WORKING GROUP ON NEPHROPS SURVEYS (WGNEPS, outputs from 2022 meeting)

VOLUME 5 | ISSUE 26

ICES SCIENTIFIC REPORTS

RAPPORTS
SCIENTIFIQUES DU CIEM

ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
CIEM CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

ISSN number: 2618-1371

ICES Scientific Reports

Volume 5 | Issue 26

WORKING GROUP ON NEPHROPS SURVEYS (WGNEPS)

Recommended format for purpose of citation:

ICES. 2023. Working Group on Nephrops Surveys (WGNEPS; outputs from 2022 meeting). ICES Scientific Reports. 5:26. 125 pp. https://doi.org/10.17895/ices.pub.22211161

Editors

Jennifer Doyle

Authors

Jacopo Aguzzi • Mikel Aristegui-Ezquibela • Candelaria Burgos • Damianos Chatzievangelou
Jennifer Doyle • Niall Fallon • Spyros Fifas • Isabel González-Herraiz • Patrik Jonsson • Mathieu Lundy
Michela Martinelli • Damir Medvešek • Atif Naseer • Enrique Nava • Nikolai Nawri
Jónas Páll Jónasson • Bárbara Pereira • Gabriele Pieri • Cristina Silva • Maddalena Tibone
Julio Valeiras • Yolanda Vila • Adrian Weetman • Kai Wieland

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

Italy and Croatia : Pomo Pits, Central Adriatic Sea (GSA 17)

ADRIATIC UWTV SURVEYS and Pomo monitoring activity

Martinelli M., Medvešek D., Domenichetti F., Canduci G., Giuliani G., Zacchetti L., Pieri G., Belardinelli A., Chiarini M., Guicciardi S., Grilli F., Penna P., Scarpini P., Cvitanić R., Isajlovic I., Vrgoc N.

In terms of landings, from 1990 to 2015 *Nephrops norvegicus* was the second crustacean exploited in the Adriatic Sea (Mediterranean basin), then becoming the fourth in 2020; besides, it showed a steep decreasing trend passing from 2195 tonnes in 2005 to around 482 tonnes in 2020 (FAO-GFCM 2022). In the Adriatic, *N. norvegicus* lives on muddy grounds at depths from 50m to over 400m, with important concentrations off the coast of Ancona, in the Pomo Pits area, and inside the Croatian channels (Morello et al. 2007; Russo et al. 2018).
The Pomo (or Jabuka in Croatian) Pits fishing ground, located in the central Adriatic Sea (Figure 1) and historically shared by Italian and Croatian fleets (Russo et al., 2018), is characterized by peculiar oceanographic conditions (e.g. periodic water mass renewal which can have an impact on the state of local benthic communities; Marini et al., 2016; Taviani et al., 2015). Vulnerable Marine Ecosystems indicators (as sea pens, etc.) were recorded in the area (Martinelli et al., 2013); moreover, the Pomo Pits represents one of the main nursery for *Merluccius merluccius* in the Adriatic Sea (Angelini et al. 2016) and the main spawning area for *N. norvegicus* (which supports itself and the areas south-west of it; Melaku Canu et al. 2021). Despite no genetic confirmation to date (e.g. Stevens and Jenkins 2020), the area hosts a subpopulation of *N. norvegicus* which differs from others in the Northern Adriatic due to the presence of small-sized mature individuals (Colella et al. 2018; Angelini et al. 2020). Since 2015, a series of management measures was implemented in the area by the Italian and Croatian governments, and then in 2017 the General Fisheries Commission for the Mediterranean (GFCM) established there a Fishery Restricted Area (FRA; GFCM 2017; EU 2019; GFCM 2021).
From 2009 to 2019 (except 2011 and 2018), a spring UWTV survey was conducted in the Pomo Pits area jointly by CNR-IRBIM Ancona and IOF Split, on board the CNR R/V Dallaporta (Martinelli et al. 2013, 2016, 2017; Chiarini et al. 2022a). Unfortunately, due to a combination of pandemic restrictions, R/V unavailability, and lack of funding, there have been no UWTV surveys in the area in the period 2020-2022. However, taking into account the latest applied adjustments (Martinelli et al. 2022) and the outcomes of a recent study on burrow emergence rhythms (Aguzzi et al. 2021), the Pomo Pits UWTV time series has been recently included, as a tuning index, in new modeling approaches tested for the Adriatic *N. norvegicus* stock assessment (e.g. GFCM 2022). Furthermore, trials on automatic burrow tracking and counting have also been recently conducted on the Adriatic UWTV footage (Figure 2), in the framework of Task 8.5 "Automatic Image Analysis" of the EU H2020 NAUTILOS (New Approach to Underwater Technologies for Innovative, Low-cost Ocean obServation; grant n. 101000825) project (Pieri et al. 2021).

In order to obtain demographic and biological information on *N. norvegicus* and other relevant species, trawl hauls at sunrise and sunset were also carried out by means of an experimental net during the UWTV Adriatic surveys; furthermore, the sledge was equipped with a CTD (Conductivity, Temperature, and Depth) profiler and other environmental sensors (Martinelli et al. 2017a). Since 2015, an additional autumn trawl survey has been carried out by CNR IRBIM in the western side of the Pomo Pits area (strata B, ext ITA and ext ITA north in Figure 1); in this survey the same net and sampling protocol are applied and CTD casts are as well executed (Martinelli et al. 2017b, 2019, 2020). The catch per unit effort (CPUE) datasets obtained for the period 2012-2019 were used to perform a short-term evaluation of the effects of changes in fisheries management measures that occurred in the area (Chiarini et al. 2022b). The same CPUE time

series were also used, in combination with environmental information (i.e. depth, bottom temperature, salinity, oxygen saturation), to build generalized additive models (GAMs) accounting for both environmental and fishery management factors; in fact, GAMs may allow a better understanding of the local distribution and abundance variations of *N. norvegicus*, and furthermore to obtain standardized CPUE time series to be used as input for stock assessment models (Chiarini et al. 2022a). In general, the total closure to bottom trawling in the no-take area, corresponding to FRA zone A, showed a positive, albeit mostly local, effect on the CPUE of *N. norvegicus*, while depth, bottom salinity and oxygen saturation levels revealed to be the most influential environmental parameters (Chiarini et al. 2022a,b).

Experimental spring and autumns trawl surveys in the western side of the Pomo Pits area were carried out also in 2020 and 2021 to continue the medium-term evaluation of the effects of the management measures enforced (activity carried out in the framework of an agreement between the Italian Ministry of Agriculture and Forestry and CNR-IRBIM; Martinelli et al. 2021). In 2022, CNR IRBIM conducted spring and autumn sampling in the western side under the umbrella of an agreement with the Italian Institute for Environmental Protection and Research to collect information for Descriptor 6 (Sea-floor Integrity) of the Marine Strategy Framework Directive; within the latter, the possible use of historical UWTV footage to map Vulnerable Marine Ecosystems indicators was also hypothesized (Scarcella et al. 2022).

In 2021 and 2022 IOF Split carried out summer and winter surveys in the eastern side of the Pomo Pits area, using the MEDITS (Mediterranean International Trawl Survey) experimental net, which substantially confirmed a strong increase in CPUE of *N. norvegicus* in zone A of Pomo FRA, but also showed some increases on the eastern (Croatian) side of the Pomo Pits region, in the area adjacent to the no-take zone.

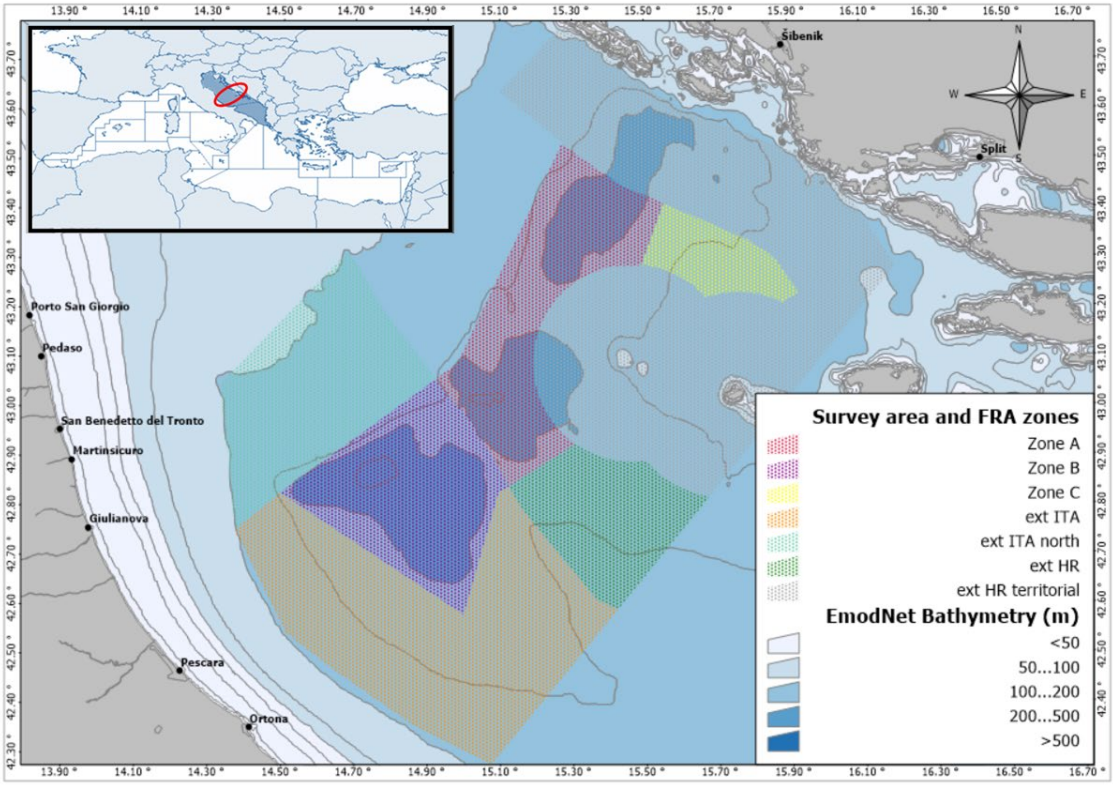

Figure 1: Map of the Pomo (Jabuka) Pits area with indication of bathymetry (EMODnet 2016) and sampling strata (including FRA zones: zone A closed to fishing activity, zones B and C subject to fisheries limitations).

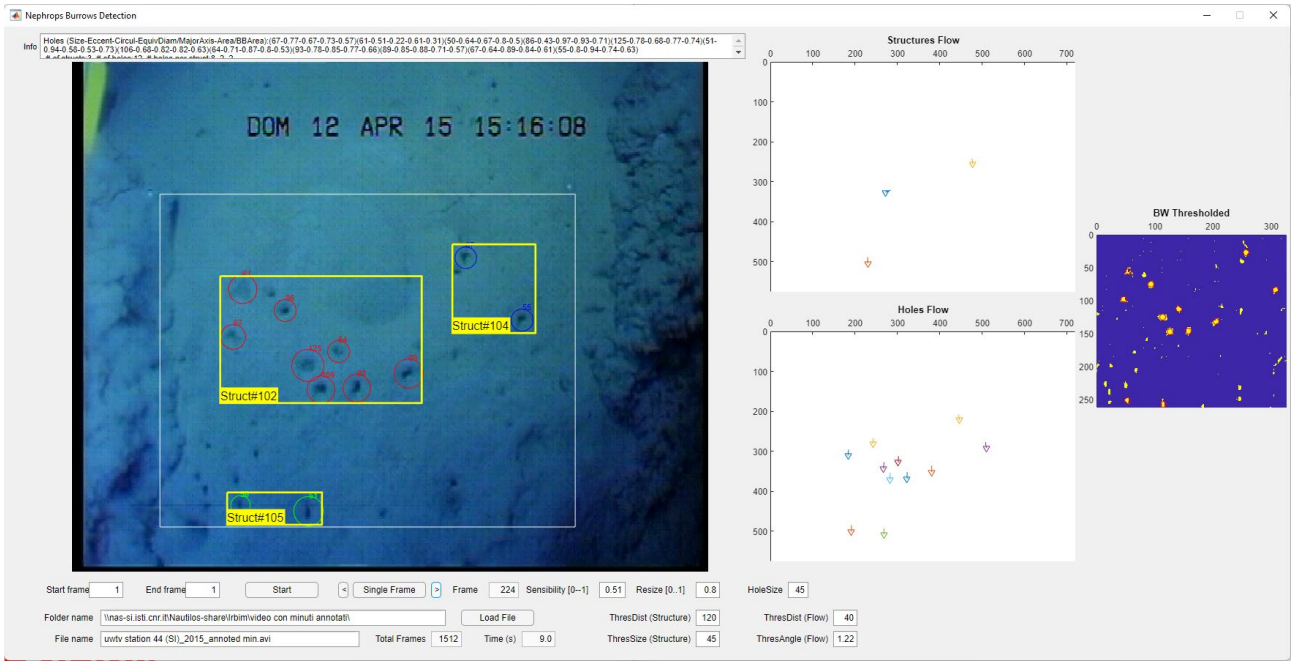

Figure 2: NAUTILOS Graphical User Interface and trials of structure detection based on optical flow and image tracking carried out on Pomo Pits UWTV footage.

References:

Aguzzi J., Bahamon N., Doyle J., Lordan C., Tuck I.D., Chiarini M., Martinelli M., Company J.B. 2021. Burrow emergence rhythms of *Nephrops norvegicus* by UWTV and surveying biases. Scientific Reports 11: 5797.

Angelini S., Hillary R., Morello E.B., Plagányi É.E., Martinelli M., Manfredi C., Isajlović I., Santojanni A. 2016. An Ecosystem Model of Intermediate Complexity to test management options for fisheries: A case study. Ecological Modelling 319: 218-232.

Angelini S., Martinelli M., Santojanni A., Colella S. 2020. Biological evidence of the presence of different subpopulations of Norway lobster (*Nephrops norvegicus*) in the Adriatic Sea (Central Mediterranean Sea). Fisheries Research 221: 105365.

Chiarini M., Guicciardi S., Angelini S., Tuck I.D., Grilli F., Penna P., Domenichetti F., Canduci G., Belardinelli A., Santojanni A., Arneri E., Milone N., Medvešek D., Isajlović I., Vrgoč N., Martinelli M. 2022a. Accounting for environmental and fishery management factors when standardizing CPUE data from a scientific survey: A case study for *Nephrops norvegicus* in the Pomo Pits area (Central Adriatic Sea). PLoS ONE 17(7): e0270703.

Chiarini M., Guicciardi S., Zacchetti L., Domenichetti F., Canduci G., Angelini S., Belardinelli A., Croci C., Giuliani G., Scarpini P., Santojanni A., Medvešek D., Isajlovic I., Vrgoč N., Martinelli, M. 2022b. Looking for a Simple Assessment Tool for a Complex Task: Short-Term Evaluation of Changes in Fisheries Management Measures in the Pomo/Jabuka Pits Area (Central Adriatic Sea). Sustainability 14, 7742.

Colella S., Angelini S., Martinelli M., Santojanni A. 2018. Observations on the reproductive biology of Norway lobster from two different areas of the Adriatic Sea. ISSN 1123-4245 Biologia Marina Mediterranea 25 (1):241-242.

EMODnet 2016. EMODnet Bathymetry Consortium. EMODnet Digital Bathymetry (DTM 2016).

EU 2019. Regulation (EU) 2019/982 of the European Parliament and of the Council of 5 June 2019 amending Regulation (EU) No 1343/2011 on certain provisions for fishing in the GFCM (General Fisheries Commission for the Mediterranean) Agreement area. OJ L 164, 20.6.2019, p. 1–22.

FAO-GFCM 2022. Fishery and Aquaculture Statistics. GFCM capture production 1970-2020 (FishStatJ). In: FAO Fisheries and Aquaculture Division [online]. Rome. Updated 2022. www.fao.org/fishery/statistics/software/fishstatj/en

GFCM 2017. Recommendation GFCM/41/2017/3 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea.

GFCM 2021. Recommendation GFCM/44/2021/2 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea (geographical subarea 17), amending Recommendation GFCM/41/2017/3.

GFCM 2022. Report of the scientific advisory committee on fisheries (SAC) working group on stock assessment of demersal species (WGSAD). Available at: https://www.fao.org/gfcm/technical-meetings/detail/en/c/1506058/ (Accessed June 02, 2022).

Marini M., Maselli V., Campanelli A., Foglini F., Grilli F. 2016. Role of the Mid-Adriatic deep in dense water interception and modification, Marine Geology 375: 5-14.

Martinelli M., Angelini S., Belardinelli A., Caccamo G., Cacciamani R., Calì F., Canduci G., Chiarini M., Croci C., Domenichetti F., Giuliani G., Grilli F., Guicciardi S., Penna P., Scarpini P., Santojanni A., Zacchetti L. 2020. Accordo tra MIPAAF e CNR-IRBIM Ancona in merito alla proposta progettuale relativa alle attività di monitoraggio periodico delle fosse di Pomo e all'attuazione di misure che, nel rispetto dei piani di gestione, comportino il mantenimento delle condizioni ambientali idonee alla vita e all'accrescimento dei molluschi bivalvi, ponendo in essere misure supplementari tese a proteggere le diverse fasi del ciclo biologico delle specie interessate (CUP J41F19000080001) - Parte Monitoraggio Fosse di Pomo periodo 2019·2020. Secondo interim report.

Martinelli M., Angelini S., Belardinelli A., Canduci G., Chiarini M., Domenichetti F., Giuliani G., Grilli F., Guicciardi S., Penna P., Zacchetti L. 2021. Accordo tra MIPAAF e CNR - IRBIM Ancona in merito alla proposta progettuale relativa alle attività di monitoraggio periodico delle fosse di Pomo e all'attuazione di misure che, nel rispetto dei piani di gestione, comportino il mantenimento delle condizioni ambientali idonee alla vita e all'accrescimento dei molluschi bivalvi, ponendo in essere misure supplementari tese a proteggere le diverse fasi del ciclo biologico delle specie interessate (CUP J41F19000080001). Parte Monitoraggio Fosse di Pomo periodo 2019 - 2020, esteso 2021. Report finale.

Martinelli M., Angelini S., Belardinelli A., Chiarini M., Croci C., Domenichetti F., Guicciardi S., Scarpini P., Santojanni A., Zacchetti L. 2019. Report finale Modulo 6. Monitoraggio Fosse di Pomo periodo 2017 - 2018 (esteso primavera 2019) Convenzione tra MIPAAFT e CNR - ISMAR Ancona per uno studio propedeutico al rinnovo dell'affidamento della gestione della pesca dei molluschi bivalvi ai Consorzi di Gestione – CUP J53C17000540001.

Martinelli M., Belardinelli A., Guicciardi S., Penna P., Domenichetti F., Croci C., Angelini S., Medvesek D., Scarpini P., Micucci D., Giuliani G., Grilli F., Isajlović I., Vrgoč N., Santojanni A. 2016. SP2_LI1_WP1_UO05_D01 - Rapporto della campagna 2015 (ex SP2_WP1_AZ3_UO05_D03 - Report 3° UWTV Survey – RITMARE) - RITMARE La Ricerca ITaliana per il MARE.

Martinelli M., Belardinelli A., Guicciardi S., Penna P., Domenichetti F., Croci C., Angelini S., Medvesek D., Froglia C., Scarpini P., Micucci D., Isajlović I., Vrgoč N., Santojanni A. 2017a. Report of the Underwater Television survey (UWTV) activities in 2016 in Central Adriatic Sea. Document presented at the 18th Meeting of the AdriaMed Coordination Committee (Tirana, Albania, 16-17 February 2017). FAO AdriaMed: CC/18/info 12.

Martinelli M., Medvešek D., Chiarini M., Domenichetti F., Canduci G., Zacchetti, L. et al. 2022. Italy and Croatia Pomo Pits, central Adriatic Sea (GSA 17) ADRIATIC UWTV SURVEYS and Pomo monitoring activity. ICES Sci.Rep. 4, 176–180.

Martinelli M., Morello E. B., Isajlović I., Belardinelli A., Lucchetti A., Santojanni A., Atkinson J. A., Vrgoč N., Arneri E. 2013. Towed underwater television towards the quantification of Norway lobster, squat lobsters and sea pens in the Adriatic Sea. Acta Adriatica 54(1): 3 – 12.

Martinelli M., Morello E.B., Angelini S., Froglia C., Belardinelli A., Domenichetti F., Croci C., Micucci D., Scarpini P., Santojanni A. 2017b. Parte 2: Fermo biologico area di Pomo - Convenzione tra MIPAAF e CNR - ISMAR Ancona per aggiornamento dei piani di gestione delle specie demersali delle GSA: 9 10, 11, 15, 16, 17, 18, 19, fermo biologico nell'area di Pomo, valutazione della pesca dei bivalvi nella fascia costiera compresa nelle 0,3 miglia nautiche e misure gestionali ZTB - CUP J52I15003990001.

Melaku Canu D., Laurent C., Morello E.B., Querin S., Scarcella G., Vrgoč N., Froglia C., Angelini S. and Solidoro C. 2021. *Nephrops norvegicus* in the Adriatic Sea: Connectivity modeling, essential fish habitats, and management area network. Fish Oceanogr, 30: 349 - 365.

Morello E.B., C. Froglia, Atkinson R. J. A. 2007. Underwater television as a fishery-inde-pendent method for stock assessment of Norway lobster (*Nephrops norvegicus*) in the central Adriatic Sea (Italy). ICES J. Mar. Sci. 64: 1116–1123.

Pieri G., Ntoumas M., Martinelli M., Chatzinikolaou E., Martins F., Novellino A., Dimitrova N., Keller K., Raimund S., King A., Smerdon A., Mazza M., Malarde D., Cocco M., Torres A., Triantafyllou G., Sá S., Bebianno M., Sparnocchia S., Trond K., Lusher A. 2021. New technology improves our understanding of changes in the marine environment. In Proceedings of the 9th EuroGOOS International Conference. EuroGOOS, Online Streaming Virtual Conference, 3–5 May, 500-508.

Russo T., Morello E.B., Parisi A., Scarcella G., Angelini S., Labanchi L., Martinelli M., D'Andrea L., Santojanni A., Arneri E., Cataudella S. 2018. A model combining landings and VMS data to estimate landings by fishing ground and harbor. Fisheries Research 199: 218–230.

Scarcella G., Martinelli M., Domenichetti F., Luzi F., Sabatini L., Zacchetti L. 2022. Convenzione tra ISPRA e CNR-IRBIM per la realizzazione di attività condivise, finalizzate a dare attuazione alle previsioni del d. lgs 13 ottobre 2010 n. 190, nell'ambito della Strategia Marina nel triennio 2021-2023. Modulo comunità epimegabentoniche – Mar Adriatico (GSA 17) Interim Report.

Stevens J. and Jenkins T. 2020. Genetic population analysis of *Nephrops norvegicus* (Norway lobster) in the Adriatic Sea (Rev. 1). Project No. 112309, Contract No. 722111. Final Technical Report (Deliverables D.1 and D.2).

Taviani M., Angeletti L., Beuck L., Campiani E., Canese S., Foglini F., et al. 2015. On and off the beaten track: Megafaunal sessile life and Adriatic cascading processes. Mar Geol.; 369: 273–274.