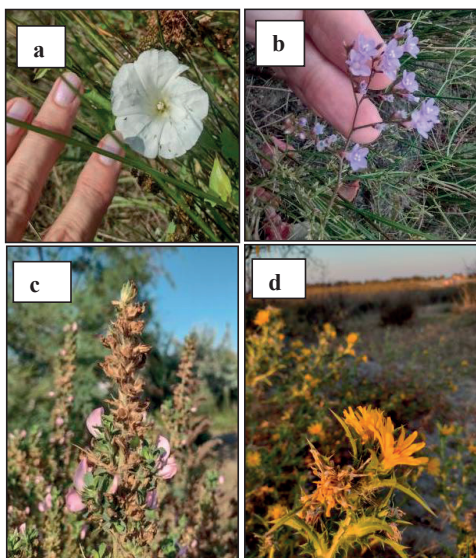


Figure 3. Some plant species identified in Sfântu Gheorghe, Tulcea county (July 2023):
 a. *Calystegia sepium*; b. *Limonium bellidifolium*;
 c. *Ononis spinosa*; d. *Scolymus hispanicus*

Some of the observed species are included in the Red List of Romania in the following categories: R - rare; V - vulnerable.

Cirsium alatum R, *Convolvulus persicus* - R, *Eryngium maritimum* - R, *Glycyrrhiza glabra* L. - R, *Hordeum bulbosum* - R, *Limonium bellidifolium* - R, *Lythrum tribracteatum* - R, *Nymphaea candida* - R, *Petasites spurius* - R, *Polygonum graminifolium* - R, *Ranunculus circinatus* - R, *Scolymus hispanicus* - R, *Trapa natans* - V, *Trifolium angulatum* - R.

The associations of *Juncetum maritimi*, *Suaedetum maritimae* or *Salicornietum europaeae* were included by Gâstescu (2021) into the meadows on low marine levees with sandy and halophile vegetation, a type of natural

ecosystem described in the Danube Delta Biosphere Reserve.

CONCLUSIONS

On the basis of observations during the field trip placed in the area of Sfântu Gheorghe, Tulcea county, in July 2023, 74 plant species belonging to a number of 37 families were determined. The families *Asteraceae* (9) and *Poaceae* (6) comprise the most species in the area.

Among the invertebrates collected from the vegetation of meadows, are worth mentioning gastropods, spiders and insects - mainly *Orthoptera* species.

Concerning the ichthyofauna associated with the biodiversity of Sfântu Gheorghe, some biometric measurements were registered, for *Callionymus risso*, *Engraulis encrasicolus*, *Ophidion rochei* and *Pomatoschistus minutus* fish species.

Since IUCN assessed *Ophidion rochei* and *Gymnammodytes cicerelus* as species classified into Data Deficient (DD) category, data reported herein are important for conservation science.

Sfântu Gheorghe village from the Danube Delta is of particular biological importance, due to its position in a unique and extremely diverse ecosystem. The Danube Delta is one of the largest and best preserved wetlands in Europe and a real refuge for a variety of plant and animal species, some of them rare or endangered.

Knowing the fauna and flora in the area of Sfântu Gheorghe is of major importance from several perspectives: ecological, economic and conservation. This contributes to maintaining the balance of ecosystems, to supporting the local community through sustainable economic activities, as well as to the protection of endangered species.

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