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“Fisheries in the Adriatic Region - a Shared Ecosystem Approach”

D 4.6.1 – Calibrated BEMTOOL applications to the Adriatic Region

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Calibrated BEMTOOL applications to the Adriatic Region

FAIRSEA – Fisheries in the Adriatic Region – a shared Ecosystem Approach

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Acronyms used

AER	Annual Economic Report
DFN	Set-nets and gillnets
DTS	demersal trawlers
FAIRSEA	Fisheries in the Adrlatic Region – a Shared Ecosystem Approach
FDI	Fisheries Dependent Information
GFCM	General Fisheries Commission for the Mediterranean
GSA	Geographical subarea
GT	Gross tonnage
HOK	Hooks
KW	Kilo Watt
OTB	Bottom Trawlers
PGP	Polyvalent passive gears
PP	Project Partner
STECF	Scientific, Technical and Economic Committee for Fisheries
TTB	Rapido trawler
WP	Work packages

1. INTRODUCTION

The objective of this deliverable is to collect and provide background information on the stocks and relative fisheries in the study area (GSA 17-18-19), focus area of the FAIRSEA project. The information assembled here is used for the calibration of the BEMTOOL model. The data collected within this deliverable report will form the basis of successive model parameterization required for scenario modelling (fishing mortality modulation and effort control), which will provide model outputs of biological, fishing impact and economic indicators. The outcomes of the scenarios that will be later explored for the Adriatic basin will be subsequently reported in the project deliverable D4.6.2, “Management scenarios of policy using BEMTOOL outputs”.

The following chapters provide an overview of the stocks and fleets of interest for the model. Detailed information about available biological data for each stock, obtained from the assessment reports and a summary of available socioeconomic and transversal data for each fleet are provided in the Annex.

2. SPECIES AND FLEETS

BEMTOOL utilises information from stock assessment as input, hence stocks that are analytically assessed can be explicitly modelled and considered as target species. Additionally, the ALADYM model (Lembo *et al.*, 2009) running within BEMTOOL builds an age/size structure population dynamic model, thus requiring information at age/size level. For the purpose of this report, seven demersal stocks, comprising four fish and three crustaceans stocks, are included.

Biological data are obtained from assessment reports from STECF (STECF, 2017, 2018a) and from GFCM WGSAD benchmark report (GFCM, 2019).

The stocks included in this report are those with officially accepted assessments based on age-structured (analytical) assessment methods. The stocks included are: Sole (GSA 17), Hake (GSA 17-18), Red mullet (GSA 17-18), Norway lobster (GSA 17-18), Spottail mantis shrimp (GSA 17), Deep-water pink shrimp (GSA 17-18-19) and Red mullet (GSA 19).

This report does not cover the assessment performed during 2019, not yet officially endorsed at the time of compiling the current document. For few selected cases, where stocks of high importance in terms of landing and revenues are assessed with non-analytical methods (e.g. Norway lobster in GSA 17-18, assessed using SPICT model) an ad-hoc assessment will be undertaken during the course of the project, if necessary. Several important target species including Giant red shrimp (GSA 18-19), Hake (GSA 19), Anchovy (GSA 17-18), Sardine (GSA 17-18), and Anchovy (GSA 19) were assessed in previous years but no endorsed assessment is available for 2018. Also for these stocks, either more recent assessments will be included (upon official endorsement) or ad-hoc assessments could be performed, if appropriate. Other stocks assessed through a production model CMSY (Common cuttlefish; STECF 17-15; Caramote prawn;

GFCM WGSAD 2017) or with a biomass index (Common Pandora; STECF 17-15) will not be included because of the relatively low landing volume (e.g. Caramote prawn) and the difficulties of implementing analytical methods (e.g. Common cuttlefish). These species are however included in BEMTOOL as part of the production with other species contributing to the total landing and the total revenues of each fleet.

The main fleets by country, gear type/fishing technology, GSA are included in the model, accounting for 27 fleets. Relationships between fleets and stocks is shown in table 2.1. Target species by fleet are obtained from MARE 27 and compared with data from AER 2018 and 2019.

The main demersal fleets in GSA 17 include Italian demersal trawlers (DTS), mostly operating with OTB; Italian Rapido trawler (TBB), Croatian demersal trawler, the DFN fleet of Croatia operating with set-nets and gillnets, and the Italian PGP fleet. Slovenia has a relatively small fleet composed of DFN and DTS fleets. In GSA 18, demersal fleets include Italian and Montenegrin DTS, DFN and HOK, and Albanian DTS fleets. In GSA 19, only Italian fleets land mostly from DTS and PGP fleets. Table 2.1 contains the complete list of fleets considered in the case study. Details of each fleet is provided in the Annex.

Table 2.1. Stocks included and fishing fleets targeting them (indicated by grey cells)

	species	Sole	Hake	Red mullet	Norway lobster	Spot-tail mantis shrimp	Deep-water pink shrimp	Red mullet
	GSA	17	17-18	17-18	17-18	17-18	17-18-19	19
1	ITA 17 DTS 6-12	Grey	Grey	Grey	Grey	Grey	Grey	Grey
2	ITA 17 DTS 12-18	Grey	Grey	Grey	Grey	Grey	Grey	Grey
3	ITA 17 DTS 18-40	Grey	Grey	Grey	Grey	Grey	Grey	Grey
4	ITA 17 PGP 00-12	Grey	Grey	Grey	Grey	Grey	Grey	Grey
5	ITA 17 TBB 12-18	Grey	Grey	Grey	Grey	Grey	Grey	Grey
6	ITA 17 TBB 18-40	Grey	Grey	Grey	Grey	Grey	Grey	Grey
7	SLO 17 DFN 6-12	Grey	Grey	Grey	Grey	Grey	Grey	Grey
8	SLO 17 DTS 12-18	Grey	Grey	Grey	Grey	Grey	Grey	Grey
9	HRV 17 DFN 06-12	Grey	Grey	Grey	Grey	Grey	Grey	Grey
10	HRV 17 DTS 06-12	Grey	Grey	Grey	Grey	Grey	Grey	Grey
11	HRV 17 DTS 12-18	Grey	Grey	Grey	Grey	Grey	Grey	Grey
12	HRV 17 DTS 18-40	Grey	Grey	Grey	Grey	Grey	Grey	Grey

13	ITA 18 DTS 6-12	
14	ITA 18 DTS 12-18	
15	ITA 18 DTS 18-40	
16	ITA 18 HOK 12-18	
17	ITA 18 PGP 00-12	
18	ALB 18 DTS 12-24	
19	MNE 18 DFN 00-12	
20	MNE 18 DTS 06-12	
21	MNE 18 DTS 12-24	
22	MNE 18 HOK 00-12	
23	ITA 19 DTS 12-18	
24	ITA 19 DTS 18-24	
25	ITA 19 PGP 00-06	
26	ITA 19 PGP 06-12	
27	ITA 19 PGP 12-18	

2.1. Summary of stock status

Of the seven stocks considered, none is in a sustainable state (Table 2.1.1). Sole and Hake appear to have the largest overexploitation ($F_{current}/F_{0.1} = 4.93$ and 3.37 respectively), while red mullet in GSA 19 has the lowest (1.05). The available stock assessments cover different time periods (Table 2.1.2), mostly less than the timeframe covered by the study. The shortest is the assessment for spottail mantis shrimp (from 2008 to 2017).

Table 2.1.1. Current status (updated to the latest available assessment) of the target stocks.

	Species	GSA	F current	F _{0.1}	F _{curr} /F _{0.1}	Reference year
1	Sole	17	0.74	0.15	4.93	2017
2	Hake	17-18	0.562	0.167	3.37	2017
3	Red mullet	17-18	0.48	0.41	1.17	2017
4	Norway lobster	17-18	0.663	0.45	1.47	2017
5	Spottail mantis shrimp	17-18	1.04	0.41	2.54	2017

6	Deep-water pink shrimp	17-18-19	1.69	0.65	2.60	2017
7	Red mullet	19	0.42	0.4	1.05	2017

Table 2.1.2. Summary of years covered by stock assessments.

Stock	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sole 17															
Hake 17-18															
Red mullet 17-18															
Norway lobster															
spottail mantis shrimp 17-18															
Deep-water pink shrimp 17-18-19															
Red mullet 19															

3. TRANSVERSAL AND SOCIO-ECONOMIC DATA

Transversal data (landings, revenues, effort) and socio-economic data were obtained through the ad-hoc FAIRSEA data call to National authorities, as well as from available datasets including the STECF Annual Economic Report (AER) database (STECF, 2018b) and AER 2019-08, and from previous projects, in particular the MARE 27 project (Spedicato *et al.*, 2016). Data gaps for some years/fleets required data reconstruction based on available years.

The information reported in this chapter includes, for each fleet, effort, landing and revenues by fleet sub-segment, GSA and country. The data required by BEMTOOL for each relevant fleet segments exploiting the target species in the area is reported in table 3.1. Data availability by country is reported in the following subchapters, summarized in Tables 3.5.1.-3.5.3, describing the time span for which official data are available and the years for which data were reconstructed.

Table 3.1. Effort, landings, revenues and socio-economic data needed in BEMTOOL for each relevant fleet segments exploiting the target species in the area.

Effort variables	Landing and revenues	Socio-economic variables
Number of vessels	Total landing by target species	Depreciation costs
Monthly (or eventually annual) average fishing days per vessel	Total landing aggregated related to the other species	Opportunity costs
Monthly (or eventually annual) average GT per vessel	Total revenues by target species	Total capital costs
Monthly (or eventually annual) average KW per vessel	Total revenues aggregated related to the other species	Capital value
		Number of employees
		Maintenance costs
		Other fixed costs
		Total fixed costs
		Labour costs
		Other income
		Fuel costs
		Other variable costs
		Total variable costs

3.1. Italy

For Italy, effort data (GT x fishing days, KW x fishing days and fishing days) were obtained from official national data through an ad-hoc data call for the years 2015-2018 at quarterly level (FDI); all three effort variables for 2008-2014 were obtained from STECF AER 2018-07, at yearly resolution, because in AER 2019 GT and KW were not available (while fishing days between AER 2018 and AER 2019 coincide). Data of number of vessels was available for fleet and GSA from the official national data at quarterly level (2015-2018; FDI) and from National Management Plan 2008- 2015). The only exception was the fleet PGP VL 00-12 in GSA 18, not included in National Management Plan, and for which effort data was obtained from MARE 27 (until 2013, assumed unchanged for 2014) and from the official national data at quarterly level (2015-2018; FDI). BEMTOOL allows to enter monthly values for fishing days: the quarterly values of all variables were thus equally split by month. In case only annual values were available, the monthly fishing days were derived according to the proportion of activity by month of MARE 27, where available (GSA 17

and 18). If not available (e.g. GSA19), the annual fishing days were equally split among the months when the fishing ban was not in force in the area.

Socioeconomic data were obtained through the ad-hoc FAIRSEA data call for official national data from 2008 to 2017 by GSA and fleet for depreciation costs, capital value, number of employees, maintenance costs, other fixed costs, labour costs (obtained by summing crew wage and unpaid labour cost), other income, fuel costs and other variable costs. Total variable cost was thus calculated in the model as the sum of fuel cost and other variable cost and total fixed cost was calculated as the sum of maintenance cost and other fixed cost.

Note that in 2019 the AER revisited and updated the calculation method used for depreciation costs and capital value, therefore these values differ compared to those of MARE 27 for the time frame 2008-2013 (STECF, 2019). The opportunity cost was based on capital value and inflation and interest rate, through the formula:

$$\text{Opportunity cost} = \text{capital value} * \frac{1 + \text{interest rate}}{1 + \text{inflation rate}} - 1$$

Annual values of interest rate and inflation rate were obtained from sdw.ecb.europa.eu/ and <https://it.inflation.eu/>, respectively (consulted on 30/07/2019). Total capital cost was calculated as the sum of opportunity and depreciation cost.

Landing and revenues were obtained from AER 2019-08 (2008-2017).

3.2. Croatia

Data for socioeconomic variables are available from 2012 and until 2017 from AER 2019, except opportunity cost that was calculated using the same method used for Italy. Labour cost, total variable, total fixed and total capital costs were calculated as for Italy. For years before 2012, the average of the years 2012-2014 was used.

Landing and revenues data were obtained from the AER 2019 for the years 2012-2018.

Effort data (GT x fishing days, KW x fishing days, number of vessels and fishing days) was available in AER 2019 for years 2012-2018

3.3. Slovenia

For Slovenia, socioeconomic variables are available from 2008 and until 2017 from AER 2019, except opportunity cost that was calculated using the same method used for Italy. Labour cost, total variable, total fixed and total capital costs were calculated as for Italy.

Landing and revenues data were obtained from the AER 2019 for the years 2008-2018.

Effort data (GT x fishing days, KW x fishing days, number of vessels and fishing days) was available in AER 2019 for years 2008-2018

3.4. Montenegro and Albania

For Montenegro and Albania, socioeconomic variables data were taken from the MARE 27 report for years 2008-2013, and estimated as the average of the last 3 years for the successive years. Landing and revenues data from 2008 to 2013 are reported in MARE 27 report and included here. The effort variables recorded in MARE 27 report are utilised.

3.5. Summary tables of data availability

The data availability by country and variable was summarized in the tables below, displaying effort data (Table 3.5.1), landing and revenues data (Table 3.5.2) and socioeconomic variables detailed by variable for Italy, Croatia and Slovenia, and aggregated across variables for Albania and Montenegro (Table 3.5.3). The tables summarise the temporal span of original and reconstructed data. An overview of the full data available is provided in the Annex.

Table 3.5.1. Effort data availability showing data available from official data (green), obtained directly by MARE 27 (pink), and reconstructed as average of previous/later years (orange). Years with asterisk (*) are not available for all fleet segments.

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Italy	*	*	*	*											
Croatia															
Slovenia															
Montenegro															
Albania															

Table 3.5.2. Landing and revenues data availability showing data available from official data (green), obtained directly by MARE 27 (pink), and reconstructed as average of previous/later years (orange).

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Italy															
Croatia															
Slovenia															
Montenegro															
Albania															

Table 3.5.3. Socioeconomic variables data availability showing data available from official data (green), obtained directly by MARE 27 (pink), reconstructed based on data in MARE 27 (brown), and reconstructed as average of previous/later years (orange). Years with asterisk (*) are not available for all fleet segments (continues in the following page).

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Italy	Depreciation cost															
	Opportunity costs															
	Total capital costs															
	Capital value															
	Nb of employees															
	Maintenance															
	Other fixed cost															
	Total fixed cost															
	Labour cost	*	*	*	*											
	Other income															
	Fuel cost	*	*	*	*											
	Other variable cost															
	Total variable cost															
			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Croatia	Depreciation cost															
	Opportunity costs															
	Total capital costs															
	Capital value															
	Nb of employees															
	Maintenance															
	Other fixed cost															
	Total fixed cost															
	Labour cost															
	Other income															

	Fuel cost																	
	Other variable cost																	
	Total variable cost																	
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		
Slovenia	Depreciation cost																	
	Opportunity costs																	
	Total capital costs																	
	Capital value																	
	Nb of employees																	
	Maintenance																	
	Other fixed cost																	
	Total fixed cost																	
	Labour cost																	
	Other income																	
	Fuel cost																	
	Other variable cost																	
	Total variable cost																	
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		
Montenegro and Albania	Socioeconomics (aggregated)																	

References

GFCM. 2019. Scientific Advisory Committee on Fisheries (SAC) Working Group on Stock Assessment of Demersal Species (WGSAD) benchmark session for the assessment of European hake in GSAs 17-18 FAO headquarters , Rome , Italy , 15-18 January 2019.

Lembo, G., Abella, A., Fiorentino, F., Martino, S., and Spedicato, M.-T. 2009. ALADYM: an age and length-based single species simulator for exploring alternative management strategies. *Aquatic Living Resources*, 22: 233–241.

Spedicato, M. T., Bitetto, I., Facchini, M. T., Accadia, P., Carpi, P., Ligas, A., Musumeci, C., et al. 2016. Study on the evaluation of specific management scenarios for the preparation of multiannual management plans in the Mediterranean and the Black Sea. SERVICE CONTRACT NUMBER - EASME/EMFF/2014/1.3.2.7/SI2.703 193 CALL MARE/2014/27.

STECF. 2017. Scientific, Technical and Economic Committee for Fisheries (STECF) – Mediterranean Stock Assessments 2017 part I (STECF-17-15). Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-67487-7, doi:10.2760/897559, JRC109350.

STECF. 2018a. Scientific, Technical and Economic Committee for Fisheries (STECF) – 2018 Mediterranean Stock Assessments - Part 2 (STECF-18-16). Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-79399-8, doi:10.2760/598716, JRC114787. <https://ec.europa.eu/jrc>.

STECF. 2018b. Scientific, Technical and Economic Committee for Fisheries (STECF) – The 2018 Annual Economic Report on the EU Fishing Fleet (STECF-18-07). Publications Office of the European Union, Luxembourg, 2018, JRC112940, ISBN 978-92-79-79390-5, doi:10.2760/56158.

STECF. 2019. Scientific, Technical and Economic Committee for Fisheries (STECF): The 2019 Annual Economic Report on the EU Fishing Fleet (STECF 19-06), Carvalho, N., Keatinge, M. and Guillen Garcia, J. editor(s), EUR 28359 EN, Publications Office of the European Union.