



# Climate Change and India

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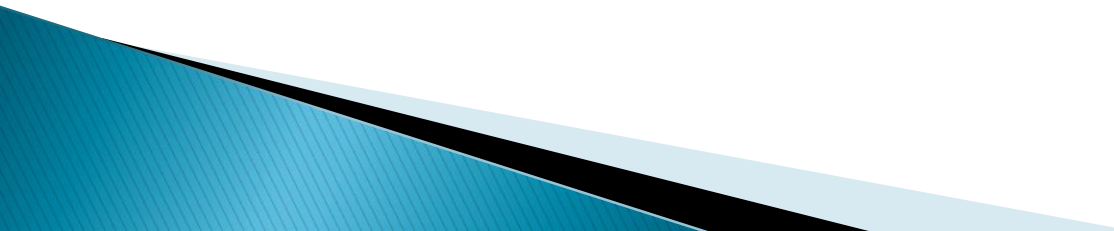
# Climate Change

- ▶ "Climate change" means a change of climate
  - which is attributed directly or indirectly to human activity
  - that alters the composition of the global atmosphere, and
  - which is in addition to natural climate variability observed over comparable time periods.
- ▶ United Nations Framework Convention On Climate Change
- ▶ UNFCCC Article 1, Definitions:  
[http://unfccc.int/essential\\_background/convention/background/items/1349.php](http://unfccc.int/essential_background/convention/background/items/1349.php)

# Climate Change

- ▶ The Intergovernmental Panel on Climate Change (IPCC) defines “climate change”
  - as “a change in the state of the climate
  - that can be identified ... by changes in the mean and / or the variability of its properties,
  - and that persists for an extended period, typically decades or longer”.
- ▶ Source: IPCC Fourth Assessment Report, Working Group I, Glossary of Terms: [http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1\\_Print\\_Annexes.pdf](http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_Annexes.pdf).

# Climate Change in the context of fisheries

- ▶ Marine fisheries and inland fisheries make substantial contribution to the food security and livelihoods
  - ▶ Marine (4.12 mn) and inland sector (12.2 mn) together contributes 16.24mn tonnes
  - ▶ Factors that amplify disaster risk in India
  - ▶ Social vulnerability disproportionately impact the coastal communities
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# India fisherfolk Population from MFC 2016

STATE PROFILE							
State	Coastal length (km)	Landing centres	Fishing villages	Fishermen families	Traditional fishermen families	BPL families	Fisherfolk population
West Bengal*	158	49	171*	81,067	56,447	55,301	3,68,816
Odisha	480	55	739	1,15,228	92,569	48,601	5,17,623
Andhra Pradesh	974	234	533	1,55,062	1,52,062	1,50,669	5,17,435
Tamil Nadu	1,076	349	575	2,01,855	1,96,784	1,83,683	7,95,708
Puducherry	45	22	39	14,347	14,328	12,968	50,270
Kerala	590	174	220	1,21,637	1,16,598	72,507	5,63,903
Karnataka	300	84	162	32,479	30,897	27,312	1,57,989
Goa	104	32	41	2,986	2,922	650	12,651
Maharashtra	720	155	526	87,717	80,906	27,400	3,64,899
Gujarat	1,600	107	280	67,610	64,395	19,123	3,54,992
Daman & Diu	21	8	12	3,163	3,094	20	15,836
Lakshadweep**	132	37	10	4,163	3,003	1,170	27,934
Andaman & Nicobar***	1,962	57	169	5,944	4,486	1,486	26,521
<b>Total</b>	<b>8,162</b>	<b>1,363</b>	<b>3,477</b>	<b>8,93,258</b>	<b>8,18,491</b>	<b>6,00,890</b>	<b>37,74,577</b>

\* Subsequent reference to villages actually mean Gram Panchayat in West Bengal. \*\* Fishing islands. \*\*\*Landing centres/Landing points

# Fishing Craft in the fisheries

States	Mechanized							Motorized			Non- motorized	Total	
	Trawlers	Gillnetters	Dolnetters / Bagnetters	Liners	Ring seiners	Purse-seiners	Others	Total Mechanized	Inboard	Outboard			Total motorized
West Bengal	2,004	1,764	191	31	0	0	24	4,014	6,564	0	6,564	476	11,054
Odisha	1,390	358	0	0	0	0	0	1,748	2,443	3,235	5,678	1,256	8,682
Andhra Pradesh	1,176	0	0	0	0	0	0	1,176	3,146	8,932	12,078	6,965	20,219
Tamil Nadu	5,278	441	0	16	219	0	7	5,961	8,945	22,334	31,279	6,115	43,355
Puducherry	223	0	0	0	78	0	0	301	387	975	1,362	656	2,319
Kerala	2,654	417	0	2	646	81	0	3,800	0	13,868	13,868	4,016	21,684
Karnataka	3,071	40	0	0	0	669	0	3,780	304	5,575	5,879	2,225	11,884
Goa	600	0	0	0	0	209	49	858	5	937	942	182	1,982
Maharashtra	3,408	584	1,637	0	0	230	8	5,867	5,979	809	6,788	2,865	15,520
Gujarat	9,905	2,602	1,554	0	0	0	0	14,061	3,541	9,284	12,825	756	27,642
Daman & Diu	1,063	342	14	0	0	0	0	1,419	95	301	396	177	1,992
<b>Total</b>	<b>30,772</b>	<b>6,548</b>	<b>3,396</b>	<b>49</b>	<b>943</b>	<b>1,189</b>	<b>88</b>	<b>42,985</b>	<b>31,409</b>	<b>66,250</b>	<b>97,659</b>	<b>25,689</b>	<b>1,66,333</b>

# Housing-scale and amenities


PROFILE OF AMENITIES & FACILITIES										
State	No. of fishing villages	Villages having								
		Bus stop/stand	Hospitals	Post Offices	Police station	Mob. phone coverage	Cyclone shelter	Jetty facility	Market facility	Auction shed
West Bengal	171	87	55	138	36	163	32	16	45	10
Odisha	739	112	59	201	40	692	287	22	44	20
Andhra Pradesh	533	310	28	41	9	471	271	4	128	15
Tamil Nadu	575	389	130	214	144	510	124	30	141	147
Puducherry	39	39	11	3	5	39	1	2	12	3
Kerala	220	209	165	155	76	220	19	56	146	73
Karnataka	162	151	79	126	56	161	1	19	65	19
Goa	41	35	18	22	10	41	0	6	26	0
Maharashtra	526	432	210	253	134	479	16	89	62	17
Gujarat	280	220	147	140	86	264	43	30	40	9
Daman & Diu	12	11	8	8	7	12	6	7	7	5
Lakshadweep	10	0	10	10	10	10	2	8	5	1
Andaman & Nicobar	169	111	92	50	35	131	40	30	19	4
<b>Total</b>	<b>3,477</b>	<b>2,106</b>	<b>1,012</b>	<b>1,361</b>	<b>648</b>	<b>3,193</b>	<b>842</b>	<b>319</b>	<b>740</b>	<b>323</b>

# HOUSING-SCALE & AMENITIES

State	Total households	Pucca	Kutcha	Rooms less than 3	Potable water source access						
					Without toilet	Electrified	Tap water	Well	Hand pump	Borewell	Others
West Bengal	81,067	15,375	65,692	68,637	39,483	61,618	4,474	201	10,552	65,106	734
Odisha	1,15,228	41,234	73,994	99,566	88,806	91,805	11,677	6,185	31,245	62,761	3,360
Andhra Pradesh	1,55,062	1,14,272	40,790	1,28,431	95,381	1,51,624	1,00,874	9,755	16,814	6,939	20,680
Tamil Nadu	2,01,855	1,57,590	44,265	1,14,536	47,569	1,98,793	1,24,716	15,497	22,044	15,151	24,447
Puducherry	14,347	12,336	2,011	5,405	3,295	14,286	11,082	31	296	969	1,969
Kerala	1,21,637	1,08,030	13,607	21,844	9,953	1,19,859	72,260	19,797	2,228	19,027	8,325
Karnataka	32,479	30,129	2,350	9,924	7,970	31,990	9,878	14,519	2,106	4,156	1,820
Goa	2,986	2,874	112	668	279	2,955	2,748	177	0	33	28
Maharashtra	87,717	79,880	7,837	56,090	34,607	86,518	68,099	11,369	1,574	2,498	4,177
Gujarat	67,610	50,923	16,687	51,930	31,952	65,754	46,619	4,271	3,999	1,144	11,577
Daman & Diu	3,163	3,010	153	1,662	1,275	3,161	2,557	7	0	2	597
Lakshadweep	4,163	3,974	189	806	15	4,139	912	2,723	41	11	476
Andaman & Nicobar	5,944	2,555	3,389	2,929	2,794	5,494	4,682	616	19	62	565
<b>Total</b>	<b>8,93,258</b>	<b>6,22,182</b>	<b>2,71,076</b>	<b>5,62,428</b>	<b>3,63,379</b>	<b>8,37,996</b>	<b>4,60,578</b>	<b>85,148</b>	<b>90,918</b>	<b>1,77,859</b>	<b>78,755</b>



# Nonclimatic stresses

- ▶ Can Indian fishers have a capacity to absorb climate shocks?
  - ▶ Geographical locations and their economic status?
  - ▶ Adaptations to climate change must be multidimensional and multi sectoral
  - ▶ Do they have access to diverse livelihoods?
    - Inequities in gender
    - Inequities in market access
    - Inequities in tenure rights
  - ▶ Do we have enough structures for disaster risk adaptation at national, regional and local levels of governance?
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# Sea Level rise

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Sea level Rise	<ul style="list-style-type: none"><li>• Thermal expansion of water</li><li>• Melting of temperate glaciers</li><li>• 1901 – 2013 MSL rose about 20 cm or 8 inches</li><li>• 2013 – 2022 MSL rose from about 0.46 cm or 0.18 inches</li></ul>	<ul style="list-style-type: none"><li>• Rise in earth's temperature, flooding, storm surges</li><li>• Loss of mangroves</li><li>• Salinization of irrigation water resources</li><li>• Damage to harbors</li><li>• Large scale migration</li></ul>	<ul style="list-style-type: none"><li>• Manage retreat using sea walls</li><li>• Accommodating coastal changes in costal construction plan</li><li>• Dune rehabilitation</li><li>• Beach nourishment</li></ul>

# Sea surface temperature

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Change in sea surface temperature	Change in the temperature from the surface to 70 feet below	<ul style="list-style-type: none"><li>• Strengthening of cyclones</li><li>• Changing fish composition in catch</li><li>• Modification of air masses in earth's atmosphere</li></ul>	<p>Reduce</p> <ul style="list-style-type: none"><li>• Industrial discharges</li><li>• Chemical effluence</li><li>• Urban waste</li></ul>

# Sea surface salinity

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Sea surface salinity	<ul style="list-style-type: none"><li>• Incursion of sea water into the costal and upstream areas</li><li>• Salinity increase in 35 grams per kilogram</li></ul>	<ul style="list-style-type: none"><li>• More salinity in the ground water harming freshwater fisheries,</li><li>• Exacerbating of the current situation of reduction in freshwater flows</li><li>• Weakened flows and longer stay of the saline water</li></ul>	

# Wind patterns

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Wind patterns	Intensity and directional stability of winds	<ul style="list-style-type: none"><li>• Uncertainties in the directions of wind flows</li><li>• Transportation of heat on surface sea currents</li><li>• Changes in permanent winds, seasonal winds and local winds</li><li>• High rise buildings on the coast</li><li>• Impact on fish movements, navigation, fishing effort, upwelling processes and occurrence of intense winds</li></ul>	<ul style="list-style-type: none"><li>• Reduce the impact of coastal construction</li><li>• Protect vegetation</li><li>• Rules for coastal area construction</li></ul>

# Seasonality and seasonal patterns

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Seasonality and seasonal patterns	<ul style="list-style-type: none"><li>• Regularity is important</li><li>• Irregular monsoon</li></ul>	<ul style="list-style-type: none"><li>• Shifting and shrinking trends</li><li>• Shifts in seasonal fish species</li><li>• Arrival of small pelagic shoals</li><li>• Unseasonal events</li><li>• Impact on breeding and migratory patterns of fish</li><li>• Impact on culture fisheries like mass mortalities and spread of diseases</li></ul>	

# Rainfall

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Rainfall	Critical trends in rainfall patterns	<ul style="list-style-type: none"><li>• Flooding</li><li>• Draught</li><li>• Reduced upwelling</li><li>• Mass kills</li><li>• Flow of freshwater and breeding</li></ul>	To protect your green cover

# Natural disasters

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Natural disasters	<ul style="list-style-type: none"><li>• Warming of oceans</li><li>• Cyclones</li><li>• Flood</li></ul>	<ul style="list-style-type: none"><li>• Intensified cyclonic activity</li><li>• Storm surges</li><li>• Cyclone Ockhi</li><li>• Cyclone, Andhra Pradesh, 1996</li><li>• Super Cyclone, Odisha, 1998</li><li>• Cyclone Aila of 2009</li><li>• Saline water intrusions</li><li>• Drinking water scarcity</li><li>• Loss of agriculture</li><li>• Seasonal occurrences to irregular happenings</li><li>• Inadequate preparedness of coastal communities</li><li>• Annual floods of major river systems</li><li>• Inadequate steps to counter flood waters like bunds in Sunderbans, siltation remains in the river and elevated river beds.</li></ul>	



# Tidal action

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Tidal action	Changing tidal action in the estuarine regions	<ul style="list-style-type: none"><li>• Increase and decrease in tidal amplitude and fluctuations in the tidal cycles based on lunar phases</li><li>• Changes in the tidal cycles and fish availability due to changes in tidal cycles.</li><li>• Increase in the tidal influx from the sea due to less freshwater flows</li><li>• Increased salinity along the upper reaches</li><li>• Erosion of the beaches and inundation</li><li>• Backwaters receive less tidal water and its impact on breeding and nursery grounds for estuarine species like clupeids, mullets, catfishes, perches and prawns</li><li>• Passage of fishing craft through creaks is difficult.</li></ul>	<ul style="list-style-type: none"><li>• Regulated coastal construction</li><li>• De-siltation at the river mouths</li><li>• Avoid construction of tidal locks or bunds upstream which will create decreased tidal action</li></ul>


# Shoreline changes

FACTORS	DESCRIPTION	IMPACTS	SOLUTIONS
Shoreline changes	Erosion and sedimentation	<ul style="list-style-type: none"><li data-bbox="691 501 1439 696">• Shoreline does not slope gently into the sea altering tides and waves to play into their energies</li><li data-bbox="691 805 1296 848">• Damages to the shoreline</li><li data-bbox="691 956 1389 1075">• Decreasing of depths of rivers and canals</li></ul>	Less construction on the coast and the river mouths


# Inland Fisheries

- ▶ Providing high quality affordable food, source of employment and foundation for inland cultural fisheries
- ▶ Inland fisheries play an important cultural role in the supply of nutrition and support for cultural diversity
- ▶ Climate is a strong controller of physical, chemical and biological processes in inland fisheries
- ▶ Climate variability impacts changes in distribution, abundance, production of inland fisheries resources
- ▶ Climate change will interact with:
  - Demand for freshwater from other sectors,
  - Construction of dams,
  - lack of transboundary river basin management,
  - implementation of wetland management legislation,
  - non-native species introduction,
  - the low buffering or mitigating capacity,
  - habitats can be transnational and can cross different climatic zones,
  - Differential impact on disadvantaged groups processing of sun drying,
  - improvement in storage and processing equipment's,
  - altering of fishing operations

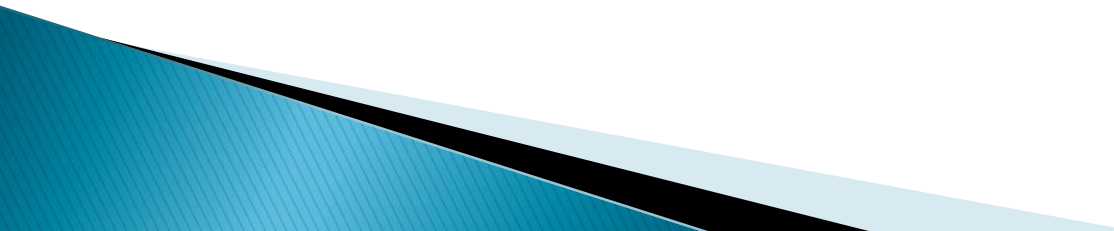
# Inland Fisheries (cont...)

- ▶ To document low stress, medium stress and high stress areas of Inland fisheries
  - ▶ Environmental rehabilitation of
    - inland water bodies,
    - Wetland management,
    - transboundary river basin management
  - ▶ Controlling the population growth to maintain ecological flows in the river basins
  - ▶ Non climatic stressors are more serious than climate stressors in inland fisheries like
    - economic development,
    - agricultural development,
    - deforestation and
    - increasing modification of river floodplain habitats
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# Action points

- ▶ The SAPCC can have wider consultation with fishing communities
  - ▶ Increase awareness among fishing communities
  - ▶ The strategic action plan clearly shows the linkages between climate change and the changes in their own fishing or fish processing operating conditions
  - ▶ Policy briefs can address the impacts and solutions at fishing village level
  - ▶ Fisheries management measures can be more context specific and adaptive through participatory bottom-up approach
  - ▶ More energy efficient engines for reducing operational costs and to reduce carbon emissions
  - ▶ Quality certification of fishing craft, periodical renewal of sea worthiness
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# Action points (cont...)

- ▶ Insure a policyholder against the occurrence of a specific event through parametric insurance
  - ▶ To extend all the welfare and insurance benefits to fishworkers involved in fishing and post-harvest practices
  - ▶ To address non-climate related stresses to equip fishing communities to face uncertain climate related risks
  - ▶ To develop housing plans with the climate change impact assessment
  - ▶ To improve access to basic services at village level
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# Interactive session

- ▶ Can we say that the number of extreme events observed by you is on the increase or decrease in your region?
  - ▶ Can we say that climate related disasters now account for more than 80% of all disaster events?
  - ▶ Do we need a robust damage and loss assessment?
  - ▶ Do we have adequate information on the prevailing, future risks and vulnerabilities?
  - ▶ Can we say that each specific fishery, fishing community or fisheries trade enterprise will exist within a particular and unique geographical, environmental, institutional context? And each will have unique risks and vulnerabilities?
- 