D3.3.3 - Recommendations for policy makers

DORY

D3.3.3 - Recommendations for policy makers (WP3)

Contents

1. Introduction

The document presents the key findings of the work done under the DORY project aimed to implement sustainable fisheries management measures in Adriatic sea and provide for recommendations useful to policy makers and planners dealing with fisheries and maritime spatial planning (MSP) process to make fisheries policies more effective and efficient and better integrating fisheries into MSP policies.
Provided inputs are particulary relevant for European, national and regional fisheries sector policies makers to better plan and develop alternantive spatial management measures supporting sustainable fisheries.
The document will be also of relevance to fisheries operators which are, jointly with policy makers and institurions, called to encourage policy change in order to achieve a greater social, economic and environmental sustainability.

The recommendations mainly take into account the results of the D3.3.2 "Cross-Border Report on spatial management scenarios for fisheries" and D3.4.1 "Report on feasibility of setting-up a cross-border protected areas describing the results of the bio-economic model DISPLACE simulations with the current (baseline) and alternative spatial management measures for fisheries".

The results allow to evaluate effects of smaller and larger marine area restrictions on stocks and fisheries, also including the economic assessment of spatial restrictions for fishery and the bio-economic consequences of fishing effort re-allocation.

2. Description of the MSP tool: DISPLACE

2.1 Model approach

The DISPLACE model framework is developing a research- and advisory-based platform to transform fishermen's detailed knowledge and micro-decision-making behavior into simulation and management evaluation tools. This involves advanced methods to assess and provide advice on the bio-economic consequences for the fisheries and fish stocks of different fishermen decisions and management options. DISPLACE is an agent-based simulation model developed to fisheries, habitat conservation, maritime spatial planning and management issues, especially from the perspective of the fisheries. Agent-based models aim to consider the socio-economic and ecological processes at the individual scale (e.g., the fishing vessels) to capture the effects of human decisions at that level and then go through the individual processes up to the aggregated dynamics (e.g., the fisheries as a whole, or other marine ecosystem components).

So far, important progress has been made in a row of applications including the Adriatic Sea, the Ionian Sea, the Black Sea, the Baltic Sea and the Irish Celtic Sea. Regional scale applications are currently being developed for the North Sea and the Baltic Sea fisheries. On the Mediterranean side, DISPLACE is applied to the north Adriatic (GSA 17) to the Italian demersal fisheries (Bastardie et al 2017). In the framework of DORY, the 2017 Adriatic Sea application has been recently updated with most recent fish stock assessment data, extended to include the Croatian fisheries.

2.3 Management and population scenarios

The effects of seven spatial management scenarios on six stocks (hake, common sole, red mullet, Norway lobster, spottail mantis shrimp and cuttlefish) were analyzed. We tested the bio-economic model including data for all the six species in order to have a complete picture of the most important commercial stocks in the central and norther Adriatic.

In this report a special focus on common sole and cuttlefish will be done. This species have been selected by mutual agreement among the partners involved in the project on the basis of both: a) their high commercial value in Italy and Croatia, b) the need of implementing shared and efficient management measures to preserve these resources.

Through a stakeholder engagement process, consisting of multiple meetings with fisherman and organisation representatives from both Italy and Croatia, all the management measures have been shared and discussed in advance with the parties involved in the sector.

The scenarios tested referred to:

1. **BASELINE SCENARIO** (*status quo*): considering recent fisheries regulation roules in Italy, Croatia and Slovenia.
2. **4-NM TRAWLING BAN ALONG THE ITALIAN COASTS (GSA17)**: it is supposed to reduce fishing pressure on this vulnerable area (Figure 1); it represents one of the most relevant nursery area for many species, especially for common sole and cuttlefish. This scenario excludes Croatia and Slovenia's waters due to existing strict fisheries regulations and complex geomorphological characteristics of eastern Adriatic coast, as well as the Maritime Departments of Monfalcone and Trieste.

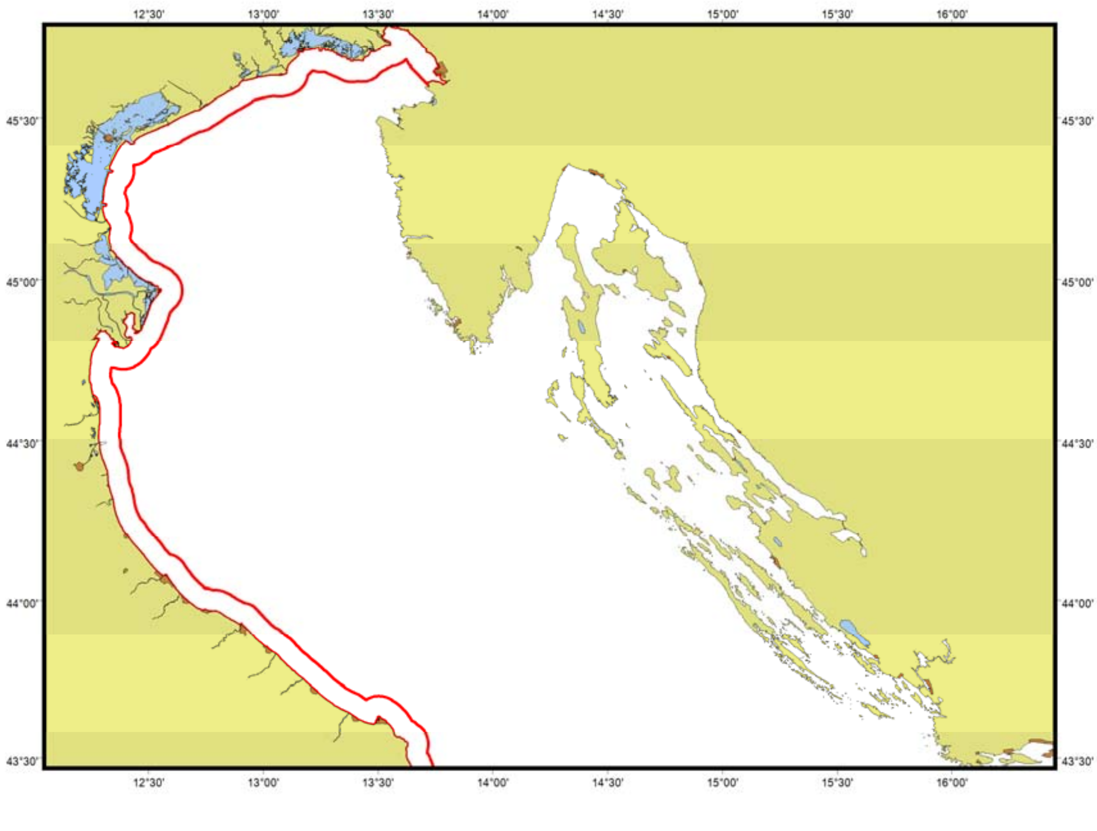


Fig. 1 – Map showing the 4-nm buffer along the Italian coast.

3. **6-NM TRAWLING BAN ALONG THE ITALIAN COASTS (GSA17)**: it is supposed to reduce fishing pressure on this vulnerable area (Figure 2); it represents one of the most relevant nursery area for many species, especially for common sole and cuttlefish. This scenario excludes Croatia and Slovenia's waters due to existing strict fisheries regulations and complex geomorphological characteristics of eastern Adriatic coast, as well as the Maritime Departments of Monfalcone and Trieste. Colloca et al. (2015) have demonstrated that the only nurseries consistently protected in European Mediterranean waters are those of coastal species, such as red mullet, common Pandora and common sole with 66.8%, 54.1% and 46.1% respectively of persistent nursery areas under protection. This is mostly due to the trawling ban within 3 nautical miles of the shoreline or 50 m depth, applied through current management measures as defined by Article 13 of EU Council Regulation 1967/2006. This situation is particularly evident for the Northern Adriatic Sea. Based on this evidence, the implementation of the spatial management measure currently in force (3 nautical miles) with an extension to the 6 nautical miles would have the potential to substantially improve current fisheries exploitation patterns.

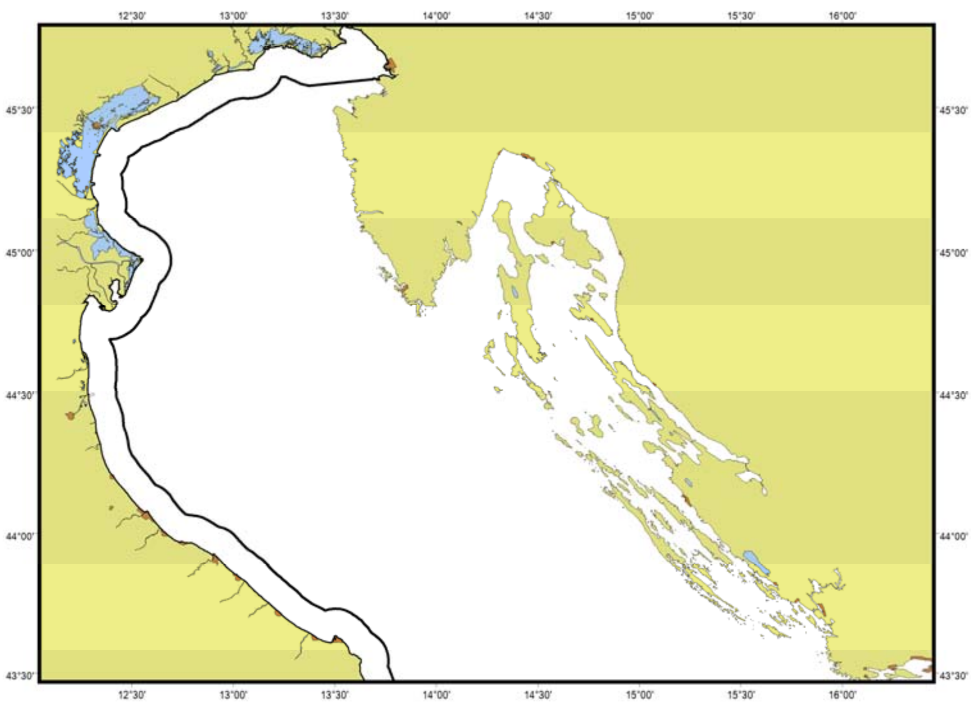


Fig. 2 – Map showing the 6-nm buffer along the Italian coast.

4. **PERMANENT CLOSURE OF THE “SOLE SANCTUARY” AREA** (Figure 3) for bottom otter and rapido/rampon trawlers (both Italian and Croatian fleets): Again, the closure of this area highlights the importance of reducing the fishing pressure on vulnerable areas (e.g., spawning areas) that are considered of biological interests for commercial species.

5. **INCREASE OF GILLNET MESH SIZE:** Increase the selectivity of gillnet through the adoption of a 72mm stretched mesh size and increase of the common sole minimum landing size to 25 cm total length (the current one is 20 cm TL);

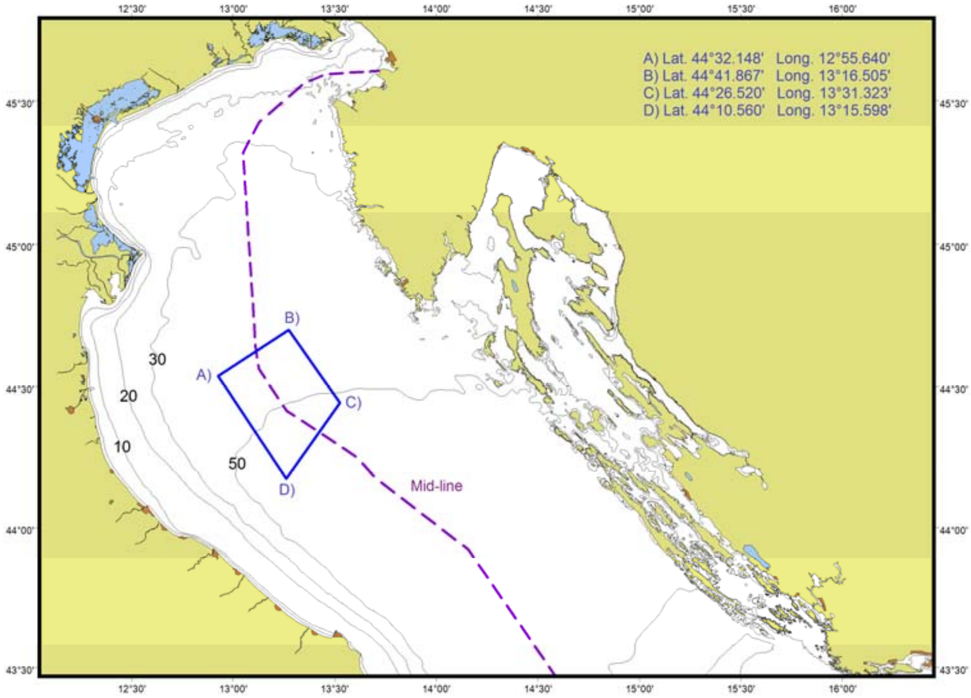
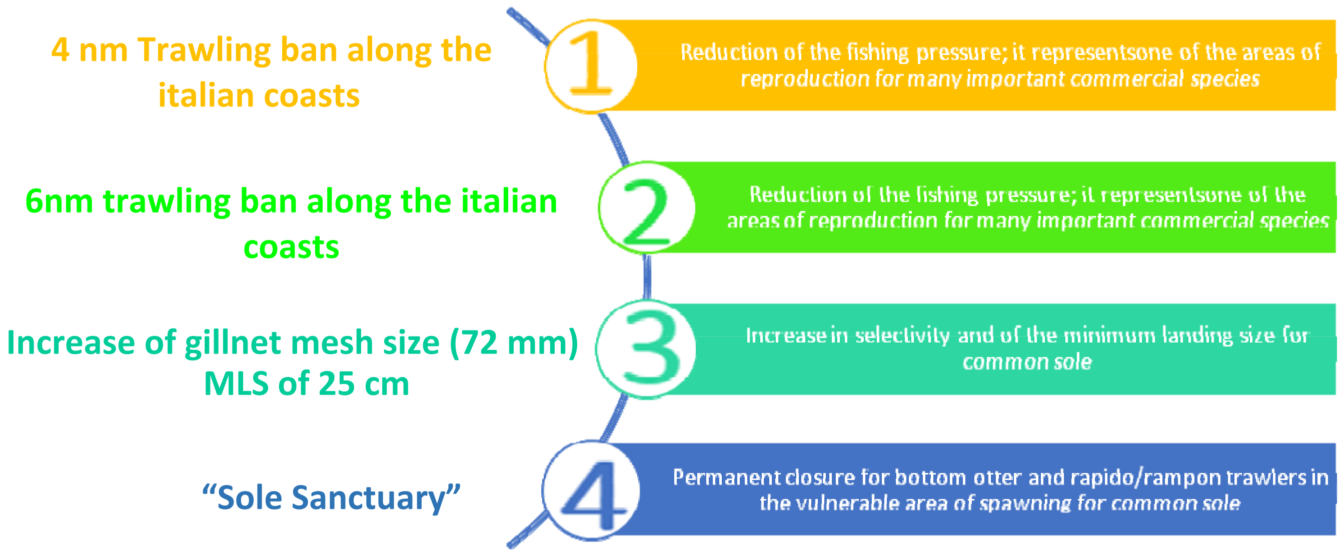


Fig. 4 – Map of the “sole sanctuary”.

We obtained a quantification of the changes provoked by the implementation of alternative plans by running Monte Carlo simulations that projected the scenarios with varying spatial harvest patterns (from the activity of individual vessels), comparing them against the baseline situation where the current management was applied. A total of 20 stochastic runs were conducted per scenario and provide quantified changes to the activity-specific impacts on the economic return, on the sustainability of the harvesting strategies for the species considered in this study, and on the fraction of underlying seafloor habitats enduring the fishing pressure.

SUMMARY OF THE TESTED SCENARIOS:



SUMMARY OF MAIN RESULTS

4nm ban	6nm ban	Mesh 72 mm M.L.S. 25 cm	"Sole sanctuary"
• **BOTTOM OTTER TRAWLING: Decrease in catches** of common sole and **increase of discard,** the effort would be focused on the border of the area. • **RAPIDO TRAWLING and GILLNET: increase** of **catches** of common sole • Constant cuttlefish catches but **increase in size** • **Decrease of revenue**	• **BOTTOM OTTER TRAWLING: decrease in catches** of common sole but also **decrease in discard** • **RAPIDO TRAWLING: increase in catches** of common sole • **GILLNET: Increase** in catches of **common sole** of **8%** • **General increase** in **cuttlefish catches** • **Increase of revenue**	• **Increase in catches** of common sole of **5%** and **decrease in discard** of **2.5%** • **Increase** in **revenue**	• **BOTTOM OTTER TRAWLING: Increase of revenue of 5%** • **RAPIDO TARWLING:** decrease in catches and increase of discard. **Decrease of revenue** • **GILLNET:** increase in catches **of common sole of 30%** and **decrease of discard of 30%.** • **Increase of revenue**

3. Recommendations

Based on the results presented in Deliverable 3.3.2 "CB Report on spatial management scenarios for fisheries", recommendations for policy makers have been issued.

3.1 Sole sanctuary

The spatial management measure concerning the **Sole Sanctuary is strongly recommended**. These results and recommendation obtained trough the DORY project have been already presented to policy makers at the "STECF EWG 19-02: Multi-Annual Plans for the fisheries exploiting demersal stocks in the Adriatic Sea" and published on the associated report (STECF, 2019).

To date, the closure should avoid many conflicts, because the fishing effort exerted in this area, especially the trawling fishery one, is very low if compared to the rest of the GSA 17, due to the distance from the ports and the type of seabed habitat, which is characterized by species that may obstruct the net meshes (e.g. bryozoans) and others (e.g. holothurians) that can affect the catches making these less suitable for market (see deliverable 3.3.2 and 3.4.1).

Moreover, the closure to the fisheries in the area could also be seen as a precautionary approach. In fact, if with the progress in technology were possible to have gears avoiding what is compromising the efficiency of trawling activity, the area would be targeted as much as the others. Since Asiatic markets demand regarding sea-cucumbers is increasing, it would also help to safeguard Holothuroidea species, in this case *Holothuria* (*Panningothuria*) *forskali*, followed by *Amathia semiconvoluta*, *Parastichopus regalis*, *Phallusia mammillata*, and *Holothuria tubulosa*.

In particular, based on the results of DISPLACE, the **exclusion of rapido trawlers (TBB) from the Sole Sanctuary** would decrease the total fishing effort, the CPUE and landings of common sole, and the discard rates of this species. On the other hand, this scenario would increase the total CPUE in the medium term. The common sole is the main target species for TBB. The **exclusion of bottom otter trawlers (OTB) from the Sole Sanctuary** would decrease the total fishing effort, the total number of trips, CPUE and landings of common sole, and total landings. On the other hand, the trip duration and the common sole discard would increase. It should be mentioned that the common sole is not a target species for OTB, as it contributes for a very small fraction of the total landings of this fleet segment. Based on the results, the **exclusion of gillnetters from the Sole Sanctuary** would increase the CPUE and the landings of the common sole in the medium term. In addition, a reduction of common sole discard would be also expected. From the outputs of DISPLACE model and based on scientific knowledge, it would be advisable to close the "Sole sanctuary" to gillnets activity, at least from December to February, during the reproductive season of common sole. It would allow to the larger individuals, that constitutes the Spawning Stock Biomass, to have more chance to reproduce succesfully. Currently, the catch composition of sole in the northern and central Adriatic Sea is dominated by ages 0 and 1-year specimens, with a low occurrence of large individuals (e.g. STECF, 2017), because the minimum landing size is 20 cm. Total length at first maturity is about 25 cm (Vallisneri et al., 2000; Fabi et al., 2009).

3.2 Minimum landing size and selectivity for common sole

According to data collected during SoleMon surveys (Scarcella et al., 2014), age class 0+ aggregates inshore along the Italian coast, mostly in the area close to the Po river mouth. Age class 1+ gradually migrates offshore and adults concentrate in the deepest waters in at South West from Istria (Fig. 4).

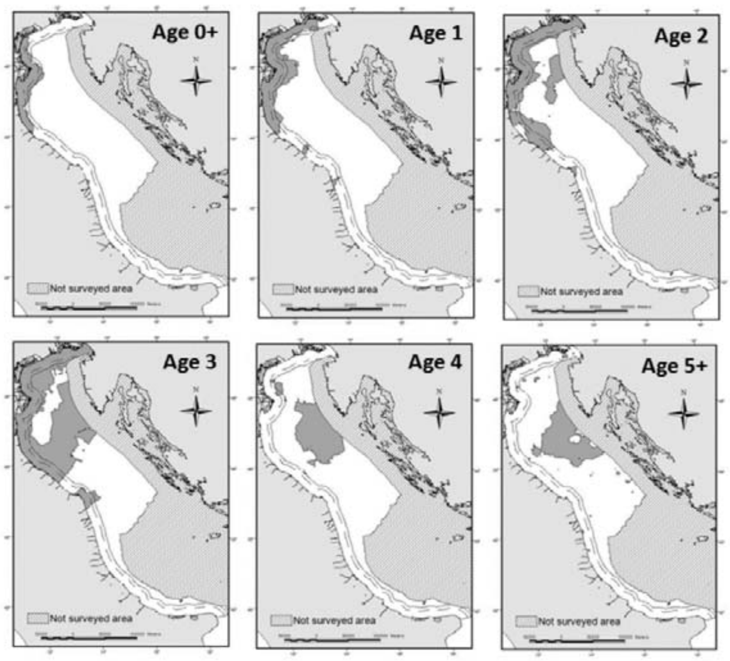


Fig. 4. Maps of hotspots calculated for the age classes of soles. The 6 and 9 nautical miles from the Italian coast are shown respectively by broken and continuous black lines (Scarcella et al., 2014).

Indeed, the whole life cycle of *S. solea* seems to follow the Adriatic circulation and the cyclonic gyres that form in autumn in the northern and central Adriatic, in correspondence to its spawning season (Russo & Artegiani, 1996). As a result of these periodic changes in resource availability, local fish markets are supplied with large quantities of some species for relatively short periods and prices may collapse if supply exceeds demand. As a result of the different spatial distributions, juveniles are exploited exclusively by Italian vessels, especially by beam trawlers (i.e. rapido trawl), while adults are caught by Croatian and Slovenian fishing fleets in their respective national waters and by the Italian fleet operating in international waters (Grati et al., 2013).

The minimum landing size (MLS) for this species is 20 cm, not corresponding with the length at first maturity estimated around 25 cm (Vallisneri et al., 2000); and 25.8 cm (Fabi et al., 2009). Based on the Length-at-age relation, exploitation could be predictable almost on all the age classes from 1 to 4+, but in relation to the STECF (2017) datas, it is dominated by ages 0 and 1-year specimens.

Demographic erosion affects not only the spawning capacity of the stock but also the average market price and revenues from fishing activities. One of the first management measures to be applied could also be the **increase in the minimum landing size**, shifting the target towards the adult portion of sole population. To avoid the impoverishment of the stock, protecting juveniles that, as said before, tend to aggregate inshore, it would also be useful to make changes in the mesh size of the small scale fishery. A 72 mm mesh size (stretched) would help to avoid the common sole target by catch (undersized), and then all the juveniles. From the results of DISPLACE model, the estimated income at medium-term should grow, due to the increase in the medium size of landings of common sole specimens.

3.3 Protection of 6 nautical miles

Colloca et al. (2015) have demonstrated that the only nurseries consistently protected in European Mediterranean waters are those of coastal species, such as red mullet, common Pandora and common sole with 66.8%, 54.1% and 46.1% respectively of persistent nursery areas under protection. This is mostly due to the trawling ban within 3 nautical miles of the shoreline or 50 m depth, applied through current management measures as defined by Article 13 of EU Council Regulation 1967/2006. This situation is particularly evident for the Adriatic Sea. Based on this evidence, the implementation of the **spatial management measure currently in force (3 nautical miles) with an extension to the 6 nautical miles** would have the potential to substantially improve current fisheries exploitation patterns.

The Italian Ministry of Agricultural, Food, Forestry and Tourism Policies (MIPAAFT) regulates the temporary closure of fishing activities for bottom (OTB and TBB) and pelagic trawlers in the Adriatic Sea (August-July). Since 2012 such Regulation also includes temporary spatial restrictions: 1) vessels enabled to coastal fishery (<6 nm from the coast) or having LOA <15 m cannot operate inside the 4 nm from the beginning of the temporary closure until 31th October; 2) vessels having LOA >15 m cannot operate inside the 6 nm from the beginning of the temporary closure until 31th October. These regulations exclude the Maritime

Departments of Monfalcone and Trieste because, due to the peculiar geo-morphology of the northern Adriatic, the fishing grounds of such Maritime Departments have a limited spatial extension.

Currently, Italian small-scale trawlers (e.g. IV category fishing license "coastal fishery") operates between the 3 and 6 nautical miles. Large-scale OTB generally exploit offshore fishing grounds, with the exception of large-scale TBB, which usually operate in shallow water fishing grounds (depth < 50 m). The exclusion of small-scale trawlers from the 6 nautical miles would generate spatial conflicts along with potential socio-economic issues for this fleet segment.

From the DISPLACE results it is possible to notice that gillnet fishery will benefit from the 6nm closure to OTB and TBB in terms of higher sole CPUE and sole landings. Rapido trawlers (TBB) will suffer a decrease of the fishing effort, as well as the total landings and sole landings. Discard rates for common sole will decrease and a general increase of the total CPUE would occur. For bottom otter trawlers (OTB) this scenario would produce a general increase in the CPUE of the total catch and the sole, total landings, as well as of sole landings.

Based on the outputs of DISPACE model and scientific knowledge, **this measure would consist in the ban for the trawlers activity (TBB and OTB) up to 6nm form the coast**. Due to peculiar geomorphology of the basin, this measure applies only to Italian fleet, and not to the Croatian and Slovenian ones. The measure is recommended in order to protect not only the common sole, but also all the species that have their Essential Fish Habitat in the coastal zone, especially the common cuttlefish. During autumn and winter individuals of common cuttlefish migrate to deeper water; returning to shallow water in spring and summer. In fact, spawning occurs in shallow, inshore waters in April to July in the Adriatic. Young specimens are restricted to shallow water until their cuttlebones are fully formed (Reid et al. 2005). With this measure part of the cicle could be preserved ensuring at the same time a better recruitment. Actually, it does not exist a minimum landing size for cuttlefish.

Moreover, to increase the reproductive success of common cuttlefish species, there would be **some good practices** to apply, since artificial hard substrate are the new excellence sites for the deposition of eggs because of the natural one decline (seagrasses). For example: to avoid cleaning traps for small-scale fishery and the installation of hard structures between the rows of mussel aquaculture.

References

Bastardie F., Angelini S., Bolognini L., Fuga F., Manfredi C., Martinelli M., Nielsen J.R., Santojanni A., Scarcella G., Grati F. 2017. Spatial planning for fisheries in the Northern Adriatic: working towards viable and sustainable fishing. Ecosphere, 8(2): e01696. 10.1002/ecs2.1696

Colloca F., Garofalo G., Bitetto I., Carlucci R., Facchini M.T., Fiorentino F., Follesa M.C., Grati F., Iglesias M., Knittweis L., Lefkaditou E., Lembo G., Manfredi C., Martiradonna A., Massutí E., Mastrantonio G., Nikolioudakis N., Ordinas F., Pace M.L., Sartor P., Scarcella G., Tserpes G., Tugores P., Valavanis V., Spedicato M.T. 2015. Identification of nursery areas for demersal stocks, a first step towards the implementation of spatial planning for Mediterranean fisheries. PLOS ONE 10(3): e0119590. Doi:10.1371/journal.pone.0119590.

Fabi, G., Grati, F., Raicevich, S., Santojanni, A., Scarcella, G., Giovanardi, O. 2009. Valutazione dello stock di Solea vulgaris del medio e alto Adriatico e dell'incidenza di diverse attività di pesca. Final Report.Ministero per le Politiche Agricole e Forestali. Direzione generale della pesca e dell'acquacoltura. VI Piano Triennale della pesca marittima e acquacoltura in acque marine e salmastre 1 (tematica c – c6). Programma di ricerca 6-a-74 (133 – XVII pp.).

Russo, A., & Artegiani, A. 1996. Adriatic sea hydrography. Scientia Marina, 60, 33-43.

Scarcella G., Grati F., Raicevich S., Russo T., Gramolini R., Polidori P., Domeni-chetti F., Bolognini L., Giovanardi O., Celic I., Sabatini L., Vrgoc N., Isajlovic I., Marceta B., Scott R.D., Fabi G. 2014. Common sole in the Northern Adriatic Sea: possible spatial management scenarios to rebuilt the stock. Journal of Sea Research. 89: 12-22.

Scientific, Technical and Economic Committee for Fisheries (STECF) – Multiannual Plan for the fisheries exploiting demersal stocks in the Adriatic Sea (STECF-19-02). Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-04009-5, doi:10.2760/026674, JRC116731

Vallisneri, M., Piccinetti, C., Stagni, A. M., Colombari, A., & Tinti, F., 2000. Dinamica di popolazione, accrescimento, riproduzione di *Solea vulgaris* (Quensel 1806) nell'alto Adriatico. Biologia Marina Mediterranea, 7(1), 65-70.