

**THE USE OF SYSTEM DYNAMICS
APPROACH TO IDENTIFY INTEGRATED
COASTAL ZONE PLANNING AND
MANAGEMENT INDICATORS FOR
MAURITIUS: A PERFORMANCE
EVALUATION MODEL**



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Coastal Zones



- ∞ Major focus for human society development
- ∞ Interface where land meets the sea and comprises of a range of coastal land, intertidal area, aquatic systems including the network of rivers and estuaries, islands, transitional and intertidal areas, salt marshes, wetlands and beaches (Cicin-Sain and Knecht, 1998)

Coastal Zones



- ∞ Coastal zones are essential as:
 - ∞ Unique geologic, ecological and biological areas of the planet
 - ∞ Most productive accessible areas to man
 - ∞ Unique habitats to the plant and animal kingdom
 - ∞ Source of food
 - ∞ Barriers to natural hazard
 - ∞ Aesthetic and scenic areas

- ∞ Coastal zones: fragile and vulnerable to threats
 - ∞ Human pressure, Natural pressure

Coastal Zones



☞ Pressures due to climate change:

☞ Sea Level rise

☞ Coastal inundation, Storm damage, Beach erosion, Wetland loss/change, Saltwater intrusion, Displacement of existing coastal plant and animal communities inland, Loss of biodiversity, Loss of tourism activities, Loss of agricultural land, Loss of water supplies, Loss of lives

☞ Increase in sea surface temperature

☞ Coral bleaching, Changes in quality of water – algal blooms, Decrease in sea-grass ecosystem, Reduced upwelling/resupply of nutrients impacting marine life, Increase in frequency and intensity of storms

Integrated Coastal Zone Management



- ❧ The coast 'appears' to all purposes to be working and functioning providing us with the uses and services we want.
- ❧ However, there is a need of the coastal zones to be **maintained** and **continued** for the future
- ❧ Hence, there is a need for a form of coastal management

- ❧ ICZM?
 - ❧ Preservation of existing resources and ecosystems
 - ❧ To ensure balanced management and sustainable development of these zones
 - ❧ To preserve resources for future generations



ICZM Programs



- ❧ United States comprises the bulk of all initiatives established worldwide

- ❧ European Parliament and European Council
 - ❧ In 2002, adopted a Recommendation on ICZM: 20 coastal member states and 2 candidate States
 - ❧ 8 principles of sound coastal planning and management
 - ❧ Integration of existing legislations – directives, frameworks
 - ❧ In 2003, member states and candidate countries have to abide to a set of EU ICZM Recommendation: 7 goals, 27 indicators and 44 measurements

- ❧ African Continent
 - ❧ ICZM Strategies and Action Plan
 - ❧ E.g, Kenya, Tanzania, Cameroun, Ghana, South Africa

ICZM Programs



☞ Mauritius

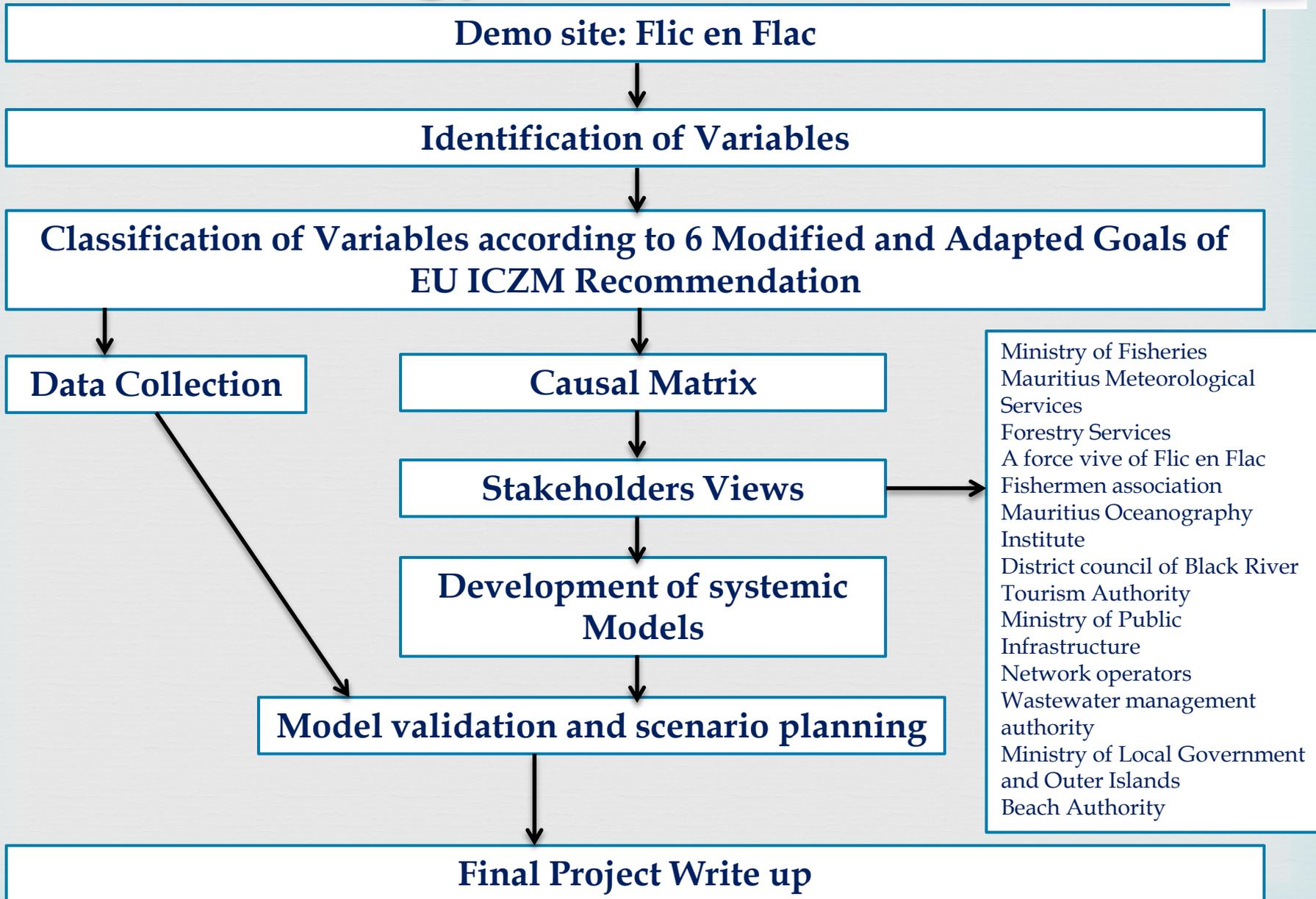
- ☞ Development of an ICZM Framework by Landell Mills in 2010
- ☞ Overall goal: promote sustainable use and development of the coastal zone in the Republic of Mauritius
- ☞ Review and development of appropriate policy and regulatory framework for ICZM promotion
- ☞ ICZM plan for identified pressure zones

Monitoring and Evaluation - important aspect of ICZM



29 October 2012

Methodology



Results



1. Identification and classification of variables
2. Representation of data collected
3. CLD

FLIC EN FLAC DEMO SITE GOALS AND VARIABLES

GOALS	VARIABLES
1. To control further development of the undeveloped Flic en Flac coastal zone.	1. Hotels and bungalows development
	2. Damage by speed boats and divers
	3. Number of inhabitants in Flic en Flac
2. To protect, enhance and celebrate natural and cultural diversity.	4. Protection of plants within the coastal zone of Flic en Flac
	5. Decrease in coral cover
3. To promote and support a dynamic and sustainable coastal economy.	6. Recreational activities for tourists
	7. Construction of roads
	8. Installation of communication services
	9. Leisure/recreational activities for residents of Flic en Flac and Mauritians

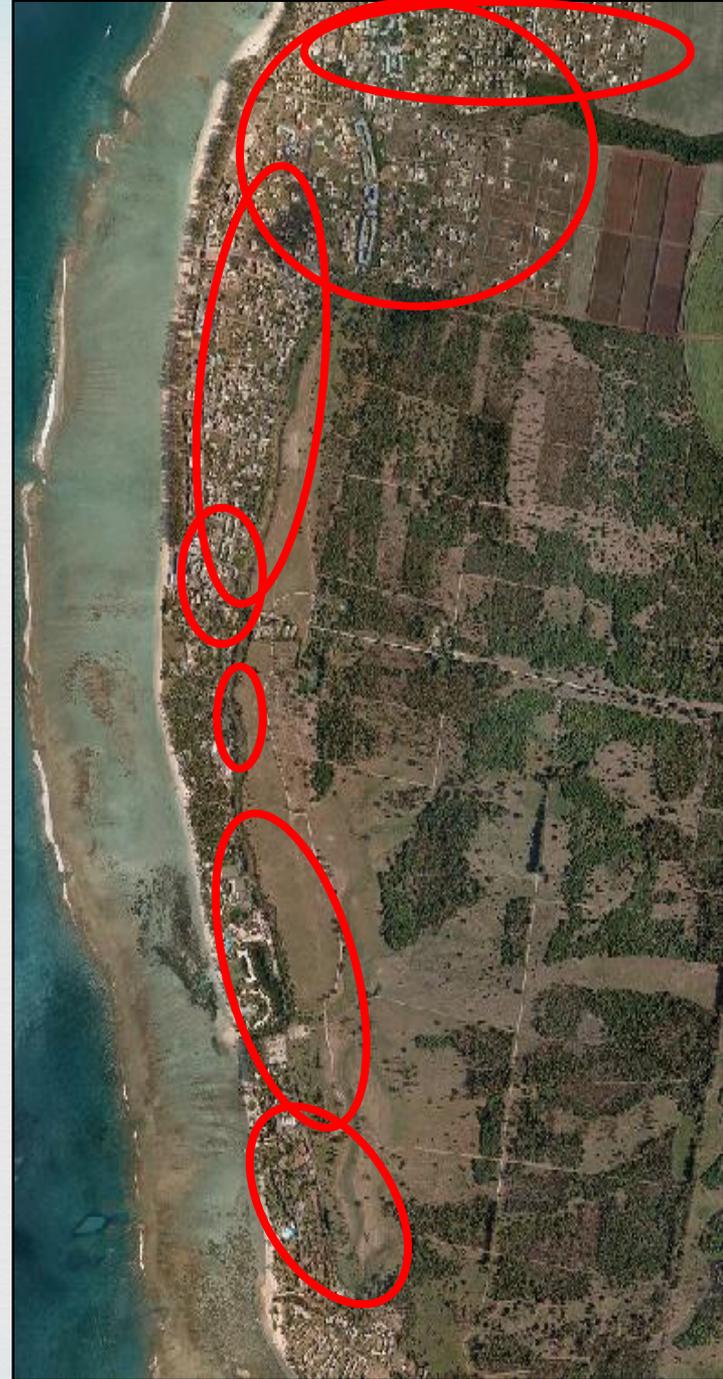
GOALS	VARIABLES
<p>4. Goal: To ensure that beaches of Flic en Flac are clean and that coastal waters are unpolluted.</p>	10. Sea water quality
	11. Quality of sand on the beach
	12. Discharge of wastewater
	13. Cleaning and scavenging services on the beach of Flic en Flac
	14. Available facilities on the beach to the public
	15. Maintenance of Flic en Flac beach
<p>5. Goal: To use natural resources wisely.</p>	16. Degraded marine ecosystem
	17. Exploitation of marine resources
<p>6. Goal: To recognize the threat to coastal zones posed by climate change and to ensure appropriate and ecologically responsible coastal protection.</p>	18. Widespread coastal erosion
	19. Sea level rise
	20. Climate change effects and extreme climatic conditions
	21. Flooding



1967

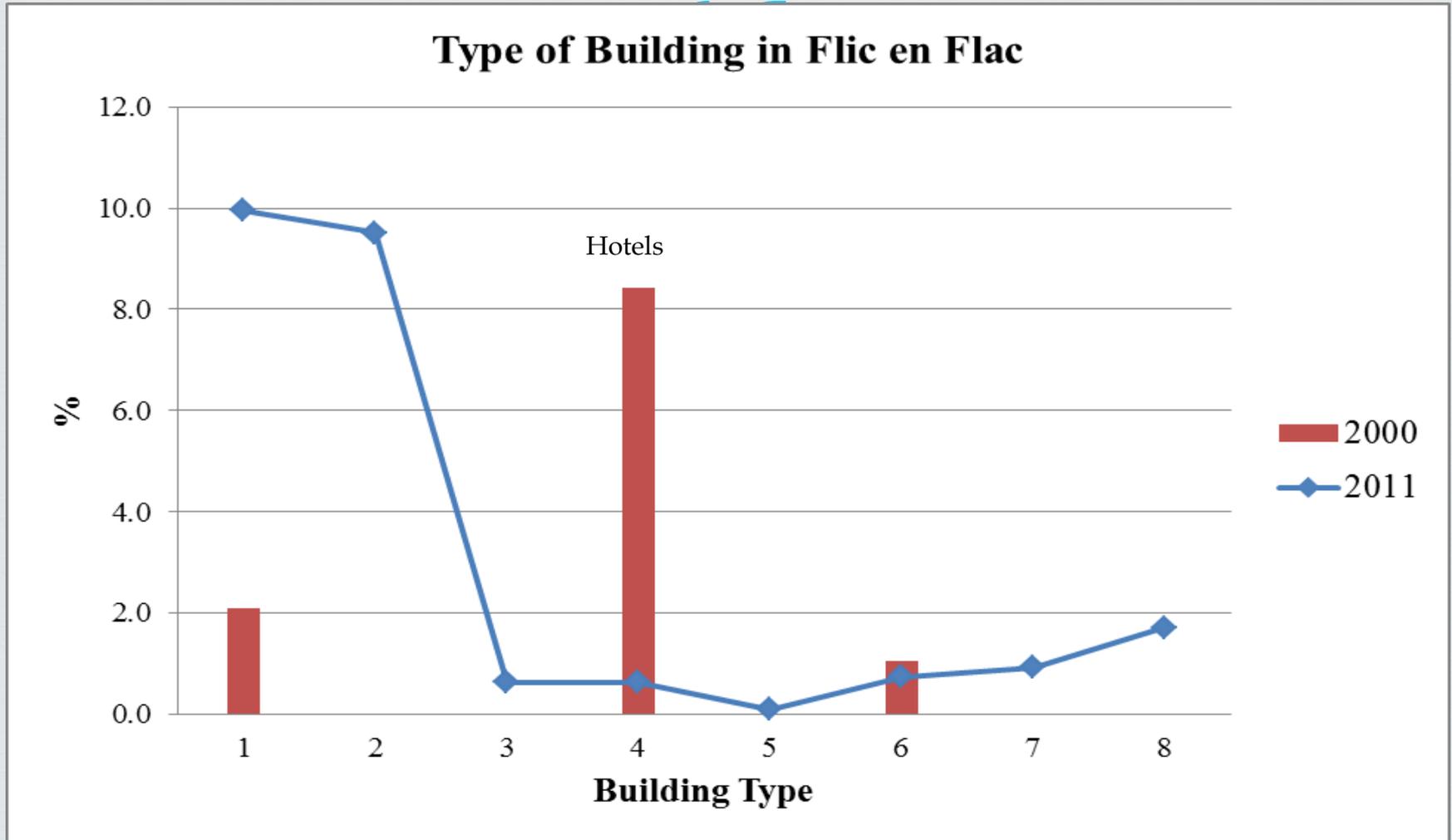


1991



2008

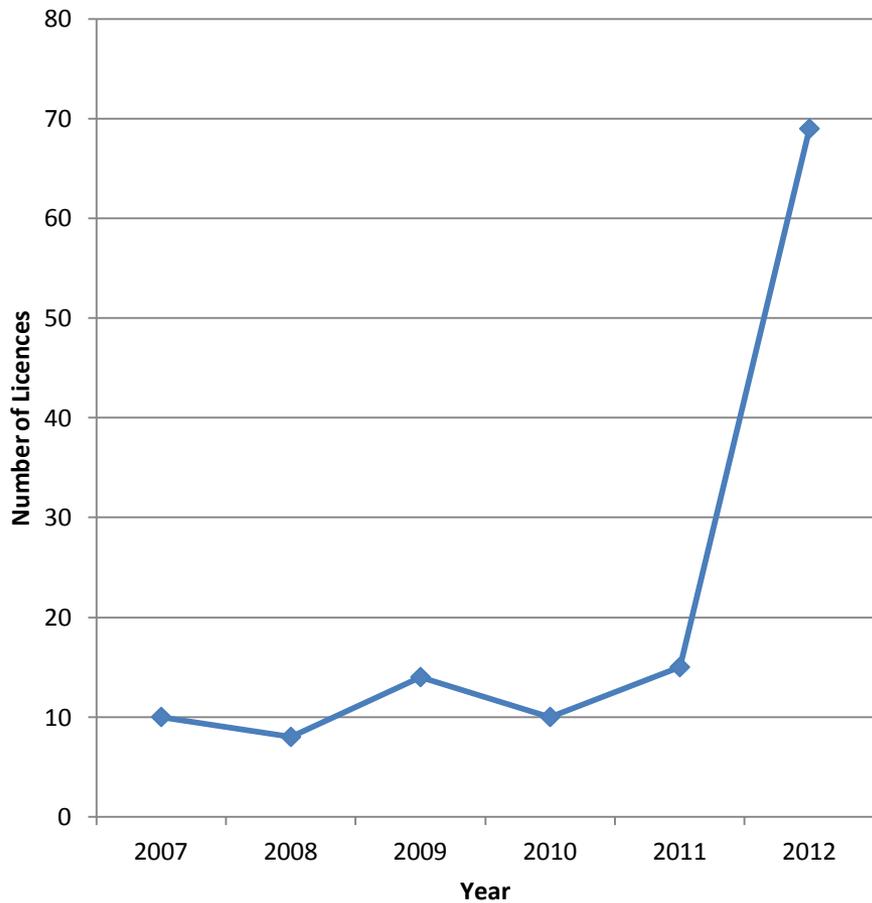
Type of building in Flic en Flac



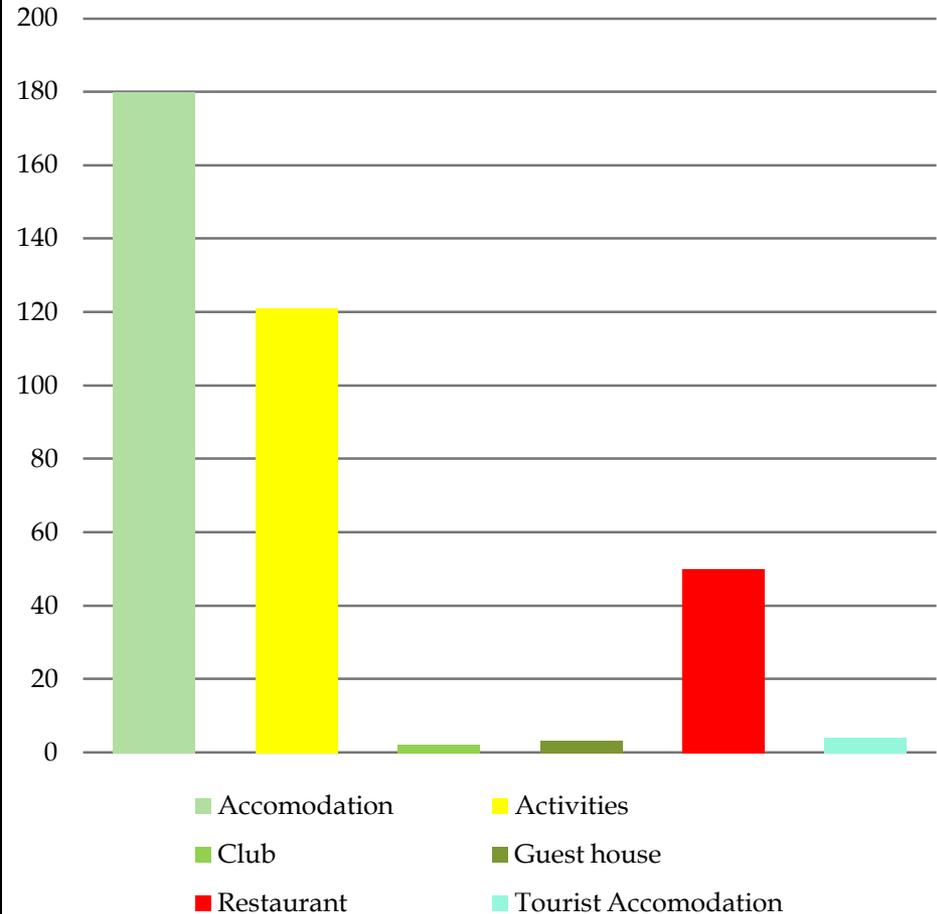
Licences Issued in Flic en Flac



Pleasure Craft Licences

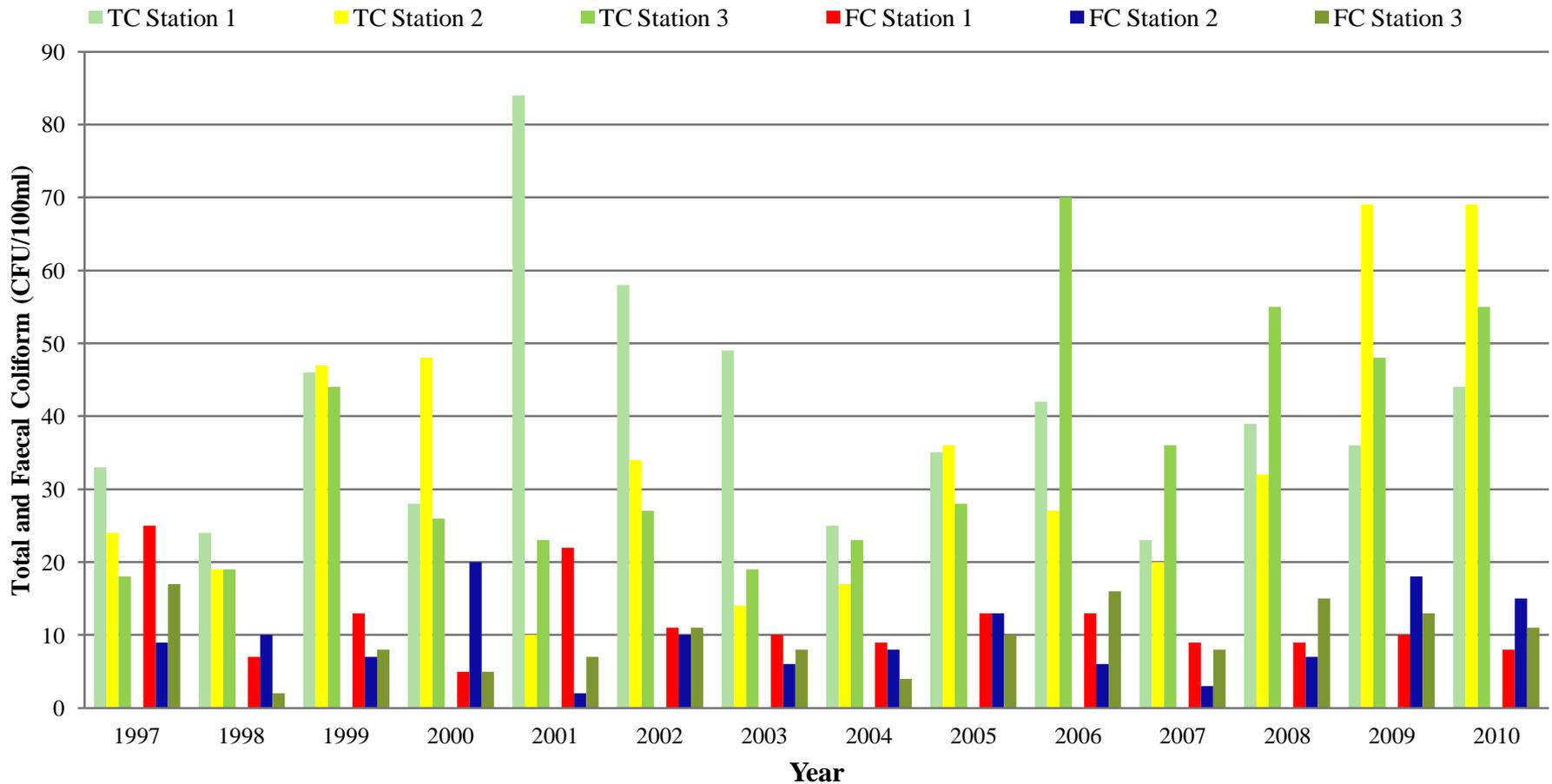


Number of Licences



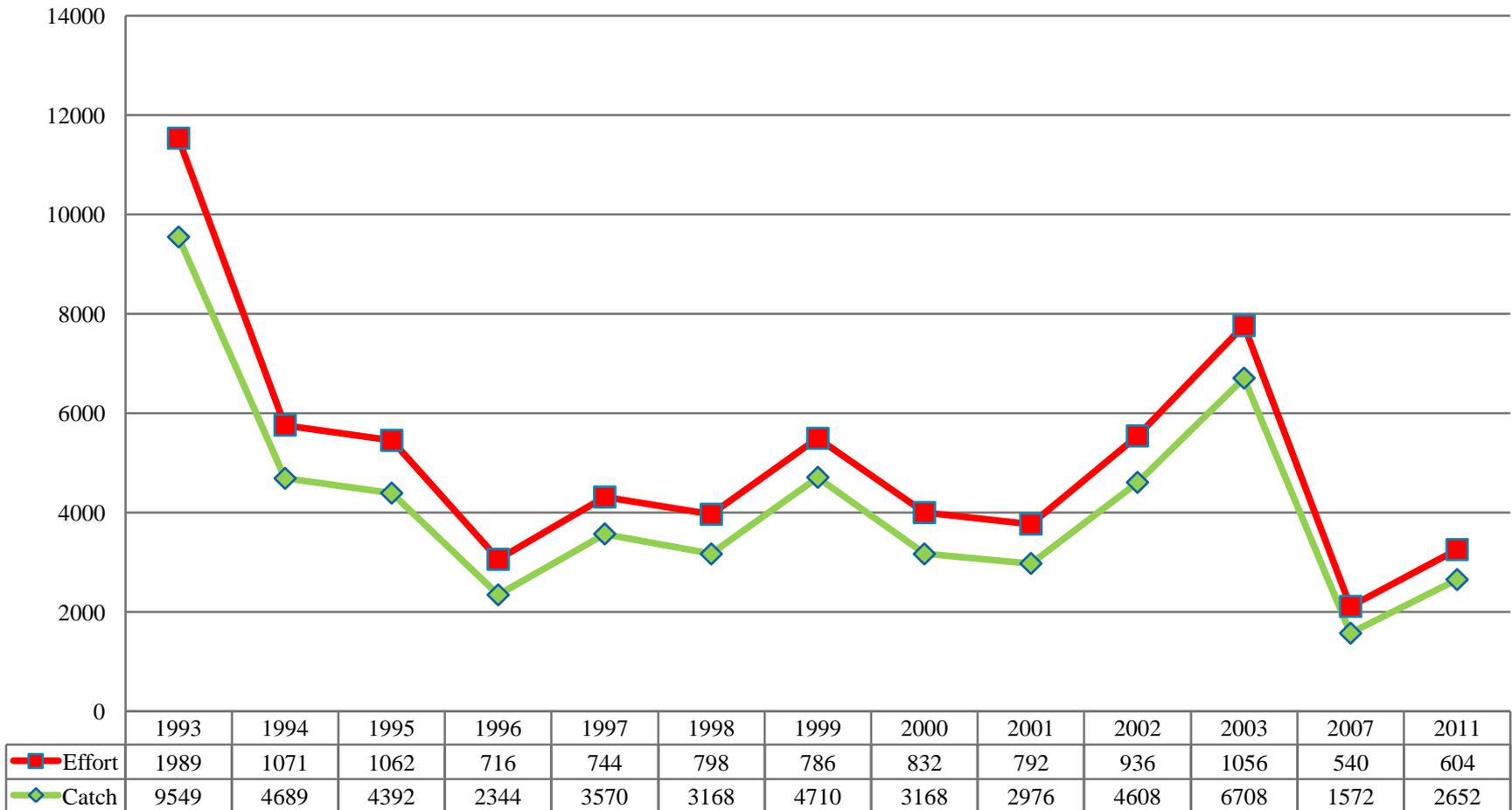
Faecal and Total Coliforms Monitoring

Bacteriological Data: Total and Faecal Coliform



Exploitation of Marine Resources

Estimated annual catch and effort for artisanal fishery in Flic en Flac



Causal Matrix - CLD

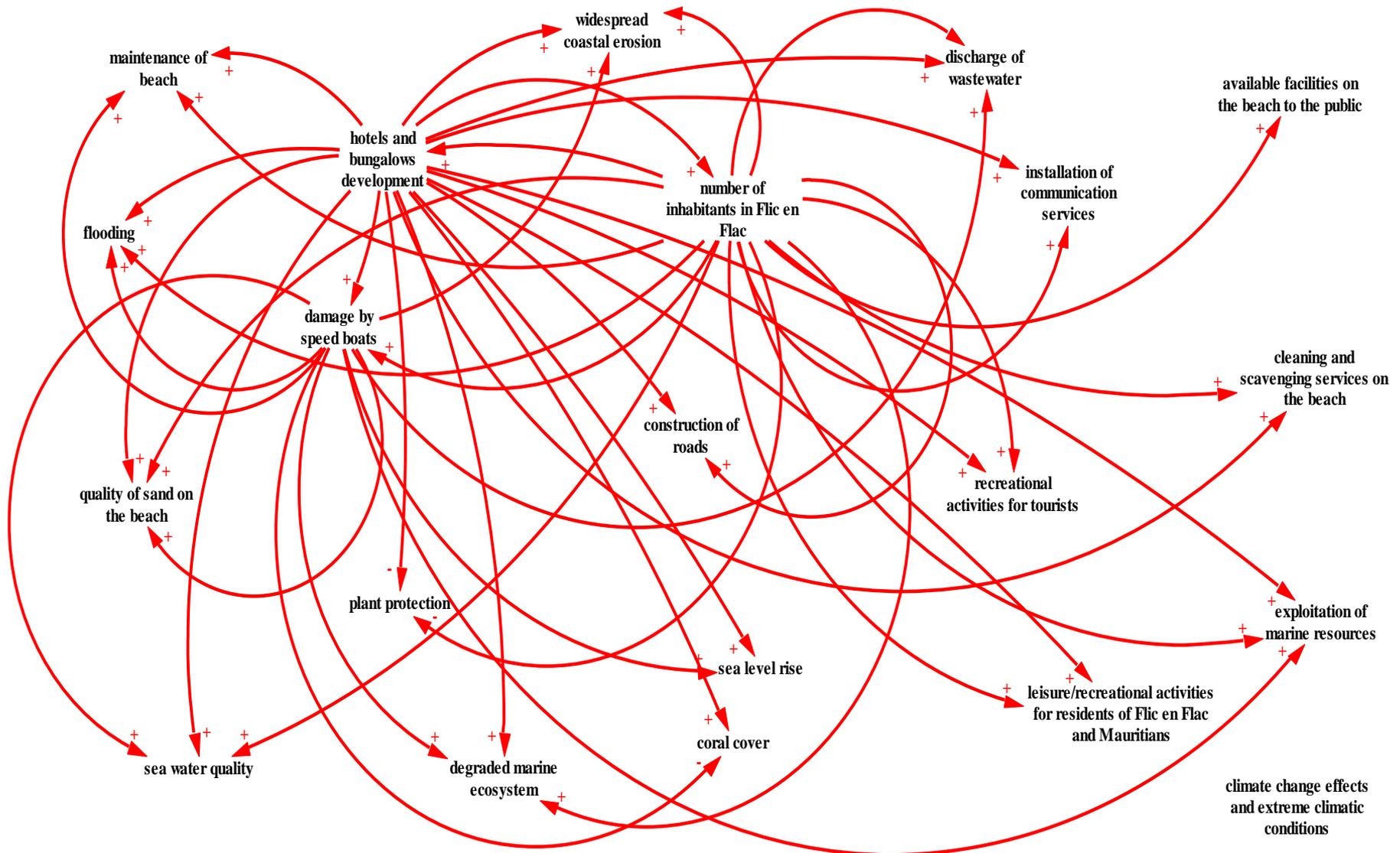


- ☞ Stakeholders views on variables: + and -
- ☞ Illustration of relationship through CLDs
- ☞ CLDs have been developed according to goals

Causal Matrix

		PHYSICAL						ECOLOGICAL						ECONOMIC				SOCIAL		ADMINISTRATIVE		
		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21
PHYSICAL	V1	+		+						+												
	V2	+	+	+			+			+	+					+	+					
	V3	+		+	+			+	+					+	+	+						
	V4	-		-	+	-	-	-	-	+	-	-	-	+	-	-	-		-	-	-	-
	V5	+	+	+	-	+	+			+	+	+	+	-		+	+	+	+	+	+	+
	V6	+		+			+		+	+					+							
ECOLOGICAL	V7	+		+			+	+														
	V8	+		+			+	+	+													
	V9	+		+				+	+	+			+		+							
	V10	+	+	+	-	+	+	+		+	+	+	-	+	+	+	+	+	+	+	+	
	V11	+	+	+	-	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	
	V12	+		+				+				+	+									
ECONOMIC	V13	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
	V14	+		+			+	+	+				+	+	+	+						
	V15			+				+	+				+	+	+	+						
	V16	+	+	+		+	+			+	+	+	+	+	+	+	+	+	+	+	+	
SOCIAL	V17	+	+	+		+	+			+	+	+	+	+	+	+	+	+	+	+	+	
	V18	+	+	+	-	+	+				+	+	+	+	+	+	+	+	+	+	+	
ADMINISTRATIVE	V19	+	+	+		+	+				+	+	+	+	+	+	+	+	+	+	+	
	V20																					
	V21	+	+	+		+	+				+	+	+	+	+	+	+	+	+	+	+	

CLD - Goal 1



Discussion & Conclusion



- ❧ 21 variables
- ❧ EU ICZM recommendation
- ❧ Data collection from local institutions

- ❧ Causal matrix
- ❧ Relationship between variables: + and -
- ❧ CLDs: illustration of relationship between variables:
 - ❧ +: one variable causes an increase of the other variable
 - ❧ -: one variable induces a decrease of the other



Thank You!

