Supplementary material for "FISHING AND WARMING RESHAPE SIZE SPECTRA OF COMMERCIAL SPECIES IN THE MEDITERRANEAN SEA"

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Supplementary material

Table S1

Table S1 presents a summary of key environmental and fishing metrics recorded annually. The data spans from the year 2000 onwards and includes the following variables:

Year: The calendar year of observation.

Temperature min: The minimum recorded temperature (in degrees Celsius) during the fishing period for that year.

Temperature max: The maximum recorded temperature (°C).

Temperature mean: The average temperature (°C) across the observed period.

Fishing effort min: The minimum recorded fishing effort (hours/year) for that year.

Fishing effort max: The maximum recorded fishing effort (hours/year).

Fishing effort mean: The average fishing effort (hours/year) over the year.

These metrics provide insight into temporal variations in environmental conditions and fishing activities. The data may be used to explore correlations between temperature fluctuations and fishing outcomes, as well as to support broader analyses related to climate impacts on marine resource exploitation.

Table S1 - Annual summary of sea surface temperature and fishing effort (2000–Present)

year	temperature min	temperature max	temperature mean	fishing effort min	fishing effort max	fishing effort mean
2000	13.55	18.35	14.58	0.57	133.59	27.58
2001	13.55	16.39	14.55	0.58	150.22	29.98
2002	13.55	17.42	14.60	0.46	150.22	26.07
2003	13.67	17.42	14.58	1.44	150.22	27.63
2004	13.55	17.42	14.54	1.58	150.22	26.92
2005	13.55	17.42	14.60	0.46	150.22	21.48
2006	13.55	17.42	14.57	0.95	150.22	21.42
2007	13.55	19.80	14.67	0.34	124.97	22.28
2008	13.55	17.42	14.61	0.36	150.22	23.21
2009	13.55	17.42	14.61	0.34	150.22	22.29
2010	13.56	17.42	14.61	0.34	150.22	20.68
2011	13.55	17.42	14.68	0.34	150.22	22.61
2012	13.56	17.42	14.61	0.56	150.22	24.91
2013	13.55	17.42	14.64	0.34	124.97	22.34
2014	13.55	18.32	15.06	1.24	112.37	27.45
2015	13.56	18.35	14.61	0.34	124.97	21.88
2016	13.55	17.42	14.63	0.34	150.22	22.48
2017	13.55	17.42	14.74	0.34	150.22	30.10
2018	13.56	17.42	14.67	0.36	133.59	22.85
2019	13.55	17.42	14.70	0.34	150.18	29.51
2020	13.35	17.42	14.72	0.34	150.22	34.81
2021	13.55	17.42	14.61	0.34	150.18	26.34
2023	13.55	17.42	14.70	0.34	150.22	32.26

Table S2

Table S2 lists modeled values of the intrinsic rate of population growth (λ, log scale; more-negative values = lower growth potential and steeper size-spectrum slopes, i.e., a higher proportion of small individuals) for nine demersal species in the south-central Mediterranean:

Bony fish — Merluccius merluccius, Mullus surmuletus, Mullus barbatus;

Crustaceans — Parapenaeus longirostris, Aristaeomorpha foliacea, Nephrops norvegicus;

Cephalopods — Loligo vulgaris, Illex coindetii, Octopus vulgaris.

Values are provided for all combinations of bottom temperature 14–20 °C and fishing effort 0.5, 20, 40, and 60 h yr^{-1}. The table is organized by taxonomic group, with temperature varying down rows and effort across blocks, allowing readers to compare within-species responses and between-species sensitivities. How to read the table. Moving down rows (warmer temperatures) or across effort blocks (greater effort) generally makes λ more negative, indicating a shift toward smaller sizes; departures from this pattern highlight species-specific responses. For example, among fishes, λ becomes markedly more negative with warming and effort (e.g., M. merluccius ≈ −3.0 at 14 °C/low effort to ≈ −0.4 at 20 °C/high effort). Crustaceans show mixed sensitivity: P. longirostris and A. foliacea track warming more strongly than effort, whereas N. norvegicus shows weaker or contrasting temperature effects. Cephalopods exhibit interaction effects: I. coindetii shows pronounced declines in λ under warm/high-effort conditions; L. vulgaris is most negative at moderate temperatures with high effort; O. vulgaris displays strong sensitivity to the joint increase of temperature and effort. These tabulated λ values are the quantitative inputs underlying the response surfaces in Figures 2–4, and they document the species-specific nature of size-structure responses to the combined pressures of environmental warming and fishing in this region.

Table S2 - Modeled values of the intrinsic rate of population growth (λ) for a range of demersal species across combinations of bottom water temperature (14–20 °C) and fishing effort (0.5–60 hours/year). The values of λ are given on a logarithmic scale, where more negative values indicate lower growth potential. The species included are *Merluccius merluccius*, *Mullus surmuletus*, *Mullus barbatus*, *Parapenaeus longirostris*, *Aristaeomorpha*

foliacea, *Nephrops norvegicus*, *Loligo vulgaris*, *Illex coindetii*, and *Octopus vulgaris*. The table shows that both increasing temperature and fishing effort generally reduce λ, with species-specific variation in sensitivity. These results highlight the combined impacts of environmental warming and fishing pressure on population dynamics in exploited marine species.

Temperature (°C)	Fishing Effort (hour/year)	λ (M. merluccius)	λ (M. surmuletus)	λ (M. barbatus)
14	0.5	-3.0	-2.8	-1.5
15	0.5	-2.8	-2.6	-1.5
16	0.5	-2.6	-2.4	-1.5
17	0.5	-2.3	-2.1	-1.3
18	0.5	-2.0	-1.8	-1.1
19	0.5	-1.6	-1.4	-0.9
20	0.5	-1.2	-1.0	-0.7
14	20.0	-2.8	-2.6	-1.5
15	20.0	-2.6	-2.4	-1.5
16	20.0	-2.4	-2.2	-1.5
17	20.0	-2.1	-1.9	-1.3
18	20.0	-1.8	-1.6	-1.1
19	20.0	-1.4	-1.2	-0.9
20	20.0	-1.0	-0.8	-0.7
14	40.0	-2.4	-2.4	-1.5
15	40.0	-2.2	-2.2	-1.5
16	40.0	-2.0	-2.0	-1.5
17	40.0	-1.7	-1.7	-1.3
18	40.0	-1.4	-1.4	-1.1
19	40.0	-1.1	-1.0	-0.9
20	40.0	-0.8	-0.6	-0.7
14	60.0	-2.0	-2.2	-1.5
15	60.0	-1.8	-2.0	-1.5
16	60.0	-1.6	-1.8	-1.5
17	60.0	-1.3	-1.5	-1.3
18	60.0	-1.0	-1.2	-1.1
19	60.0	-0.7	-0.8	-0.9

20	60.0	-0.4	-0.4	-0.7
Temperature (°C)	**Fishing Effort (hour/year)**	**λ (P. longirostris)**	**λ (A. foliacea)**	**λ (N. norvegicus)**
14	0.5	-1.5	-1.6	-1.5
15	0.5	-1.4	-1.5	-1.6
16	0.5	-1.3	-1.4	-1.7
17	0.5	-1.2	-1.2	-1.7
18	0.5	-1.0	-1.0	-1.8
19	0.5	-0.8	-0.7	-1.8
20	0.5	-0.5	-0.4	-1.9
14	20.0	-1.5	-1.6	-1.5
15	20.0	-1.4	-1.5	-1.6
16	20.0	-1.3	-1.4	-1.7
17	20.0	-1.2	-1.2	-1.7
18	20.0	-1.0	-1.0	-1.8
19	20.0	-0.8	-0.7	-1.8
20	20.0	-0.5	-0.4	-1.9
14	40.0	-1.5	-1.6	-1.5
15	40.0	-1.4	-1.5	-1.6
16	40.0	-1.3	-1.4	-1.7
17	40.0	-1.2	-1.2	-1.7
18	40.0	-1.0	-1.0	-1.8
19	40.0	-0.8	-0.7	-1.8
20	40.0	-0.5	-0.4	-1.9
14	60.0	-1.5	-1.6	-1.5
15	60.0	-1.4	-1.5	-1.6
16	60.0	-1.3	-1.4	-1.7
17	60.0	-1.2	-1.2	-1.7
18	60.0	-1.0	-1.0	-1.8
19	60.0	-0.8	-0.7	-1.8
20	60.0	-0.5	-0.4	-1.9
Temperature (°C)	**Fishing Effort (hour/year)**	**λ (L. vulgaris)**	**λ (I. coindetii)**	**λ (O. vulgaris)**
14	0.5	-2.0	-1.0	-2.6
15	0.5	-1.8	-1.1	-2.4

16	0.5	-1.6	-1.3	-2.2
17	0.5	-1.3	-1.5	-2.0
18	0.5	-1.1	-1.7	-1.8
19	0.5	-1.0	-1.9	-1.6
20	0.5	-0.8	-2.1	-1.4
14	20.0	-2.0	-0.8	-2.4
15	20.0	-1.8	-0.9	-2.2
16	20.0	-1.6	-1.1	-2.0
17	20.0	-1.3	-1.3	-1.8
18	20.0	-1.1	-1.5	-1.6
19	20.0	-1.0	-1.7	-1.4
20	20.0	-0.8	-1.9	-1.2
14	40.0	-2.2	-0.6	-2.2
15	40.0	-2.0	-0.7	-2.0
16	40.0	-1.8	-0.9	-1.8
17	40.0	-1.5	-1.1	-1.6
18	40.0	-1.3	-1.3	-1.4
19	40.0	-1.2	-1.5	-1.2
20	40.0	-1.0	-1.7	-1.0
14	60.0	-2.4	-0.4	-2.0
15	60.0	-2.2	-0.5	-1.8
16	60.0	-2.0	-0.7	-1.6
17	60.0	-1.7	-0.9	-1.4
18	60.0	-1.5	-1.1	-1.2
19	60.0	-1.4	-1.3	-1.0
20	60.0	-1.2	-1.5	-0.8