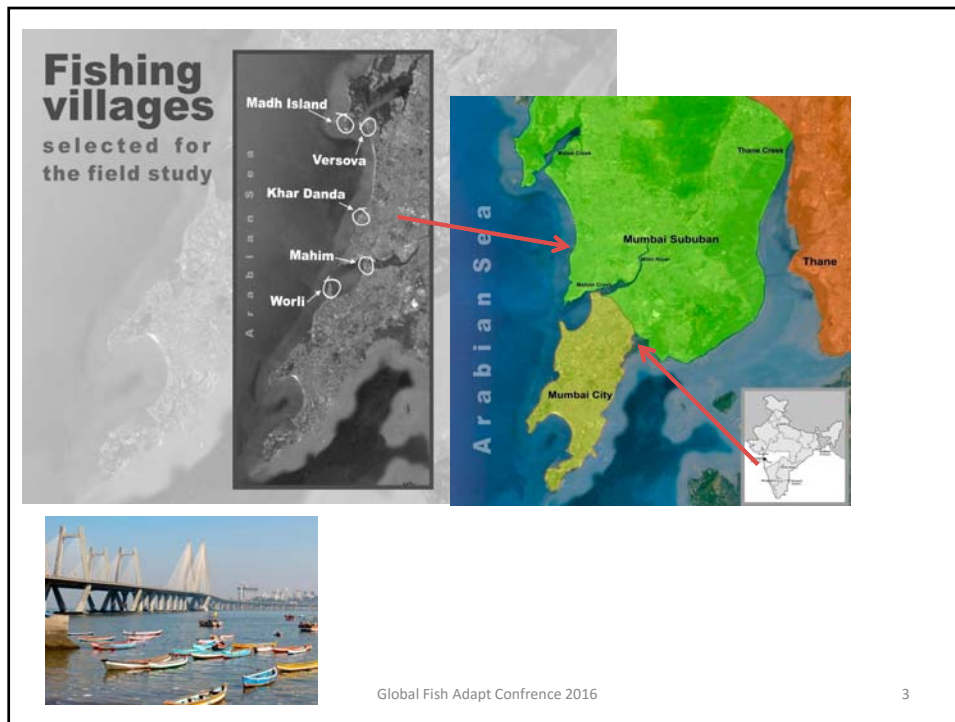


Climate change and vulnerability of fishing communities

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Back ground

- India has 8000 km long coastline, densely populated and includes high low lying areas.
- There are more than 60 districts along the coastline of India belonging to 9 coastal states.
- Traditionally these areas are also home to a large number of fishing communities.

Study Objective: To understand the livelihood, Vulnerability and adaptation aspects of fishing communities and also to analyze the socio-economic implications of climate change.

- A Household survey comprising two hundred fishermen is conducted from five fishing villages in Mumbai (Versova, Madh, Khar, Worli and Mahim), India.

- A substantial number of populations in and around Mumbai are fishing communities and they are the earliest inhabitants of the city, popularly known as 'Koli' communities.
- The unprecedented growth of the city in terms of increasing economic activities, tourism development and increase in migrants has seriously affected the livelihood of these indigenous fishing communities.
- The fishing villages of Kolis in Mumbai are known as Koliwada that can be easily described by small and overpopulated Katcha houses.
- Kolis bear most of the impacts of climate change like Flooding, SLR, High tides, **shift in rainfall** which further reduces their earnings in terms of reduction in fish catch.



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Methodology used for the Study

The study uses primary data obtained through household surveys for various empirical analyses like

- (i) the perception analysis based on descriptive statistics
- (ii) for deriving vulnerability scores,
- (iii) and efficiency analysis using stochastic frontier.



Versova Fish landing centre

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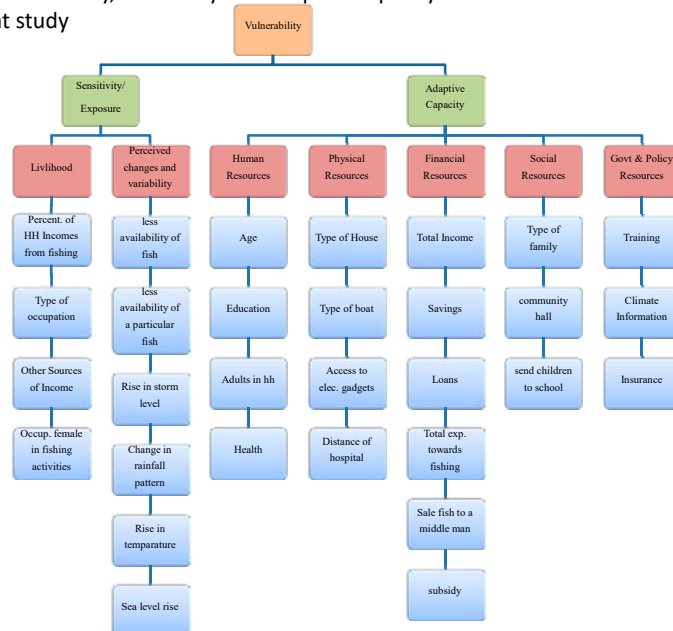
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Perceptions/observations of households on climate change

Observations on climate						
	Very high	High	Moderate	Low	Very Low	Total
Rise in temperature	67 (36.8%)	82 (45.1%)	21 (11.5%)	12 (6.6%)	0	182 (100%)
Rise in rainfall	44 (24.2%)	57 (31.3%)	54 (29.7%)	27 (14.8%)	0	182 (100%)
Change in rainfall pattern	89 (48.9%)	68 (37.4%)	24 (13.2%)	1 (.5%)	0	182 (100%)
Sea level rise	22 (12.1%)	78 (42.9%)	52 (28.6%)	28 (15.4%)	2 (1.1%)	182 (100%)
Rise in storm heights and frequency	32 (17.6%)	78 (42.9%)	53 (19.1%)	19 (10.4%)	0	182 (100%)

Source: Field Survey

Indicators of vulnerability, sensitivity and adaptive capacity selected for the present study



Adaptive capacity, Sensitivity and Vulnerability scores for survey villages

Village	Vulnerability scores	Sensitivity Scores	Adaptive capacity scores
Khardand	0.61	0.82	0.39
Madh	0.67	0.85	0.48
Mahim	0.58	0.8	0.36
Versova	0.59	0.8	0.37
Worli	0.65	0.81	0.4

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Measurement of Climate change awareness using discriminant function

	Standardized coefficients	Unstandardized coefficients	Structured Coefficients
Constant		1.108	
No of trip by boat owners	0.5	1.012	0.544
Age of the respondent	0.457	0.043	0.519
Type of family	-0.598	-1.292	-0.446
Observation on Sea level rise (SLR)	-0.045	-0.093	-0.285
Access to television	-0.318	-3.046	-0.256
Education	-0.161	-0.444	-0.188
Sex	-0.306	-0.873	-0.147
Experience of flood	0.371	0.784	0.108
Own boats	0.356	1.187	0.04

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Measuring Efficiency using Stochastic Frontier/CD function

Technical efficiency (%)	Frequency	Percentage	Mean Efficiency (%)
less than 20	36	22.00	15.08
21-30	37	22.60	25.91
31-40	28	17.10	34.64
41-50	17	10.40	45.00
51-60	10	6.10	56.50
61-70	11	6.70	64.90
Above 70	25	15.20	84.60
	164		Mean Efficiency of the 164 households is 40

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Social factors/variable affecting efficiency

Variables	Parameters	Co-efficient	t-ratio
Constant	δ_0	0.24	0.6
Age	δ_1	0	0.44
Education	δ_2	-0.09	-1.62***
Type of family	δ_3	-0.16	-1.46
Training	δ_4	-0.05	-0.4
Obs. Temperature	δ_5	0.15	2.53**
Obs. Rainfall	δ_6	-0.01	-0.19
Obs. Rainfall pattern	δ_7	-0.11	-1.4
Obs. Sea level	δ_8	-0.04	-0.67
Obs. Storm	δ_9	0	-0.08
Electronics. Gadgets	δ_{10}	0.3	5.27*

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Findings

➤ 36.8% of the fishermen surveyed perceive **rise in temperature** over the years and ranked the same as very high, and according to 49% the **change in rainfall pattern** is ranked very high.

➤ It is also observed that heavy rainfall is occurring more in the later part of monsoon (i.e. in September and October), usually in this period the fish catches are more but there is also increase in fear of going into the sea.

➤ However, earlier (as derived from elderly fishermen) the monsoon period in Mumbai was quite stable, fewer incidents of storms and high tides are observed. These elderly fishermen possess better understanding of the sea and wind pattern than the current generation fishermen.

➤ Only 52.2% of fishermen are aware of climate change, a discriminant function analysis shows that joint family, number of fishing trips and the age of the fishermen influence climate change awareness more in comparison to other factors such as access to television, education, sex/gender, boat ownership, and flood experience.

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➤ The distribution of efficiencies differs among households. However, the mean efficiency (0.40) shows a majority of the households are having a very low level of efficiency. Fishermen having mechanized boats manage their fish catch efficiently as the mean efficiency score for mechanized boat owner is 59.64.

➤ The analyses derive some interesting results. Fuel costs, number of working days, number of trip days and number of workers are some of the most important variables which affect the fish production in Mumbai.

➤ Among the inefficiency parameters, observation on temperature change, education, type of family and electronic gadgets used affect the efficiency of fishermen.

➤ Fishermen from joint families and educated fishermen are more efficient than others.

➤ Fishermen are now observing a different climate pattern, and accordingly, they adapt and target those fish species that are available in winter and summer seasons.

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Policy Implications and Suggestions

- This study suggests that issue of lack of asset formation and financial insecurity among young fishermen may be taken care by linking the fisheries societies in Mumbai and in other regions with local governments.
- The benefits of subsidies, insurance may be distributed progressively based on their financial needs to all fishermen rather than benefiting the large scale fishermen alone.
- Though mechanized boat owners are found less vulnerable in comparison to motorized boat owners, but mechanized fishing is found to be more environmentally destructive than others and therefore policy may be focused to improve environment quality as well as for reducing household's vulnerability.

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- Awareness drive like, radio, door to door announcement, village meetings, and workshops are needed.
- The local government along with fishing societies may take necessary steps in providing infrastructural facilities such as development of fish markets, better cold storage and transport facilities.
- Government may introduce minimum support price similar to agricultural commodities for different types of fish and institutionalize the market mechanism which is free from the clutches of the middlemen.
- The provision of minimum support price will provide financial insurance to the fishermen.
- There is a high pressed need to stop infiltration of migrants to fishing and to generate alternative occupation as well as alternative employment opportunities to Koli communities as well as to migrants.

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- Government may regulate all developmental activities like housing projects, port activities, and activities like coastal link road near the coast to give fishermen adequate physical space.
- Improving the natural environment near the coast and fishing villages is an urgent need.
- The discharge of plastic and other toxic materials into the sea is harmful for fish and should be banned.
- Destruction of mangroves must be stopped as mangroves combat climate problems as well as providing nursery ground for fishes.

Thank You



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With Mahesh K Baria from Versova Village