

13 Fisheries and Marine Ecosystems

13.1 Scenarios

The fisheries and marine ecosystem models are quite diverse. Most include climate-impact models via ESM-simulated primary-production changes, and many also include impacts of changes in water temperature on ectotherm metabolic rates. A very small subset of the models includes ocean-acidification effects. Most models include fishing, either as an imposed process based on observed historical fishing effort (which start in 1950), or as an endogenous process based on simple economic factors.

Fishing effort should be held at constant 1950 levels from 1861-1950. It should then follow the standard historical reconstruction from 1950-2006 typically used by the model, using reconstructed effort or economic forcings as appropriate. Effective effort should be held constant following 2005 in all simulations. For models that include acidification effects, all simulations should include ocean acidification in accordance with the respective climate scenario.

Climate scenarios	
picontrol	Pre-industrial climate and 286ppm CO ₂ concentration. The climate data for the entire period (1661-2299) are unique – no (or little) recycling of data has taken place.
historical	Historical climate and CO ₂ concentration.
rcp26	Future climate and CO ₂ concentration from RCP2.6.
rcp60	Future climate and CO ₂ concentration from RCP6.0.
rcp85	Future climate and CO ₂ concentration from RCP8.5.
Human influences scenarios	
nosoc	No fishing.
histsoc	Historical reconstruction of fishing starting in 1950.
2005soc	Fishing fixed at year 2005 levels.

Table 31 ISIMIP2b scenarios for simulations of the impacts on marine ecosystems and fisheries.

	Experiment	Input	Pre-industrial 1661-1860	Historical 1861-2005	Future 2006-2099	Extended future 2100-2299
I	no climate change, pre-industrial CO ₂	Climate & CO ₂	not simulated	picontrol	picontrol	picontrol
	varying fishing up to 2005, then fixed at 2005 levels thereafter	Human & LU		histsoc	2005soc	2005soc
II	RCP2.6 climate & CO ₂	Climate & CO ₂	not simulated	historical	rcp26	rcp26
	varying fishing up to 2005, then fixed at 2005 levels thereafter	Human & LU		histsoc	2005soc	2005soc
III	RCP6.0 climate & CO ₂	Climate & CO ₂	not simulated	Experiment II	rcp60	not simulated
	varying fishing up to 2005, then fixed at 2005 levels thereafter	Human & LU			2005soc	
IV-VII	not simulated					
VIII	RCP8.5 climate & CO ₂	Climate & CO ₂	not simulated	Experiment II	rcp85	not simulated
	varying fishing up to 2005, then fixed at 2005 levels thereafter	Human & LU			2005soc	

Table 32 Additional sector-specific simulations for the fisheries and marine ecosystems sector

Experiment	Input	Pre-industrial 1661-1860	Historical 1861-2005	Future 2006-2099	Extended future 2100-2299
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la	no climate change, pre-industrial CO ₂	Climate & CO ₂	not simulated	picontrol	picontrol	not simulated
	no fishing	Human & LU		nosoc	nosoc	
lb	NPP control. All forcings except NPP at pre-industrial levels.	Climate & CO ₂	not simulated	npp-control	npp-control	not simulated
	No fishing	Human & LU		nosoc	nosoc	
lc	Temperature control. All forcings except NPP at pre-industrial levels.	Climate & CO ₂	not simulated	temperature-control	temperature-control	not simulated
	no fishing	Human & LU		nosoc	nosoc	
VIIIa	RCP8.5 climate & CO ₂	Climate & CO ₂	not simulated	historical	rcp85	not simulated
	no fishing	Human & LU		nosoc	nosoc	

13.2 Output data

Table 33 Common output variables to be provided by global and regional marine fisheries models.

Variable name (long name)	Variable name	Unit (NetCDF format)	Resolution	Comments
Essential outputs from global and regional models (provide as many as possible)				
TOTAL system biomass density	tsb	g C m ⁻²	monthly	all primary producers and consumers
TOTAL consumer biomass density	tcb	g C m ⁻²	monthly	all consumers (trophic level >1, vertebrates and invertebrates)

Biomass density of consumers >10cm	b10cm	g C m ⁻²	monthly	if L infinity is >10 cm, include in >10 cm class
Biomass density of consumers >30cm	b30cm	g C m ⁻²	Monthly	if L infinity is >30 cm, include in >30 cm class
TOTAL Catch (all commercial functional groups / size classes) where fishing included in model	tc	g wet biomass / m ² , g m ⁻²	monthly	catch at sea (commercial landings plus discards, fish and invertebrates)
TOTAL Landings (all commercial functional groups / size classes) where fishing included in model	tla	g wet biomass / m ² , g m ⁻²	monthly	commercial landings (catch without discards, fish and invertebrates)
Optional output from global and regional models				
Biomass density of commercial species where fishing included in model	bcom	g C m ⁻²	monthly	Discarded species not included (Fish and invertebrates)
Biomass density (by functional group / size class) where fishing included in model	b-<class>-<group>	g C m ⁻²	monthly	Provide name of each size class (<class>) and functional group (<group>) used, and provide a definition of each class/group
Catch (by functional group / size class) where fishing included in model	c-<class>-<group>	g wet biomass / m ² ,g m ⁻²	monthly	Provide name of each size class (<class>) and functional group (<group>) used, and provide a definition of each class/group