

ANNALES

Anali za istrske in mediteranske študije
Annali di Studi istriani e mediterraneei
Annals for Istrian and Mediterranean Studies
Series Historia Naturalis, 31, 2021, 2





ANNALES

**Anali za istrske in mediteranske študije
Annali di Studi istriani e mediterraneei
Annals for Istrian and Mediterranean Studies**

Series Historia Naturalis, 31, 2021, 2

**UREDNIŠKI ODBOR/
COMITATO DI REDAZIONE/
BOARD OF EDITORS:**

Alessandro Acquavita (IT), Nicola Bettoso (IT), Christian Capapé (FR), Darko Darovec, Dušan Devetak, Jakov Dulčić (HR), Serena Fonda Umani (IT), Andrej Gogala, Daniel Golani (IL), Danijel Ivajnsič, Mitja Kaligarič, Marcelo Kovačič (HR), Andrej Kranjc, Lovrenc Lipej, Vesna Mačič (ME), Alenka Malej, Patricija Mozetič, Martina Orlando-Bonaca, Michael Stachowitsch (AT), Tom Turk, Al Vrezec

**Glavni urednik/Redattore capo/
Editor in chief:**

Darko Darovec

**Odgovorni urednik naravoslovja/
Redattore responsabile per le scienze
naturali/Natural Science Editor:**

Lovrenc Lipej

Urednica/Redattrice/Editor:

Martina Orlando-Bonaca

Lektor/Supervisione/Language editor:

Polona Šergon (sl.), Petra Berlot Kužner (angl.)

Prevajalci/Traduttori/Translators:

Martina Orlando-Bonaca (sl./it.)

**Oblikovalec/Progetto grafico/
Graphic design:**

Dušan Podgornik, Lovrenc Lipej

Tisk/Stampa/Print:

Založništvo PADRE d.o.o.

Izdajatelj/Editori/Published by:Zgodovinsko društvo za južno Primorsko - Koper / Società storica del Litorale - Capodistria®
Inštitut IRRIS za raziskave, razvoj in strategije družbe, kulture in okolja / Institute IRRIS for Research, Development and Strategies of Society, Culture and Environment / Istituto IRRIS di ricerca, sviluppo e strategie della società, cultura e ambiente®**Sedež uredništva/Sede della redazione/
Address of Editorial Board:**Nacionalni inštitut za biologijo, Morska biološka postaja Piran / Istituto nazionale di biologia, Stazione di biologia marina di Pirano / National Institute of Biology, Marine Biology Station Piran SI-6330 Piran / Pirano, Fornače/Fornace 41, tel.: +386 5 671 2900, fax +386 5 671 2901;
e-mail: annales@mbss.org, **internet:** www.zdjp.si

Redakcija te številke je bila zaključena 13. 12. 2021.

**Sofinancirajo/Supporto finanziario/
Financially supported by:**

Javna agencija za raziskovalno dejavnost Republike Slovenije (ARRS), Mestna občina Koper

Annales - Series Historia Naturalis izhaja dvakrat letno.**Naklada/Tiratura/Circulation:** 300 izvodov/copie/copiesRevija *Annales, Series Historia Naturalis* je vključena v naslednje podatkovne baze / *La rivista Annales, series Historia Naturalis* è inserita nei seguenti data base / *Articles appearing in this journal are abstracted and indexed in:* BIOSIS-Zoological Record (UK); Aquatic Sciences and Fisheries Abstracts (ASFA); Elsevier B.V.: SCOPUS (NL); Directory of Open Access Journals (DOAJ).To delo je objavljeno pod licenco / *Quest'opera è distribuita con Licenza / This work is licensed under a Creative Commons BY-NC 4.0.*Navodila avtorjem in vse znanstvene revije in članki so brezplačno dostopni na spletni strani <https://zdjp.si/en/p/annalesshn/>
The submission guidelines and all scientific journals and articles are available free of charge on the website <https://zdjp.si/en/p/annalesshn/>
Le norme redazionali e tutti le riviste scientifiche e gli articoli sono disponibili gratuitamente sul sito <https://zdjp.si/en/p/annalesshn/>

VSEBINA / INDICE GENERALE / CONTENTS 2021(2)

BIOINVAZIJA
BIOINVASIONE
BIOINVASION**Cemal TURAN, Mevlüt GÜRLEK,
Deniz ERGÜDEN & Hakan KABASAKAL**

A New Record for the Shark Fauna of the Mediterranean Sea: Whale shark, *Rhincodon typus* (Orectolobiformes: Rhincodontidae) 167
Nova vrsta v favni morskih psov Sredozemskega morja: morski pes kitovec, Rhincodon typus (Orectolobiformes: Rhincodontidae)

Andrea LOMBARDO & Giuliana MARLETTA

New Evidence of the Ongoing Expansion of *Okenia picoensis* Paz-Sedano, Ortigosa & Pola, 2017 (Gastropoda: Nudibranchia) in the Central-Eastern Mediterranean 173
Novi podatki o širjenju areala vrste Okenia picoensis Paz-Sedano, Ortigosa & Pola, 2017 (Gastropoda: Nudibranchia) v srednjem vzhodnem Sredozemskem morju

SREDOZEMSKI MORSKI PSI
SQUALI MEDITERRANEI
MEDITERRANEAN SHARKS**Hakan KABASAKAL**

A Review of Shark Biodiversity in Turkish Waters: Updated Inventory, New Arrivals, Questionable Species, and Conservation Issues 181
Pregled pestrosti morskih psov v turških morjih: dopolnjen seznam, novi prišleki, vprašljive vrste in naravovarstveni problemi

Hakan KABASAKAL & Erdi BAYRI

Great White Sharks, *Carcharodon carcharias*, Hidden in the Past: Three Unpublished Records of the Species from Turkish Waters 195
Trije neobjavljeni primeri pojavljanja belega morskega volka, Carcharodon carcharias, iz turških voda izbrskani iz preteklosti

IHTIOLOGIJA
ITTILOGIA
ICHTHYOLOGY**Malek ALI, Vienna HAMMOUD,
Ola FANDI & Christian CAPAPÉ**

First Substantiated Record of Crested Oarfish *Lophotus lacepede* (Osteichthyes: Lophotidae) from the Syrian Coast (Eastern Mediterranean Sea) 205
Prvi utemeljeni zapis o pojavljanju čopovke Lophotus lacepede (Osteichthyes: Lophotidae) ob sirske obali (vzhodno Sredozemsko morje)

**Mohamed Mourad BEN AMOR,
Khadija OUNIFI-BEN AMOR,
Marouène BDIQUI & Christian CAPAPÉ**

The Second Record of Oilfish, *Ruvettus pretiosus* (Gempylidae), in Tunisian Waters (Central Mediterranean Sea) 211
Drugi zapis o pojavljanju vrste Ruvettus pretiosus (Gempylidae) v tunizijskih vodah (osrednje Sredozemsko morje)

Okan AKYOL & Vahdet ÜNAL

On the Occurrence of *Seriola fasciata* (Carangidae) in the Eastern Mediterranean Sea 217
O pojavljanju vrste Seriola fasciata (Carangidae) v vzhodnem Sredozemskem morju

**Nassima EL OMRANI,
Hammou EL HABOUZ,
Abdelbasset BEN-BANI,
Abdellatif MOUKRIM,
Roger FLOWER & Abdellah BOUHAIMI**

Age and Growth of the Pouting *Trisopterus luscus* (Linnaeus, 1758) (Pisces, Gadidae) from Moroccan Central Atlantic Waters 223
Rast in starost francoskega moliča Trisopterus luscus (Linnaeus, 1758) (Pisces, Gadidae) v atlantskih vodah osrednjega Maroka

Mourad CHÉRIF, Rimel BENMESSAOUD & Christian CAPAPÉ

Age and Growth Parameters of the Red Mullet *Mullus barbatus* (Mullidae) from Northern Tunisia (Central Mediterranean Sea) 235
Starostni in rastni parametri pri navadnem bradaču Mullus barbatus (Mullidae) iz severne Tunizije (osrednje Sredozemsko morje)

Yana SOLIMAN, Adib SAAD, Vienna HAMMOUD & Christian CAPAPÉ

Heavy Metal Concentrations in Tissues of Red Mullet, *Mullus barbatus* (Mullidae) from the Syrian Coast (Eastern Mediterranean Sea) 243
Vsebnost težkih kovin v tkivih bradača, Mullus barbatus (Mullidae) iz sirske obale (vzhodno Sredozemsko morje)

Christian CAPAPÉ, Youssouph DIATTA, Almamy DIABY, Sihem RAFRAFI-NOUIRA & Christian REYNAUD

Record of a Single Clasper Specimen in *Zanobatus schoenleinii* (Chondrichthyes: Zanobatidae) from the Coast of Senegal (eastern tropical Atlantic) 251
Najdba primerka vrste Zanobatus schoenleinii (Chondrichthyes: Zanobatidae) le z enim klasperjem iz senegalske obale (vzhodni tropski Atlantik)

FAVNA
 FAVNA
 FAVNA

Ana FORTIČ, Domen TRKOV, Lovrenc LIPEJ, Marco FANTIN & Saul CIRIACO

New Evidence of the Occurrence of *Knoutsodonta pictoni* (Nudibranchia, Onchidorididae) in the Northern Adriatic 261
Novi podatki o pojavljanju vrste Knoutsodonta pictoni (Nudibranchia, Onchidorididae) v severnem Jadranu

Noureddine BENABDELLAH, Djillali BOURAS, Mohammed RAMDANI & Nicolas STURARO

Biodiversity and Structural Organization of Mollusk Communities in the Midlittoral Coastal Area Between Bouzedjar and Arzew (Western Algeria) 267
Biodiverziteteta in struktura združbe mehkužcev v bibavičnem območju med predeloma Bouzedjar in Arzew (zahodna Alžirija)

Rudi VEROVNIK, Nejc RABUZA, Miroslav REPAR, Matjaž ZADRGA & Paul TOUT

On the Presence of Two-Tailed Pasha (*Charaxes jasius* (Linnaeus, 1767), Papilionoidea: Nymphalidae) in the Northeastern Adriatic Region 285
O pojavljanju dvorepega paše (Charaxes jasius (Linnaeus, 1767), Papilionoidea: Nymphalidae) na območju severovzhodnega Jadrana

Viktor BARANOV & Borut MAVRIČ

New Records of Non-Biting Midges (Diptera, Chironomidae) from Marine and Coastal Habitats of the Slovenian Part of the Adriatic Sea 291
Nove najdbe trzač (Diptera, Chironomidae) iz morskih in obmorskih habitatov v slovenskem delu Jadrana

FLORA
 FLORA
 FLORA

Amelio PEZZETTA, Marco PAOLUCCI & Mario PELLEGRINI

Le Orchidaceae del sito di interesse comunitario "Monte Pallano e Lecceta d'Isca d'Archi" e delle zone limitrofe 301
Kukavičevke območja, pomembnega za skupnost "Monte Pallano e Lecceta d'Isca d'Archi" in sosednjih območij

DELO NAŠIH ZAVODOV IN DRUŠTEV
 ATTIVITÀ DEI NOSTRI ISTITUTI E SOCIETÀ
 ACTIVITIES BY OUR INSTITUTIONS AND ASSOCIATIONS

Marina DERMASTIA, Tina ELERŠEK, Jadranka JEZERŠEK, Lučka KAJFEŽ BOGATAJ, Matjaž KUNTNER, Tamara LAH TURNŠEK, Matjaž LIČER, Lovrenc LIPEJ, Miha MIKELJ, Izidor OSTAN OŽBOLT, Maja RAVNIKAR, Katja SINUR, Darja STANIČ, Timotej TURK DERMASTIA, Al VREZEC

Okoljski manifest 315

IN MEMORIAM

Jadran FAGANELI

V spomin prof. dr. Jožetu Štirnu (1934-2021) 321

Kazalo k slikam na ovitku 326
 Index to images on the cover 326

NEW RECORDS OF NON-BITING MIDGES (DIPTERA, CHIRONOMIDAE) FROM MARINE AND COASTAL HABITATS OF THE SLOVENIAN PART OF THE ADRIATIC SEA

Viktor BARANOV

Ludwig Maximilian University Munich, Biocenter, Großhaderner Str. 2, 82152 Planegg-Martinsried, Germany

Borut MAVRIČ

Marine Biology Station Piran, National Institute of Biology, Fornače 41, 6330 Piran, Slovenia
e-mail: borut.mavric@nib.si

ABSTRACT

Based on the samples taken from the marine shore and two coastal lagoons at three locations along the Slovenian part of the Adriatic coast, 4 species of non-biting midges (Diptera, Chironomidae) were determined, *Thalassomya frauenfeldi* Schiner, 1856, *Halocladius* (*Halocladius*) *variabilis* (Staeger, 1839), *Halocladius* (*Halocladius*) *varians* (Staeger, 1839) and *Chironomus* (*Chironomus*) *salinarius* Kieffer, 1915. All four species represent first records from marine and lagoon environments, to be added to 28 previously recorded species for Slovenia. As nearby Croatia is being Chironomidae biodiversity hotspot, we can expect numerous species of Chironomidae yet to be discovered in Slovenia and hopefully this research will be a steppingstone for further chironomid research.

Key words: chironomids, Adriatic Sea, *Thalassomya frauenfeldi*, *Halocladius variabilis*, *Halocladius varians*, *Chironomus salinarius*

NUOVI RITROVAMENTI DI MOSCERINI CHIRONOMIDI (DIPTERA, CHIRONOMIDAE) IN HABITAT MARINI E COSTIERI DELLA PARTE SLOVENA DEL MARE ADRIATICO

SINTESI

In base ai campioni prelevati lungo la riva e in due lagune costiere, in tre località della parte slovena della costa adriatica, sono state determinate 4 specie di moscerini chironimidi (Diptera, Chironomidae), *Thalassomya frauenfeldi* Schiner, 1856, *Halocladius* (*Halocladius*) *variabilis* (Staeger, 1839), *Halocladius* (*Halocladius*) *varians* (Staeger, 1839) e *Chironomus* (*Chironomus*) *salinarius* Kieffer, 1915. Tutte e quattro le specie rappresentano i primi ritrovamenti in ambienti marini e lagunari, che si aggiungono alle 28 specie precedentemente registrate in Slovenia. Poiché la vicina Croazia è un punto caldo per la biodiversità dei Chironomidi, possiamo aspettarci numerose nuove specie da scoprire in Slovenia, e speriamo che questo studio sia un punto di partenza per ulteriori ricerche sui chironomidi.

Parole chiave: chironomidi, Adriatico, *Thalassomya frauenfeldi*, *Halocladius variabilis*, *Halocladius varians*, *Chironomus salinarius*

INTRODUCTION

Non-biting midges (Diptera, Chironomidae) are among the most abundant and diverse groups of the extant insects (Armitage *et al.*, 1995). Larvae of most Chironomidae species are inhabiting freshwater, occupying variety of available microhabitats (Ferrington, 2007). Small number of taxa, among over 7000 described species (Ashe and O'Connor, 2009), are however inhabiting saline, hypersaline and marine habitats (Armitage *et al.*, 1995). Marine Chironomidae are inhabiting coastal areas, being associated with algal mats on the rocks in the intertidal zone (Kaiser *et al.*, 2021). These Chironomidae larvae are playing important role in the maintaining of the matter and energy flow in the coastal habitats and represent important indicators of the environmental status (Armitage *et al.*, 1995; Ferrington, 2007). Therefore, understanding the coastal Chironomidae fauna is crucial for monitoring and conservation of the coastal areas (Neumann *et al.*, 1997).

Unfortunately, the Chironomidae fauna of the Slovenian part of the Adriatic coast is poorly known, as most studies of the Chironomidae in Slovenia concentrated on the paleolimnological studies of the alpine lakes, and lake Bled in particular (Andrič *et al.*, 2009), impact of the mining on the benthic organisms (Trontelj & Ponikvar-Zorko, 1998) as well as biomonitoring of the alpine riverine systems (Mori & Brancelj, 2006, 2011). According to Fauna Europea, only 28

Tab. 1: Sampling sites and sampling methods for the collection of the material used in the paper.

Tab. 1: Vzorčevalne postaje in metode zbiranja materiala, uporabljenega v tej raziskavi.

Site	Sampling method	Sampling period	Latitude	Longitude
Marine Biology Station NIB, Piran, rocky shore and concrete steps	Selective hand sampling, from the depth cca. 10 cm	2 nd September 2019	45.52°N	13.57°E
Tanatocenosis Ankaran, algal mat	Selective hand sampling, from the depth ca. 10-20 cm	3 rd September 2019	45.57°N	13.74°E
Lagoon of Škocjanski zatok Nature Reserve, Koper, soft sediments	Benthic grab (0.045 m ²) at cca. 50-100 cm depth	winter and summer 2009, summer 2011, winter 2012, winter and summer 2018	45.55°N	13.75°E

species of Chironomidae are formally recorded from Slovenia (Sæther & Spies, 2011).

Although Chironomids are known to be very abundant in the Slovenian coastal lagoons, no formal species records exist (Pitacco *et al.*, 2018). An unidentified species of the *Halocladius* was previously recorded from the Salines of Sečovelje National Park (Juteršek & Dolinar, 2021).

In this communication, we are presenting new records of the Chironomidae from the Slovenian coastal area.

MATERIAL AND METHODS

Material was collected near Marine Biology Station (Piran), at the Ankaran Tanatocenosis beach and in the Lagoon of Škocjanski zatok, near Koper, utilizing array of the hydrobiological methods (manual collection from the substrate in first two locations and benthic grab in the third). More details are provided in the Table 1 and Figures 1 and 2. All studied specimens were mounted into the Fore-Berlese medium as described by Salmon (1947).

Specimens were imaged using a Keyence VHX-6000 Digital microscope, with a ring-light type illumination. All images were recorded as composites, to achieve the required depth of focus. Images were stitched and stacked to overcome the limitation of the width of the field of view, using in built software of the digital microscope (Haug & Ehrlich 2008; Haug *et al.*, 2011, 2013). Specimens were identified using following keys: Hirvenoja (1973), Cranston (1983) and Orendt *et al.* (2013).

Voucher material is preserved in the collection of the Marine Biology Station of the National Institute of Biology (Piran, Slovenia).

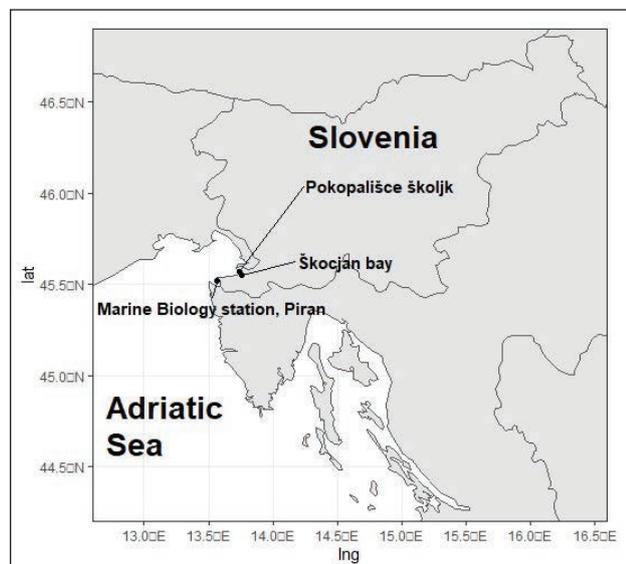


Fig. 1: Sampling locations along Slovenian coast of the Adriatic Sea included in the research.

Sl. 1: Vzorčevalne postaje vzdolž slovenske jadranske obale, ki so bile zajete v raziskavi.



Fig. 2: Coastal habitats of *Chironomidae* representatives on the Slovenian Adriatic coast: A. Rocky shore next to Marine Biology Station NIB, Piran; B. Škocjanski zatok Nature Reserve, Koper; C. Ankaran tanatocenosis, Ankaran; D. Some of the *Chironomidae* habitats are among the most important Adriatic coastal wetlands – lagoon at tanatocenosis Ankaran with common greenshank (*Tringa nebularia*) in the center.
Sl. 2: Obrežni habitati, kjer so bile najdene vrste trzač na slovenski jadranski obali: A. Skalnata obala pred Morsko biološko postajo NIB, Piran; B. Naravni rezervat Škocjanski zatok, Koper; C. tanatocenoza v Ankaranu; D. Nekateri habitati, kjer so bile najdene trzače, so med najpomembnejšimi jadranskimi obrežnimi mokrišči – laguna pri tanatocenozi v Ankaranu z zelenonogim martinčcem (*Tringa nebularia*) v ospredju.

RESULTS AND DISCUSSION

Four species of chironomids were found in the inspected material, all of them being new record for Slovenia.

Chironomidae Newman, 1834
Telmatogetoninae Wirth, 1949
Thalassomya frauenfeldi Schiner, 1856

Two second instar and seven 4th instar larvae were collected on the concrete steps and stones (about 1 m x 40 cm), leading into the sea, directly in front of the Marine Biological Station's building, on 2nd of September 2019 (Fig. 3). Larvae were handpicked from the substrate.

Distribution notes: *T. fauenfeldi* is widely distributed in Europe, in countries around Mediterranean, Black, Baltic and North seas, as well as at the Canary Isles (Ashe & O'Connor, 2009). Adult animals are short-lived, inhabiting the wet rocks in the intertidal zone, while larvae are developing at the algal mats in the supralittoral zone (Cranston, 1983).

Orthocladiinae Lenz, 1921
Halocladus (Halocladus) variabilis (Staeger, 1839)

Two 4th instar larvae were collected on the concrete steps, leading into the sea, directly in front of the Marine Biological Station's building, on 2nd of September 2019.

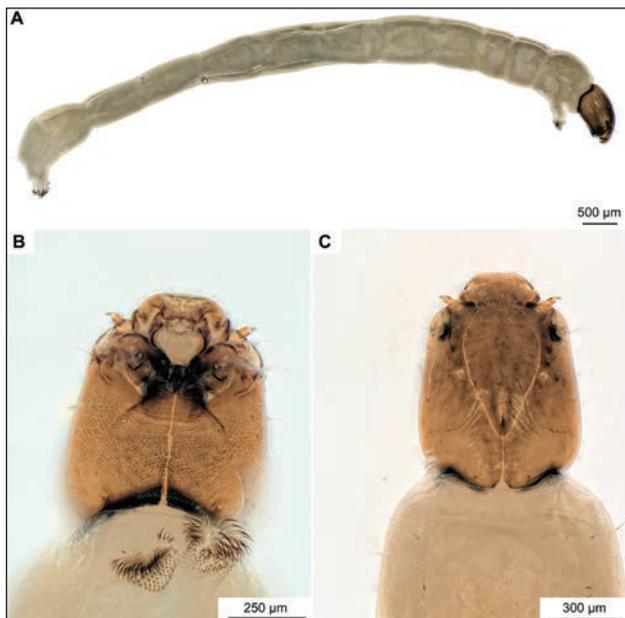


Fig. 3: *Thalassomyia frauenfeldi*. **A.** Habitus of the 4th instar larva; **B.** Head capsule, ventral view; **C.** Head capsule, dorsal view.

Sl. 3: *Thalassomyia frauenfeldi*. **A.** Ličinka v četrtem stadiju; **B.** Glava, ventralni pogled; **C.** Glava, dorzalni pogled.

Distribution notes: *H. variabilis* is widely distributed in North America (USA, Canada, Greenland) and Europe, in the countries surrounding the Black, Mediterranean, North and Baltic seas, as well as at the Azores, Balearic, Faroe Isles, Great Britain and Iceland (Ashe & O'Connor, 2012). Larvae of the species are inhabiting predominantly rocky environments, routinely inhabiting the rock pools at the sea shore, as well as ports and sea-side channels (Hirvenoja, 1973; Moller Pillot, 2013).

Halocladius (Halocladius s.str.) varians (Staeger, 1839)

Three 2nd and 3rd instar larvae (Fig. 4) were sampled by a benthic grab at the lagoon of Škocjanski zatok Nature Reserve, Koper in 2011, and by hand from the shore algal mats at the Ankaran thanatocenosis on 3rd of September 2019.

Distribution notes: *H. varians* is widely distributed in North Africa (Morocco), Near East (Lebanon) and Europe, in the countries surrounding the Black, Mediterranean, North and Baltic seas, as well as at the Azores, Madeira, Great Britain and Ireland (Ashe & O'Connor, 2012). Adult animals are short-lived, swarming in large quantities next to the sea-side buildings and structures (Moller Pillot, 2014). Larvae are inhabiting long tubes on stones, plants and other structures, in the intertidal area, next to the low-water mark (Moller Pillot, 2013). In addition to the brackish and marine water, larvae are also free-living in the polluted freshwater, i.e. in the lower course of river

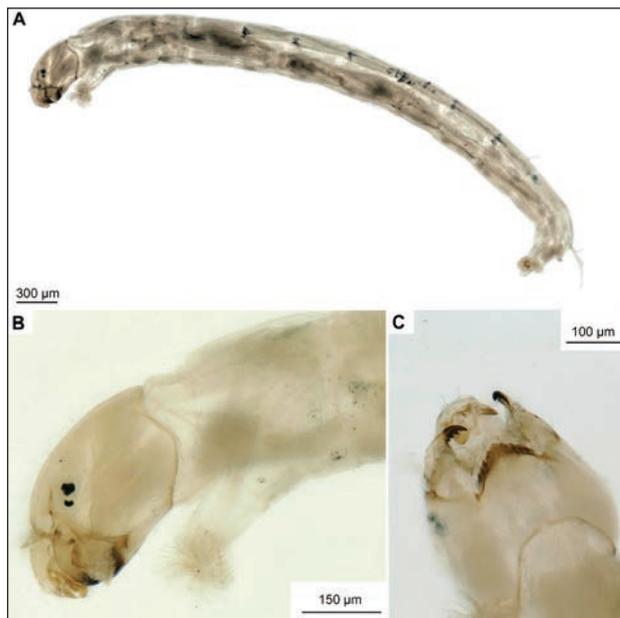


Figure 4. *Halocladius varians*. **A.** Habitus of the 3rd instar larva; **B.** Head capsule, lateral view; **C.** Head capsule, ventral view.

Sl. 4: *Halocladius varians*. **A.** Ličinka v tretjem stadiju; **B.** Glava, bočni pogled; **C.** Glava, ventralni pogled.

Rhine (Hirvenoja, 1973). *H. varians*, were probably the chironomids recorded by Juteršek & Dolinar (2021) as phytophagous on the algal mats at the Salines of Sečovlje National Park. We came to this conclusion, based on the photos of the specimens involved in the study of Juteršek & Dolinar (2021), clearly showing the sand tubes similar to ones built by *H. varians*, as well as larvae and adult flies, very similar to *H. varians* (Juteršek & Dolinar (2021, fig. 2a-g). In the work of this authors, larvae of the chironomids in question were destroying the microbial mats, involved in the traditional process of the salt production at the the Salines of Sečovlje National Park (Juteršek & Dolinar, 2021).

Chironominae Macquart, 1838

Chironomini Macquart, 1838

Chironomus (Chironomus s.str.) salinarius Kieffer, 1915

Numerous 4th instar larvae were sampled by a benthic grab at the lagoon of Škocjanski zatok Nature Reserve, Koper on each sampling period. In the benthic samples from the lagoon *Ch. salinarius* larvae can account even to 1/3 of all benthic organisms present (Fig 5C-F) Pitacco *et al.*, 2018).

Distribution notes: Slovenia was the only European country with the access to either Mediterranean, Black Sea or Baltic coast not to have *Ch. salinarius* previously recorded (Moller Pillot, 2009). Taking into account

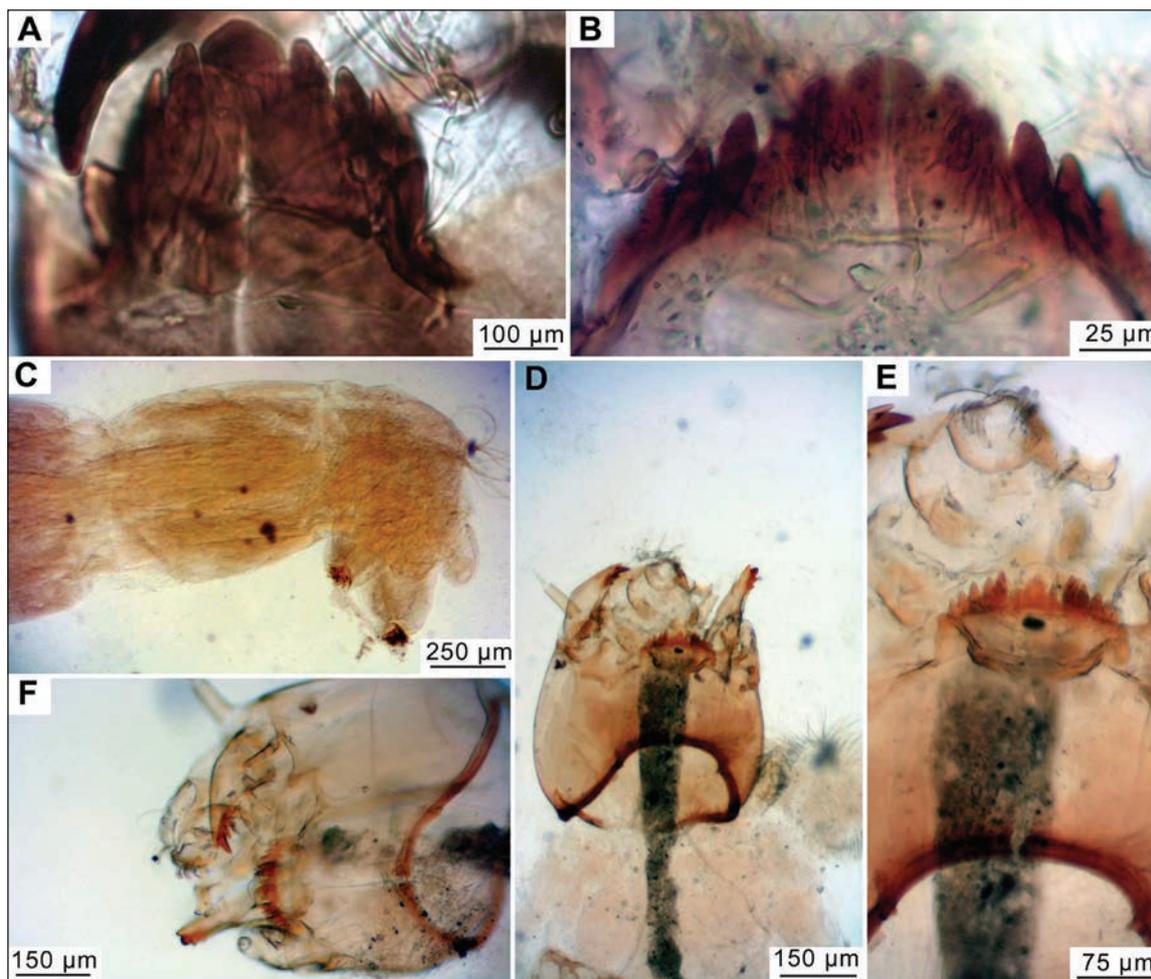


Figure 5. *Halocladus variabilis*, A-B; *Chironomus salinarius*, C-F. A. Ventral side of headcapsule of the 3rd instar larva; B. Mentum, ventral view; C. End of abdomen; D. Head capsule, ventral view; E. Mentum, ventrally; F. Mentum and mandibles, ventrally.

Sl. 5: *Halocladus variabilis*, A-B; *Chironomus salinarius*, C-F. A. Ventralna stran glave ličinke v tretjem stadiju; B. Mentum, ventralni pogled; C. Zadnji del abdomna; D. Glava, ventralno; E. Mentum, ventralno; F. Mentum in čeljustnici, ventralno.

abundance of *Ch. salinarius* in northern Adriatic region, it is hardly a surprise that we have found this species in Slovenia. Species appears to play an important role in the brackish lagoons of Slovenia, due to their local abundance (Pitacco *et al.*, 2018), by playing the part in the cycling of the organic matter and carbon sequestration (Baranov *et al.*, 2016).

CONCLUSIONS

This short study shows that large proportion of Chironomidae fauna of Slovenia is not recorded yet. For example, Luxembourg, with over 10 times lower surface area than Slovenia (998 km² vs 7,827 km² respectively) has 154 species of Chironomidae re-

corded (Saether & Spies, 2011). Taking into account, that nearby Croatia turned out to be a Chironomidae biodiversity hotspot (Gilka *et al.*, 2013; Andersen *et al.*, 2016; Ivković *et al.*, 2015, 2020; Čerba, 2020; Dorić *et al.*, 2021), we can expect numerous species of Chironomidae yet to be discovered in Slovenia. These studies will help both development of the hydrobiological research and water quality monitoring of Slovenia.

ACKNOWLEDGMENTS

We are grateful to the handling editor Ladislav Hamerlík and Dubravka Čerba for their help in improving manuscript.

NOVE NAJDBE TRZAČ (DIPTERA, CHIRONOMIDAE) IZ MORSKIH IN OBMORSKIH HABITATOV V SLOVENSKEM DELU JADRANA

Viktor BARANOV

Ludwig Maximilian University Munich, Biocenter, Großhaderner Str. 2, 82152 Planegg-Martinsried, Germany

Borut MAVRIČ

Marine Biology Station Piran, National Institute of Biology, Fornače 41, 6330 Piran, Slovenia
e-mail: borut.mavric@nib.si

POVZETEK

V vzorcih iz morskega obrežja in dveh obalnih lagun na treh lokalitetah vzdolž slovenskega dela Jadrana sta avtorja določila štiri vrste trzač (Diptera, Chironomidae), *Thalassomya frauenfeldi* Schiner, 1856, *Halocladius* (*Halocladius*) *variabilis* (Staeger, 1839), *Halocladius* (*Halocladius*) *varians* (Staeger, 1839) in *Chironomus* (*Chironomus*) *salinarius* Kieffer, 1915. Vse štiri vrste predstavljajo prve najdbe iz morskih in lagunskih okolij v Sloveniji, ki dopolnjujejo seznam 28 predhodno potrjenih vrst za Slovenijo. Glede na dejstvo, da je bližnja Hrvaška vroča točka diverzitete trzač, avtorja pričakujeta, da bodo v prihodnosti potrjene številne vrste iz družine Chironomidae, ta prispevek pa kot začetni korak za prihodnje raziskave trzač.

Ključne besede: trzače, Jadransko morje, *Thalassomya frauenfeldi*, *Halocladius variabilis*, *Halocladius varians*, *Chironomus salinarius*

REFERENCES

- Andersen, T., V. Baranov, L.K. Hagenlund, M. Ivković, G.M. Kvifte & M. Pavlek (2016):** Blind flight? A new troglobiotic Orthoclad (Diptera, Chironomidae) from the Lukina Jama–Trojama Cave in Croatia. *PloS one*, 11(4), e0152884.
- Andrič, M., J. Massaferrero, U. Eicher, B. Ammann, M.C. Leuenberger, A. Martinčič & A. Brancelj (2009):** A multi-proxy Late-glacial palaeoenvironmental record from Lake Bled, Slovenia. *Hydrobiologia*, 631(1), 121-141.
- Armitage, P.D., L.C. Pinder & P.S. Cranston (Eds.) (2012):** The Chironomidae: biology and ecology of non-biting midges. Springer Science & Business Media.
- Ashe, P. & J.P. O'Connor (2009):** A world catalogue of Chironomidae (Diptera). Part 1. Buchonomyiinae, Chilenomyiinae, Podonominae, Aphroteniinae, Tanypodinae, Usambaromyiinae, Diamesinae, Prodiamesinae and Telmatogetoninae. Irish Biogeographical Society, Dublin [6] + 445 pp.
- Ashe, P. & J.P. O'Connor (2012):** A world catalogue of Chironomidae (Diptera). Part 2. Orthocladiinae. Two volumes (Sections A, B). Irish Biogeographical Society, Dublin [14] + xvi + 468 pp., [6] + 500 pp.
- Baranov, V., J. Lewandowski & S. Krause (2016):** Bioturbation enhances the aerobic respiration of lake sediments in warming lakes. *Biology letters*, 12(8), 20160448.
- Čerba, D., M. Koh, V. Ergović, Z. Mihaljević, D. Milošević & L. Hamerlik (2020):** Chironomidae (Diptera) of Croatia with notes on the diversity and distribution in various habitat types. *Zootaxa*, 4780(2), 259-274.
- Cranston, P.S. (1983):** The larvae of Telmatogetoninae (Diptera: Chironomidae) of the Holarctic region - Keys and diagnoses. In: Wiederholm, T. (ed.): Chironomidae of the Holarctic region. Keys and diagnoses. Part 1 - Larvae. *Entomologica scandinavica*, Supplement 19, 17-22.
- Dorić, V., I. Pozojević, N. Vučković, M. Ivković & Z. Mihaljević (2021):** Lentic chironomid performance in species-based bioassessment proving: High-level taxonomy is not a dead end in monitoring. *Ecological Indicators*, 121, 107041.
- Ferrington, L.C. (2007):** Global diversity of non-biting midges (Chironomidae; Insecta-Diptera) in freshwater. In: Freshwater animal diversity assessment (pp. 447-455). Springer, Dordrecht.
- Giłka, W., M. Zakrzewska, V. Baranov & P. Dominiak (2013):** Diagnostic clues for identification of selected species of the *Micropsectra atrofasciata* group, with description of *M. uva* sp. nov. from Croatia (Diptera: Chironomidae: Tanytarsini). *Zootaxa*, 3702(3), 288-294.
- Huč, S. (2019):** The first documented finds of *Calliostoma laugieri* (Payraudeau, 1826) (Gastropoda: Calliostomatidae) on the coastal mollusc shell deposit at Ankaran. *Natura Sloveniae*, 21(1), 55-56.
- Juteršek, M. & M. Dolinar (2021):** Chironomid larvae destroy cultivated microbial mat in protected Adriatic salterns. *Aquatic Conservation: Marine and Freshwater Ecosystems*. Online ahead of print.
- Haug, J.T., C. Haug & M. Ehrlich (2008):** First Fossil Stomatopod Larva (Arthropoda: Crustacea) and a New Way of Documenting Solnhofen Fossils (Upper Jurassic, Southern Germany). *Paleodiversity*, 1, 103-109.
- Haug, J.T., C. Haug, V. Kutschera, G. Mayer, A. Maas, S. Liebau, C. Castellani, U. Wolfram, E.N.K. Clarkson & D. Waloszek (2011):** Autofluorescence Imaging, an Excellent Tool for Comparative Morphology: Autofluorescence Imaging. *Journal of Microscopy*, 244(3), 259-272. <https://doi.org/10.1111/j.1365-2818.2011.03534.x>.
- Haug, J.T., C.H.G. Müller & A. Sombke (2013):** A Centipede Nymph in Baltic Amber and a New Approach to Document Amber Fossils. *Organisms Diversity & Evolution*, 13(3), 425-432. <https://doi.org/10.1007/s13127-013-0129-3>.
- Hirvenoja, M. (1973):** Revision der Gattung *Cricotopus* van der Wulp und ihrer Verwandten. *Ann. Zool. Fen.*, 10, 1-363.
- Ivković, M., M. Miliša, V. Baranov & Z. Mihaljević (2015):** Environmental drivers of biotic traits and phenology patterns of Diptera assemblages in karst springs: The role of canopy uncovered. *Limnologia*, 54, 44-57.
- Ivković, M., V. Dorić, V. Baranov, Z. Mihaljević, L.P. Kolcsár, G.M. Kvifte, J. Nerudova & A.C. Pont (2020):** Checklist of aquatic Diptera (Insecta) of Plitvice Lakes National Park, Croatia, a UNESCO world heritage site. *ZooKeys*, 918, 99.
- Kaiser, T.S., A. von Haeseler, K. Tessmar Raible & D.G. Heckel (2021):** Timing strains of the marine insect *Clunio marinus* diverged and persist with gene flow. *Molecular Ecology*, 30(5), 1264-1280.
- Moller Pillot, H.K.M. (2013):** Chironomidae larvae of the Netherlands and adjacent lowlands. III. Biology and ecology of the aquatic Orthocladiinae – Prodiamesinae – Diamesinae – Buchonomyiinae – Podonominae – Telmatogetoninae. *KNNV Publ., Zeist (NL)*, 314 pp.
- Mori, N. & A. Brancelj (2006):** Macroinvertebrate communities of karst springs of two river catchments in the Southern Limestone Alps (the Julian Alps, NW Slovenia). *Aquatic Ecology*, 40(1), 69-83.
- Mori, N. & A. Brancelj (2011):** Spatial and temporal variability of hyporheic invertebrate community within a stream reach of the River Bača (W Slovenia). *Natura Sloveniae*, 13(1), 25-38.

- Neumann, D., R. Kaminsky & F. Heimbach (1997):** Timing of eclosion in marine insects on Mediterranean shores—studies on *Clunio mediterraneus*, *C. ponticus* and *Thalassomyia frauenfeldi* (Diptera: Chironomidae). *Marine Biology*, 129(3), 513-521.
- Orendt, C., A. Dettinger-Klemm & M. Spies (2015):** Bestimmungsschlüssel für die Larven der Chironomidae (Diptera) der Brackgewässer Deutschlands und angrenzender Gebiete. In: Schilling, P. (ed.): Bund/Länder-Messprogramm für die Meeresumwelt von Nord- und Ostsee (BLMP) – Ber. Qual.sich.stelle 2013/1. Deutschland/Umweltbundesamt, Dessau-Roßlau, etc.; 242 pp.
- Pitacco, V., L. Lipej, B. Mavrič, M. Mistri & C. Munari (2018):** Comparison of benthic indices for the evaluation of ecological status of three Slovenian transitional water bodies (northern Adriatic). *Marine pollution bulletin*, 129(2), 813-821.
- Qi, X., X.L. Lin, T. Ekrem, R.G. Beutel, C. Song, I. Orlov, C.-T. Chen & X.H. Wang (2019):** A new surface gliding species of Chironomidae: An independent invasion of marine environments and its evolutionary implications. *Zoologica Scripta*, 48(1), 81-92.
- Salmon, J.T. (1947):** New methods in microscopy for the study of small insects and arthropods." In *Transactions of the Royal Society of New Zealand*, vol. 77, pp. 250-253.
- Sæther, O.A. & M. Spies (2011):** Fauna Europaea: Chironomidae. In: Beuk, P., Pape, T. (eds) *Fauna Europaea: Diptera Nematocera*. Fauna Europaea version 2.4. Internet database, outdated version.
- Soong, K., G.F. Chen & J.R. Cao (1999):** Life history studies of the flightless marine midges *Pontomyia* spp. (Diptera: Chironomidae). *Zoological Studies-Taipei*, 38(4), 466-473.
- Trontelj, A. & P. Ponikvar-Zorko (1998):** Influence of a uranium mine on the macrozoobenthic communities of the streams in the nearest environs, Slovenia. *Water science and technology*, 37(8), 235-241.