

References	Year	Site	Sampling time	Lenght (mm)		Size range	Gamete emission peak	Survey
				Early maturity	Full maturity			
Salvatorelli	1967	Chioggia (N Adriatic Sea)	N.D.	N.D.	N.D.	N.D.	July – Aug.	H
Poggiani et al.	1973	N and C Adriatic Sea	July 1968 – Mar. 1970	16 – 18	N.D.	N.D.	July – Aug.	H
Froggia	1975	C Adriatic Sea	N.D.	N.D.	N.D.	N.D.	May – July; Sept. – Oct.	M
Marano et al.	1980	Gulf of Manfredonia (S Adriatic Sea)	Jan. – Dec. 1978	N.D.	N.D.	N.D.	Late Apr.; Aug. – Sept.	H
Marano et al.	1982	Gulf of Manfredonia (S Adriatic Sea)	Jan. 1978 – Dec. 1979	N.D.	N.D.	Medium	Sept. – Oct.	H
Valli and Zecchini- Pinesich	1981	Grado (N Adriatic Sea)	Apr. 1975 - 1979	N.D.	N.D.	N.D.	June – Aug.	H
Corni et al.	1985	Cesenatico (N Adriatic Sea)	Sept. – Dec. 1982	N.D.	N.D.	Commercial	Post Emission	H
Valli et al.	1985	Grado (N Adriatic Sea)	Sept. 1981 – 1982	N.D.	N.D.	12.5 –38.3	Apr. – July	H

N.D. indicates data not available or not determinable (Source MIPAAF, modified with data updated to 2019).

C, N and S indicate Center, North and South, respectively.

H and M indicate histological and macroscopic, respectively.

**Supplementary materials; Table S1.** Summary of references and reproductive data for *Chamelea gallina*. Basin of reference: Mediterranean Sea.

References	Year	Site	Sampling time	Length (mm)		Size range	Gamete emission peak	Survey
				Early maturity	Full maturity			
Cordisco et al.	2005	Molise, Apulia (C and S Adriatic Sea)	2000 – 2001 – 2003	N.D.	N.D.	N.D.	Apr. – July	M
IZS Abruzzo e Molise	2006	Pescara (C Adriatic Sea)	N.D.	12	N.D.	N.D.	N.D.	N.D.
Romanelli et al.	2009	Adriatic Sea	N.D.	13 – 15	20 – 25	N.D.	N.D.	N.D.
Rizzo et al.	2011	Chioggia (N Adriatic Sea)	June 2009 – Feb. 2010	N.D.	N.D.	N.D.	June – July; Dec. – Feb.	M
Franceschini and Bernardello	2013	Veneto (N Adriatic Sea)	N.D.	13 – 15	20 – 25	N.D.	Apr. – Sept.	N.D.
Scopa et al.	2014	Molise (C Adriatic Sea)	2003-2012	13 – 15	20 – 25	N.D.	Apr. – Oct.	N.D.
MIPAAF	2015	Italian Coasts	N.D.	15	20	N.D.	Mar. – Apr.; Oct. – Nov.	N.D.
MIPAAF	2017	(N and C Adriatic Sea)	Apr. – June 2017	10	11 – 12	N.D.	May – Sept.	H
MIPAAF	2018	(N and C Adriatic Sea)	Jan. – Dec. 2018	8 – 9	10 – 11	N.D.	May – June	H

**Supplementary materials; Table S1.** (Continued)

References	Year	Site	Sampling time	Lenght (mm)		Size range	Gamete emission peak	Survey
				Early maturity	Full maturity			
Ràmon Herrero	1993	Gulf of Valencia	May 1988 – 1990	N.D.	N.D.	>20	June – Aug.	M
Rodríguez de la Rúa et al.	2003	Atlantic – Mediterranean	June 1999 – May 2000	16	N.D.	5.7 – 35.2	Apr. – July	H
Delgado et al.	2013	Gulf of Cadiz	May 2010 – Apr. 2011	10.29	N.D.	3 – 32	Mar. – Sept.	H
Joaquim et al.	2014	Gulf of Cadiz	Jan. – Dec. 2009	N.D.	N.D.	24 – 30	June – Aug.	H

N.D. indicates data not available or not determinable (Source MIPAAF, modified with data updated to 2019).

H and M indicate histological and macroscopic, respectively.

**Supplementary materials; Table S2.** Summary of references and reproductive data for *Chamelea gallina*. Basin of reference: Atlantic Ocean.

References	Year	Site	Sampling time	Lenght (mm)		Size range	Gamete emission peak
				Early maturity	Full maturity		
Dalgic et al.	2009	Southern Black Sea	Dec. 2002 – Nov. 2003	N.D.	N.D.	N.D.	June – Aug.
Erkan	2009	Southern Black Sea	July 2006	N.D.	N.D.	>20	June – July

N.D. indicates data not available or not determinable (Source MIPAAF, modified with data updated to 2019).

**Supplementary materials; Table S3.** Summary of references and reproductive data for *Chamelea gallina*. Basin of reference: Black Sea.

Site	Year	Source
N Adriatic Sea	2004	<a href="https://ricerca.gelocal.it/nuovavenezia/archivio/nuovavenezia/2004/11/09/VP6VM_VP603.html">https://ricerca.gelocal.it/nuovavenezia/archivio/nuovavenezia/2004/11/09/VP6VM_VP603.html</a>
N Adriatic Sea	2008	<a href="https://www.venetoagricoltura.org/">https://www.venetoagricoltura.org/</a> ; ISPRA, 2008
N Adriatic Sea (Friuli–Venezia Giulia)	2011	<a href="https://www.ansa.it/mare/notizie/rubriche/ambienteepesca/2011/08/21/visualizza_new.html_753631241.html">https://www.ansa.it/mare/notizie/rubriche/ambienteepesca/2011/08/21/visualizza_new.html_753631241.html</a>
Po river estuary (Emilia–Romagna)	2013	<a href="https://www.ilrestodelcarlino.it/">https://www.ilrestodelcarlino.it/</a>
C–N Adriatic	2018	Piano di Attuazione DM 17/06/2019
Porto Viro (Veneto)	2020	<a href="https://www.rovigoindiretta.it/">https://www.rovigoindiretta.it/</a>

C and N indicate Center and North, respectively.

**Supplementary materials; Table S4.** List of the main clam die-offs recorded in the last 20 years.

Consortium name	Co.Ge.Mo. Monfalcone	Co.Ge.Vo.Venezia.	Co.Ge.Vo.Chioggia	Co.Ge.Mo. Ravenna	Co.Ge.Mo Rimini.	Consorzio Co.Ge.Vo Pesaro.	Co.Ge.Vo Ancona	Co.Ge.Vo Civitanova Marche.
Compartment	From the mouth of the Isonzo river (north) to Punta Tagliamento (south)	From Punta Tagliamento (north) to the North dam of the port of Chioggia (south)	Chioggia - From the north dam of the port of Chioggia (north) to the mouth of Po di Goro (south)	Ravenna - From the Po di Goro lighthouse (north) to Canale Tagliata north of Cesenatico (south)	Rimini - From Canale Tagliata in Cesantico (north) to the port of Cattolica (south)	From Gabicce (north) to the Cesano river (south)	From the Cesano river (north) to the Potenza river (south)	From the Potenza river (north) to the Chienti river (south).
Number of associated vessels	42 out of 42 (18 clam and 24 cockles)	86 out of 86 (63 clam and 23 cockles)	77 out of 77 (58 clam and 19 cockles)	18 out of 18 (clam)	36 out of 36 (clam)	65 out of 65 (clam)	74 out of 74 (clam)	25 out of 25 (clam)
Reference scientific body	University of Trieste + AGRI.TE.CO., Venice	AGRI.TE.CO., Venice	AGRI.TE.CO., Venice	University of Bologna (Biology and Fisheries Laboratory, Fano)	Cooperative MARE, Cattolica.	University of Bologna (Biology and Fisheries Laboratory, Fano)	CNR-IRBIM (formerly ISMAR).	CNR-IRBIM (formerly ISMAR).
Target species	Cockles, razor clams, clams and peanut worm	Clams and cockles, razor clams, lagoon cockle and murexes	Clams and cockles, razor clams, lagoon cockle, peanut worm and murexes	Clams	Clams	Clams	Clams	Clams
Strengths	Sowing, restocking and rotation Coordination with Co.Ge.Vo ; reduction of fishing effort for bivalves and peanut worm Collaboration with scientific bodies	Management of bivalve stocks with excellent yields in terms of production and socio-economic level Sowing, restocking and rotation activities Management measures towards nourishment and the Mo.S.E. Supracompartmental coordination Co.Ge.Vo. of Chioggia and Monfalcone - OP Bivalvia Veneto and Op Fasolari Constant monitoring of the resource Collaboration with scientific body well-developed commercial policies	Management of bivalve stocks with excellent yields in terms of production and socio-economic level Sowing, restocking and rotation activities Management measures towards nourishment and the Mo.S.E. Supracompartmental coordination Co.Ge.Vo. of Venezia - OP Bivalvia Veneto and Op Fasolari Constant monitoring of the resource Collaboration with scientific body well-developed commercial policies	Sowing, restocking and rotation activities Creation of nursery areas Constant monitoring of the resource Collaboration with small-scale fishermen	Rotation of fishing activities Constant monitoring of the resource Collaboration with scientific bodies Commercial policies	Rotation of fishing activities Biennial monitoring of the resource Collaboration with scientific bodies	Rotation of fishing activities Biennial monitoring of the resource Collaboration with scientific bodies.	Rotation of fishing activities Biennial monitoring of the resource Collaboration with scientific bodies

**Supplementary materials; Table S5a.** Consorsia present in Italy, with details on dislocation and fleet main characteristic and technologies.

<b>Critical issues</b>	Natural banks in an extremely critical phase, in particular for clam and razor clam resources	In the last 5 years the razor clam resource has become almost nil, such as not to allow any fishing activity Nourishment and port activities along the coast Intense die-off in 2018	In the last 5 years the razor clam resource has become almost nil, such as not to allow any fishing activity Nourishment and port activities along the coast Intense die-off in 2018	Fishing activity is limited in the southern part of the compartment due to environmental limitations, infrastructures, Military Polygon etc. Unauthorized fishing for <i>Tapes philippinarum</i> Several die-off events	Massive presence of urban centers with a strong seaside tourist vocation Presence of numerous shellfish farming facilities Decrease in production yields Intense die-off in 2018	Fluctuation of production yields Intense die-off in 2018	Fluctuation of production yields Intense die-off in 2018	Fluctuation of production yields Intense die-off in 2018
<b>Notes</b>	All boats are equipped with a GPS system	All boats are equipped with a AIS system	All boats are equipped with a AIS system	18 boats equipped with a GPS system	GPS system provided by Visurin	All boats are equipped with a GPS system	73 boats equipped with a GPS system and 1 boat equipped with AIS	23 boats equipped with a GPS system and 2 boats equipped with AIS

#### Supplementary materials; Table S5a (Continued).

Consortium name	Co.Vo.Pi S. Benedetto del Tronto.	Co.Ge.Vo Pescara.	Abruzzo	Co.Ge.Vo Frentano Ortona.	Consorzio Co.Ge.Mo Il Colosso di Barletta	Co.Ge.Mo Napoli	Consorzio Co.Ge.Mo Gaeta	Consorzio Co.Ge.Mo Roma
<b>Compartment</b>	From the Chienti river (north) to the Tronto river (south)	From the mouth of the Tronto river (north) to the mouth of the Alento river (south)		From Francavilla a mare (north) to the mouth of the river Trigno (south)	Barletta - From the municipality of Zapponeta (north) to the municipality of Bisceglie (south)	Naples - From the mouth of the Garigliano river (north) to the Procida mountain (south)	From the mouth of the Astura river (north) to the mouth of the Garigliano river (south)	Rome - From Fiumicino - Passoscuro to the mouth of the Astura river
<b>Number of associated vessels</b>	56 out of 56 (clam)	74 out of 82 (clam)		21 out of 21 (clam)	24 out of 25 (clam)	14 out of 14 (clam and razor clam)	4 out of 4 (razor clam)	14 out of 14 (clam and razor clam)
<b>Reference scientific body</b>	CNR-IRBIM (formerly ISMAR)	Zooprophylactic IZSAM (Experimental Institute of Abruzzo and Molise Giuseppe Caporale, Teramo)		CIRSPE (Italian Center for Research and Studies for Fishing, Rome)	-	-	-	-
<b>Target species</b>	Clams	Clams		Clams	Clams, lagoon cockle	Razor clams, wedge shells, clams	Razor clams, wedge shells	Razor clams, wedge shells, clams

#### Supplementary materials; Table S5b. Consorsia present in Italy, with details on dislocation and fleet main characteristic and technologies.

<b>Strengths</b>	Rotation of fishing activities Biennial monitoring of the resource Collaboration with scientific bodies	Sowing, restocking and rotation activities Constant monitoring of the resource Adoption of more selective gears Scientific support Sensitization of fishermen towards environmental protection issues	Management of clam stocks with good yields both in terms of production and socio-economic level Sowing, restocking and rotation activities Constant monitoring of the resource Scientific support Fishermen training	Sowing, restocking and rotation activities Adoption of more selective gears	Stock management of razor clams with good yields both in terms of production and socio-economic level Constant capture data collection	Stock management of razor clams with good yields both in terms of production and socio-economic level Constant capture data collection
<b>Critical issues</b>	Fluctuation of production yields Intense die-off in 2018	Limited area of action, also following the establishment of the AMP Torre del Cerrano Excessive fishing effort in terms of the number of boats Decrease in production yields	Clam resource circumscribed and limited to some areas Occasional events of deaths	Fishing activity territorially limited due to adverse sedimentological causes Excessive number of boats	Reduced availability of fishing grounds Water classification	Reduced availability of fishing grounds Water classification
<b>Notes</b>	46 boats equipped with a GPS system and 11 boats equipped with AIS system	All boats equipped with a GPS system or AIS system	18 boats equipped with a GPS system and 3 boats equipped with AIS system	All boats equipped with a GPS system	Future endowment indicated	-

**Supplementary materials; Table S5b** (Continued).

Year	2002	2003	2004	2005	2006	2008	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Boat number	41	-	42	42	42	41	41	41	42	42	-	-	42	42	42	42	42	40

**Supplementary materials; Table S6.** Trend in the number of boats (2002–2018). Source IREPA–MIPAAF; Socio–economic observatory for fisheries and aquaculture.

Survey conducted by AGRI.TE.CO. for the Friuli–Venezia Giulia Region in the years 2017–2018; ISTAT working paper 2020.

	Punta Sdobba	Banco Mula di Muggia	Isola Sant'Andrea	Lignano Sabbiadoro
Tons	10.3	16.1	16.7	8.5
Class 0.1 – 1.5 cm	2.8%	40.1%	49.3%	40.9%
Class 1.6 – 1.9 cm	22.5%	24.8%	26.4%	28.4%
Class 2.0 – 2.4 cm	71.6%	33.0%	22.1%	27.4%
Class = 2.5 cm	3.1%	2.1%	2.2%	3.3%
Biomass g/m <sup>2</sup>	51.5	53.7	54.7	41.0

**Supplementary materials; Table S7.** Characteristics of the mussel population seeded in the different areas of Friuli Venezia Giulia to restore the *Chamelea gallina* population. Source of data: Co.Ge.Mo. Monfalcone, 2016.

Survey time	Sampling month	≥ 2.5 cm	2.4 – 2.0 cm	≤ 2.0 cm
Pre	Feb 2016	0.5	0.3	0.9
Post	May 2016	0.2	19.8	20.0
Post	Jul 2016	0.6	0.4	1.0
Post	Aug 2016	0.1	0.1	0.2
Post	Oct 2016	0.0	0.0	0.0

**Supplementary materials; Table S8.** Biomass in g/m<sup>2</sup> of *Chamelea gallina* for the Punta Sdobba area before and after the reactivation action in April 2016: Co.Ge.Mo. Monfalcone, 2016.

Survey time	Sampling month	≥ 2.5 cm	2.4 – 2.0 cm	≤ 2.0 cm
Pre	Feb 2016	0.1	4.3	4.4
Post	May 2016	4.8	16.2	21.0
Post	Jul 2016	1.7	15.4	17.1
Post	Aug 2016	3.4	14.1	17.5
Post	Oct 2016	2.8	8.0	10.8

**Supplementary materials; Table S9.** Biomass, in g/m<sup>2</sup>, of *Chamelea gallina* for the Banco Mula di Muggia area, before and after the reactivation intervention which took place in April 2016 (Data source: Co.Ge.Mo. Monfalcone, 2016).

Survey time	Sampling mounth	≥ 2.5 cm	2.4 – 2.0 cm	≤ 2.0 cm
Pre	Feb 2016	1.2	8.4	9.6
Post	May 2016	Fish trap	Fish trap	Fish trap
Post	Jul 2016	18.0	33.7	51.6
Post	Aug 2016	25.1	31.8	56.8
Post	Oct 2016	43.3	33.4	76.6

**Supplementary materials; Table S10.** Biomass in g/m<sup>2</sup> of *Chamelea gallina* for the area in front of the Island of Sant'Andrea, before and after the reactivation intervention which took place in April 2016. Data source: Co.Ge.Mo. Monfalcone, 2016.

Survey time	Sampling mounth	≥ 2.5 cm	2.4 – 2.0 cm	≤ 2.0 cm
Pre	Feb 2016	2.9	2.3	5.2
Post	May 2016	0.9	3.1	4.0
Post	Jul 2016	5.6	8.1	13.8
Post	Aug 2016	5.0	3.4	8.5
Post	Oct 2016	10.7	2.3	13.0

**Supplementary materials; Table S11.** Biomass in g/m<sup>2</sup> of *Chamelea gallina* for the Lignano Sabbiadoro coast, before and after the reactivation intervention which took place in April 2016. Data source: Co.Ge.Mo. Monfalcone, 2016.

Survey time	Sampling mounth	≥ 2.5 cm	2.4 – 2.0 cm	≤ 2.0 cm
Pre	May2017	2.9	2.3	5.2
Post	Jul 2017	0.9	3.1	4.0
Post	Oct 2017	5.0	3.4	8.5

**Supplementary materials; Table S12.** Biomass, in g/m<sup>2</sup>, of *Chamelea gallina* for the Lignano Sabbiadoro coast, before and after the reactivation intervention which took place in May 2017. Data source: Co.Ge.Mo. Monfalcone, 2016.



Compartment	Area	Good management	Attention range	Prohibition of fishing
			g/m <sup>2</sup>	
GSA17	North-central Adriatic	> 10.0	5.0 – 7.5	< 5.0

**Supplementary materials; Table S13.** Graphical representation of the fishing potential for Co.Ge.Mo. di Monfalcone to the state of the resource *Chamelea gallina*.

	2017	2017	2018	sept -2018	2019
Punta Sdobba	0.00	N.D.	N.D.	0.00	N.D.
Banco Mula di Muggia	2.80	N.D.	N.D.	0.00	N.D.
Banca d'Orio – Bocca d'Anfora	N.D.	N.D.	N.D.	0.10	N.D.
Sant'Andrea Island	43.30	N.D.	N.D.	1.50	N.D.
Lignano Sabbiadoro	10.70	5.00	3.35	1.10	5.03

**Supplementary materials; Table S14.** Biomass (g/m<sup>2</sup>) of *Chamelea gallina* over commercial size, compared with the indications reported for GSA17 in the D.M. 24/07/2015. Data source: Co.Ge.Mo. Monfalcone, 2016; Co.Ge.Mo. Monfalcone, 2019. N.D. is for No Data Available.