14 Marine Fisheries (FISH-MIP)

14.1 Sector-specific input

14.1.1 Climate-related forcing for historical simulations

Table 39 Historical and future forcing datasets for global and regional models.

Dataset description	Time period	Comments
GFDL reanalysis product CORE-forced MOM-SIS-TOPAZ	1959-2004	observation/re-analysis based time-series as used in Cheung et al. 2013 (1.0° x 1.0° degree) => includes observed climate variability
IPSL-CM5A-LR (ISIMIP GCM2; driven by CMIP5 historical forcing)	1951-2005	GCM data has not been bias-corrected, but a potential drift has been removed using each model's CMIP5 control run, and data has been interpolated to a common grid (1.0° x 1.0°)
GFDL ESM2M (ISIMIP GCM4; driven by CMIP5 historical forcing)		
planned: CESM1-BGC (driven by CMIP5 historical forcing)		
IPSL-CM5A-LR (ISIMIP GCM2; four datasets driven by RCP2.6, RCP4.5, RCP6.0, and RCP8.5 forcing, respectively)	2006-2100	GCM data has not been bias-corrected, and no drift correction was applied (no substantial drift in the future simulations). Data has been interpolated to a common grid (1.0° x 1.0°)
GFDL ESM2M (ISIMIP GCM4; four datasets driven by RCP2.6, RCP4.5, RCP6.0, and RCP8.5 forcing,		

respectively)		
planned: CESM1-BGC (four datasets driven by RCP2.6, RCP4.5, RCP6.0, and RCP8.5 forcing, respectively)		

NOTE: All data will be provided as depth-resolved (3D), depth-integrated, surface and bottom.

Table 40 Forcing variables provided as input for global and regional marine fisheries models.

Variable	Name	Unit	Frequency	Comments
u current	*uo*	m/s	Monthly	
v current	*vo*	m/s	Monthly	
Temperature	*t*	K	Monthly	
Dissolved oxygen concentration	o2	mol / m^3	Monthly	
Primary productivity	*intpp*	mol C / m^3 / s	Monthly	
Phytoplankton carbon concentration	*phyc*	mol / m^3	Monthly	Sum of small and large phytoplankton
Small phytoplankton carbon concentration	*sphyc*	mol / m^3	Monthly	Size range or Min-Max for each GCM, if available
Large phytoplankton carbon concentration	*lphyc*	mol / m^3	Monthly	Size range or Min-Max for each GCM, if available

Zooplankton carbon concentration	*zoo*	mol / m^3	Monthly	Sum of small and large zooplankton
Small (micro)zooplankton carbon concentration	*szoo*	mol / m^3	Monthly	Size range or Min-Max for each GCM, if available
Large (meso)zooplankton carbon concentration	*lzoo*	mol / m^3	Monthly	Size range or Min-Max for each GCM, if available
pH	*Ph*		Monthly	
Salinity	*So*	Psu	Monthly	

14.1.2Historical fishing effort

For this round, modelers will use their own default fishing effort and catch data. In most cases this will be Sea-Around-Us-Project (SAUP) data obtained through a memorandum of understanding (MOU) or data from Regional Fisheries Management Organizations (RFMOs) or local fisheries agencies.

14.1.3Spin-up and initialization

Input data is provided from 1951/1959 to 2004/2005. Years until 1970 can be replicated as needed and used for spin-up. Historical reporting is from 1971-2005, but if your model starts later, start when your model normally starts!

14.2 Output data

- ⇨ **Provide temporally (monthly) and spatially (1 x 1 degree grid) explicit column-integrated time series (1971-2005, 2006-2100)** (All files should be saved with .nc4 file extension; a conversion script for .csv files can be found at: http://vre1.dkrz.de).

- ⇨ **Use variable names as specified in Table 41 below, and check the overall ISIMIP simulation protocol for how to name your files.**

- ⇨ **If there is no data value for outputs, use the value: 1.e+20f**
- ⇨ **Mandatory output**: this is the priority for first round of model comparisons (provide as many as possible!)
- ⇨ **Optional output**: if you can, please store or upload all output you receive from your model, we may eventually use it

Table 41 Common output variables to be provided by global and regional marine fisheries models.

Output variable	Variable name Resolution		Unit (NetCDF format)	Comments
Mandatory output from global and regional models (provide as many as possible)				
TOTAL system biomass density (*tsb*)	*tsb*	monthly	g C / m^2 (g C m-2)	all primary producers and consumers
TOTAL consumer biomass density (t*bc*)	*tcb*	monthly	g C / m^2 (g C m-2)	all consumers (trophic level >1, vertebrates and invertebrates)
Biomass density of consumers >10cm	*b10cm*	monthly	g C / m^2 (g C m-2)	if L infinity is >10 cm, include in >10 cm class
Biomass density of consumers >30cm	*b30cm*	monthly	g C / m^2 (g C m-2)	if L infinity is >30 cm, include in >30 cm class
TOTAL Catch (all commercial functional groups / size classes) (*tc*)	*tc*	monthly	g wet biomass / m^2	catch at sea (commercial landings plus discards, fish and invertebrates)

			(g m-2)	
TOTAL Landings (all commercial functional groups / size classes) (*tla*)	*tla*	monthly	g wet biomass / m^2 (g m-2)	commercial landings (catch without discards, fish and invertebrates)
Optional output from global and regional models				
Biomass density of commercial species (*Bcom*)	*bcom*	monthly	g C / m^2 (g C m-2)	Discarded species not included (Fish and invertebrates)
Biomass density (by functional group / size class) (B_i)	*b-<class>-<group>*	monthly	g C / m^2 (g C m-2)	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) (C_i)	*c-<class>-<group>*	monthly	g wet biomass / m^2 (g m-2)	Provide name of each size class (<class>) and functional group (<group>) used, and provide a definition of each class/group

14.3 Summary of simulations

Table 42 outlines all experiments (historical and future) for the global and regional fisheries and marine ecosystem models.

- ⇨ Note: the three CMIP5-based runs will continue into the future, reducing the total number of runs to be done!!!
- ⇨ Historical reporting period: 1971-2005 (or when your model starts)

⇨ Future reporting period: 2006-2100

Climate scenarios:

- Historical runs: 1 re-analysis product & IPSL hindcast; Next: GDFL & CESM hindcasts
- Future runs: Priority IPSL 2.6 & 8.5; Next GFDL & CESM 8.5; Next IPSL 4.5 & 6.0

Fishing scenarios:

- Historical runs: Priority (default): use time-varying effort; Next (unfished): zero fishing effort/mortality
- Future runs: Priority (default): keep fishing constant at 2005 levels; Next (unfished): continue historical unfished (zero fishing effort/mortality) run into future

Any other impacts: (default): keep constant at 2005 levels

Table 42 Summary of historical and future runs for global and regional fisheries models

	Climate data GCM	Scenario	Fishing effort	Ocean acidification	# runs
Historical runs	GFDL ESM2 (re-analysis)	hist	default (time-varying effort/mortality) unfished (zero effort/mortality)	default (time-varying pH)	2
	IPSL-CM5A-LR (GCM 2)	hist	default (time-varying effort/mortality) unfished (zero effort/mortality)	default (time-varying pH)	2

Historical runs	GFDL ESM2M (GCM 4)	hist	default (time-varying effort/mortality) unfished (zero effort/mortality)	default (time-varying pH)	2
	CESM BGC	hist	default (time-varying effort/mortality) unfished (zero effort/mortality)	default (time-varying pH)	2
Future runs	IPSL-CM5A-LR (GCM 2)	2.6 (rcp2p6) 8.5 (rcp8p5)	keep constant at 2005 levels unfished (zero effort/mortality)	use time-varying pH with GCM input	4
Future runs	IPSL-CM5A-LR (GCM 2)	4.5 (rcp4p5) 6.0 (rcp6p0)	keep constant at 2005 levels unfished (zero effort/mortality)	use time-varying pH with GCM input	4
	GFDL ESM2M (GCM4)	2.6 (rcp2p6) 8.5 (rcp8p5)	keep constant at 2005 levels unfished (zero effort/mortality)	use time-varying pH with GCM input	2

TBA	CESM BGC	2.6 (rcp2p6) 8.5 (rcp8p5)	keep constant at 2005 levels unfished (zero effort/mortality)	use time-varying pH with GCM input	2