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The transformation of coastal governance pattern from Human ecology to political ecology—A case study of Jimei Peninsula, Xiamen, China

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Abstract: The coastal zone, situated at the sensitive interface between land and sea, serves as a pivotal area of extensive human economic activities. As one of China's economic special zones, Xiamen exemplifies the comprehensive trajectory of coastal governance in China. This research adopts an interdisciplinary approach grounded in historical geography and political ecology, employing data collection methods encompassing historical literature, field surveys, and interviews. The research findings indicate that: (1) The year 1994 witnessed the pivotal role played by the United Nations Convention on the Law of the Sea (UNCLOS) in connecting Jimei Peninsula from a local context to the international arena, thus signifying a momentous turning point in the process of scale reconstruction. However, the subsequent implementation of the Coastal Exclusion Policy in 2002 had detrimental consequences, leading to the disintegration of the local scale, the erosion of maritime culture, and the disregard for the livelihood security of displaced coastal populations. (2) The Coastal Exclusion Policy serves as an instrumental tool for implementing scale politics, while its functional realignment has had profound implications for the coastal zone, encompassing economic transformation, ecological degradation, and the marginalization of the socio-cultural fabric that intertwines humans and the coastal environment.

Keywords: Coastal Exclusion Policy; Governance; Scale; Function Shift

1. Introduction

Since the official enactment of the United Nations Convention on the Law of the Sea (UNCLOS) in 1994, global attention towards marine governance has gradually increased. This shift can be attributed to expectations for environmental sustainability [1] as well as considerations regarding the security of maritime spaces and resources [2].

From an ecological geography perspective, the marginality of geographic environments is a hotspot for biodiversity. Species residing at the edge of ecosystems often exhibit high adaptability. Coastal zone species commonly possess the following characteristics: genetic adaptations for the biotic evolution of marine and terrestrial environments [3] , the ability to exchange and absorb energy between marine and terrestrial habitats [4] , strong adaptability with population extinction having cascading effects on plant ecology [5, 6] , and habitat destruction as a primary cause of extinction [7, 8]. The coastal zone, including the terrestrial, intertidal, and nearshore marine areas, represents the interface between land and sea, extending a certain width on both sides of the coastline. Although there is no unified definition for its extent, it is known to possess characteristics such as risk, sensitivity, openness, and complexity [9-12] . It constitutes a complex socio-economic and ecological composite regional system, characterized by conflicting and acute human-environment relationships. Despite being the most biodiverse region, it remains the most

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impoverished academic desert due to the uncertainty in enhancing effective conditions for coastal population replenishment [13-15]. Therefore, the coastal zone is the cornerstone of sustainable development, requiring resilience to face various impacts and the regulation of social governance systems.

The global governance of Coastal zones is primarily focused on two main aspects: resources and activities [16]. For example, the centralized coastal governance pattern implemented by the central government in Malaysia represents a case of national-level coordination. It involves the development of comprehensive governance plans, including national wetland policies and initiatives for beach conservation [17]. On the other hand, countries such as Northern Ireland, Japan, Victoria in Australia, Indonesia, and Brazil demonstrate examples of governance at the integrated local scale. In these cases, coastal communities, local residents as volunteers, non-governmental organizations, and civil society organizations participate in coastal zone governance, effectively carrying out functions of supervision, implementation, governance, and research [18-22]. These examples illustrate that countries have undergone governance processes that involve multiple political scales. Furthermore, scholars have recognized that in the context of increasing competition over marine resources globally, the coastal zone has become a site of degradation, marginalization, disputes, and conflicts. With the growing human activities in the marine environment, scholars advocate for a greater emphasis on the political dimensions of ocean and coastal governance research [23].

In recent years, there has been a noticeable increase in approaching ocean issues from the perspective of political ecology. Political ecologists focusing on the marine environment have begun to analyze how power operates in ocean and coastal environments [23], indicating the explanatory power of this research approach in coastal zone studies. Studies involving political ecology in coastal governance mostly explore four aspects: power and politics, knowledge and narratives, scale and history, justice and fairness [24]. Political ecologists argue that scale is constructed by actors in social and political contexts to maintain or reconfigure power relations [25].

Chambers, Helgadottir, Carothers, and others discuss how the power and influence of large fishing conglomerates consolidate control and ownership over the Icelandic fisheries, marginalizing small-scale fishermen and coastal communities in national politics [26] . Stonich examines the impact of tourism development on the health of local water, land, and marine resources using the case of the Bay Islands of Honduras, emphasizing the vulnerability of the poorest residents to the related environmental changes [27]. Ajibade discusses the creation of the Eko Atlantic project in Nigeria from an environmental perspective, exploring how it reshapes the risk landscape and further marginalizes certain groups and future generations [28]. Donkersloot and Menzies explain how Irish fishing communities and fleets have been influenced by external political forces, thereby affecting the actual choices of coastal fishermen [29] . However, Vazquez argues that these governance measures are not well-suited to the ecological environment and overlook local voices, failing to address deeper structural issues of resource governance and acquisition to respond to environmental change [30] . Political ecology often focuses on the "local" arenas of political contestation outside formal institutions, including cultural and symbolic competitions as well as everyday resistance within families, communities, and civil society [31]. Most of the aforementioned studies concentrate on the influence of economic systems and policies on the environment, with limited attention to the relationship between environmental degradation and local residents. There is also a lack of research that examines the connections between human-political transitions and ecological degradation.

The coastline of China is approximately 18,000 kilometers long. The comprehensive governance of coastal zones in its true sense began in 1994 with the cooperation between China and the United Nations Development Programme (UNDP). It was only in 2004 that the country started considering integrated land-sea governance as a national strategy [11] . However, prior to this, China's coastal provinces had already been the fastest developing regions in the country. Studies have indicated that by 2017, the per capita GDP in coastal zone areas was close to that of high-income countries [11, 32]. On the other hand, the high

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intensity of land development and population density in these Coastal zones have resulted in significant social and environmental changes, resource pressures, coastal pollution, continuous decline in ecosystem health, and increased environmental risks [10, 33-35] . These issues indicate that the economic benefits of coastal zones are not proportionate to the governance of their ecological environment.

Xiamen, on the other hand, has been one of the pioneering cities in implementing coastal zone governance in China and has achieved remarkable success in international coastal governance [36, 37]. However, recent research has shown that the ecological environment in the maritime area centered around Xiamen is deteriorating. This includes a reduction in biodiversity and species numbers, with the population of Chinese white dolphins decreasing by nearly 50% from 2004 to 2019 [38]. The development of tourism in Xiamen has led to the conversion of some habitats of Xiamen wrasses into tourist attractions, resulting in a continuous decrease in their population and habitat space[39]. A comparison between the data from a 2015 survey on marine animal resources and historical data revealed a significant decline in the number and species of marine animals [40]. Over the past few decades, the degree of human-induced artificialization along the coast has increased significantly, with the construction of ports, docks, and bridges occupying a large portion of the coastline, leading to a significant decrease in fishery resources [39, 40].

The aforementioned research conclusions indicate that the governance pattern implemented in the coastal zone of Xiamen since 1994 has had negative impacts on both the natural and human ecological systems. Moreover, the uniqueness of the Xiamen case lies in its direct linkage from the local to the international level in terms of political scale. The transformation of the governance pattern has had disruptive effects, influenced by international laws and regulations, which have had impacts on local culture and ecology but have received limited discussion.

Studies on the intersection of human ecology and political ecology in the context of coastal governance have mainly focused on geography[41, 42]. However, there is still a research gap regarding the transitional phase of human ecological and political ecological aspects in coastal governance. Therefore, the main objective of this study is to explore the changes in coastal governance in the Xiamen Coastal zone over the past 30 years. The viewpoint advocated in this research is that the current issues in coastal governance in China arise from the uncertainty in the methods of human and political transformation/connection/buffer zones and the ambiguity of the governance targets. While coastal governance measures focus on enhancing economic value and protecting the ecological environment in Xiamen, they often overlook the integration of culture and the rule of law. This study aims to explain the relationship between the scale variation of coastal governance patterns- and ecological degradation through case analysis.

2. Materials and Methods

2.1 Study Area

This study focuses on the Jimei Peninsula in Xiamen City, as shown in Figure 1, which is located at the junction of the eastern and western sea areas of Xiamen. The coastal zone at the southern tip of the Jimei Peninsula is one of the few areas in Xiamen that remains relatively unchanged, and it is also one of the few living areas that still retains the culture of southern Fujian. Administratively, it falls under the jurisdiction of Xiamen City. However, its unique development history fully reflects the contradiction between culture and the rule of law. Prior to 1994, the fishermen of Jimei Peninsula followed traditional fishing and aquaculture practices, such as small-scale aquaculture, seasonal fishing, and fishing bans during breeding periods, allowing the marine environment time for self-recovery. It was only in 1994 when Xiamen established a marine group dedicated to coastal zone governance and subsequently issued policies and notices such as the "Functional Zoning of Xiamen Sea Areas," "Regulations on the Use and Governance of Xiamen Sea Areas," "Several Provisions on Xiamen Marine Environmental Protection," and "Inte-

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grated Rehabilitation of Aquaculture Prohibition in the Western Sea Area." Only after expanding the scope of marine governance to the coastal zone did the relationship between Jimei fishermen and the ocean begin to change, as this meant that all fishermen in Jimei Peninsula had to withdraw from the economic sphere of the coastal zone.

The Jimei Peninsula is located in the northwest of Xiamen City, Fujian Province, with geographical coordinates ranging from 117.57°E to 118.04°E and 24°25' to 24°46'N latitude. Its land area is approximately 275.79 square kilometers [43] . The Jimei Peninsula features a combination of various geographical features, including low mountains, hills, plateaus, plains, and coastal tidal flats, as it is situated in a transitional zone between land and sea. This has contributed to the formation of a semi-fishing and semi-agricultural society [44] . The maritime area of the Jimei Peninsula is approximately 40 square kilometers. Due to natural siltation, land reclamation, and the construction of reservoirs along the coast, the coastline and tidal flats have gradually reduced, and some areas have experienced varying degrees of pollution. Before 1956, the coastline of the Jimei District consisted of the coastlines of the Jimei Peninsula, Xinglin Bay, Xinglin Peninsula, Maluan Bay, and islands in Xinglin Bay, which were relatively long. However, with the construction of Xinglin Dam (Xinglin Reservoir) and Xinglin Bay Reservoir, as well as extensive land reclamation, the coastline has gradually shortened. The scope of this study is defined as east to Jimei Bridge, south to Antarctic Ao Garden, west to Ten Mile Causeway, and north to the end of Xinglin Bay Greenway.

Figure 1. Study Area

2.2 Study Framework and Method Design

By incorporating perspectives from Human Ecology [45] and New Human Ecology [46] , it is possible to effectively explain the pattern of the Jimei Peninsula prior to 1994. However, after 1994, while the distribution of educational spaces remained stable, the coastal zone underwent significant changes that cannot be explained using methods from

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human ecology. This study is a continuation of the human ecological perspective on the Jimei Peninsula [47] , focusing on the land use changes in the coastal zone.

Political ecology is a discipline that focuses on the study of environmental changes and the interactions between society and nature [48] . It emphasizes the relationship between social and environmental systems and their dynamics[24] . It also highlights the interconnectedness at different scales and the dialectical nature of human-environment relationships [24, 49] . Scale is an important topic in political ecology, as it is socially constructed, and actors manipulate scale to achieve specific outcomes[49]. The concept of scale politics, originally proposed by Smith, refers to the expansion of scale to achieve certain political goals [50] . Furthermore, it highlights how scale is produced and reproduced as a political strategy [51].

Since the implementation of China's reform and opening-up policies, it has undergone a transformation from isolation to global interaction, which has sparked intense discussions on scale politics and even led to the proposal of theoretical models applicable to China [52, 53] . However, this study believes that the broad nature of social science should lean towards empirical research using diverse local cases in order to expand the multifaceted implications of scale politics and achieve a more realistic understanding. The land use changes in the coastal zone of the Jimei Peninsula, influenced by strong global interactions, have undergone reform through the process of scaling and scale intersections, with weak local responses. Scale politics is a reality that exists without conflicts but has led to various environmental deteriorations. This study suggests that the key to these deteriorations should occur in the transition between human ecology and political ecology, as shown in Figure 2.

From the perspective of scale politics, political ecology in this process may be influenced by Marxism and inclined towards the analytical methods of political economy, viewing the relationship between humans and nature from a socio-historical perspective. Therefore, this study adopts methods such as case analysis, analysis of secondary literature, and field surveys. Firstly, official and unofficial public data are collected, followed by the analysis of media materials, and interviews with fishermen (Table 1) are conducted. The data is then integrated and coded. By examining policies, comparing the temporal nodes of policies with the graphical representation of coastal spatial changes in the Jimei Peninsula, this study aims to explain how coastal line changes are influenced by policy changes.

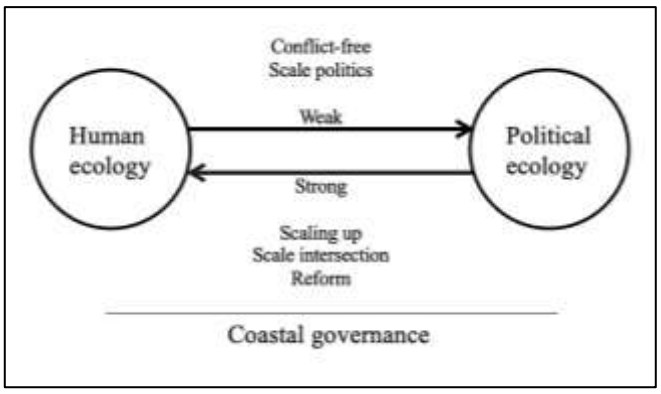

Figure 2. Research Framework Diagram

2.3 Research materials

There are two main sources of analysis: one is secondary literature on coastal zone governance, including official and institutional information, official statements, internal meeting minutes, research reports, planning reports, survey reports, etc. The second is the interview records of various institutions and residents of coastal fishing villages, which represent unofficial opinions.

Table 1. Overview Table of Interviewees and Summary.

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Case	Code	Gender	Age	Background of interviewee and Interview Summary	Time of Interviewed
1	M-a	Male	About 70 years old (Mr. Chen)	Reside in Jimei Dashe, belonging to the Chen clan of Dashe. Has been living near the Jiageng Memorial Hall since birth. Engaged in aquaculture in the coastal waters near Jimei Bridge. Prior to the implementation of the coastal Exclusion Policy in 2002, cultivated clams as a sideline. Received compensation when Jimei implemented the Coastal Exclusion Policy in 2006. The interviewee has experienced the entire process of coastal governance in Xiamen.	2023-04-15
2	M-b	Male	About 20 years old (Mr. Chen, student)	Reside in Jimei Dashe, belonging to the Chen clan of Dashe. Born in 2000 and has been living in Jimei Dashe. During the period of the Coastal Exclusion Policy, the interviewee was still young and lived near the Jiageng Memorial Hall. Used to play on the beaches near Ao Garden when young, thus having a clear understanding of the changes in the coastal environment.	2023-04-15
3	M-c	Male	About 30 years old (Mr. Chen, boss)	Reside in Xiang'an District, belonging to the local residents and fishermen. Owns a fishing boat and relied on aquaculture and fishing for a living in the village over twenty years ago. Joined the father in going out to sea at a young age and personally experienced the process of coastal governance in Xiamen. Has deep insights into the Coastal Exclusion Policy and other policies.	2023-04-16
4	F-a	Female	About 40 years old (Ms. Chen)	Reside in Jimei Dashe, belonging to the Dashe residents. Has been operating a vegetable stall in the area for many years and has a clear understanding of the changes in local seafood harvest.	2023-04-20
5	M-d	Male	About 50 years old (Mr. Chen)	Reside in Jimei Dashe, belonging to the Dashe residents. Has been operating a vegetable stall in the area for many years and is responsible for sourcing vegetables and seafood. Has a good understanding of the changes in Jimei Dashe's aquaculture households and the fishing and aquaculture situation in the surrounding waters.	2023-04-20
6	F-b	Female	About 60 years old (Ms. Chen)	Reside in Jimei Dashe, belonging to the Dashe residents. Buys oysters from seafood vendors for further processing and selling to oyster pancake businesses. Engaged in this activity on a daily basis and has a clear understanding of the changes in the source of seafood during the coastal governance period in Xiamen.	2023-04-20
7	F-c	Female	About 50 years old (Ms. Lin)	Reside near Beihai Bay and often take children to dig clams under Jimei Bridge. Has a profound experience of the entire process of coastal governance in Xiamen. Believes that the seawater has been purified, the amount of garbage has reduced, and the scenery has become more beautiful, but the area of intertidal flats has decreased.	2023-05-29
8	M-e	Male	About 50 years old (Mr. Liu)	Reside near Xinglin Bay, originally from Henan province. Discharged from the military and relocated to Xiamen in the 1980s. Has a deep understanding of the ecological changes in Xinglin Bay, which used to be an aquaculture farm with a poor environment. Considers Xiamen's coastal governance to be quite effective, with improvements in ecological and residential environments. Personally, witnessed the landscape construction of the Xinglin Bay coastline.	2023-04-09
9	M-f	Male	About 30 years old (Mr. Chen)	Resides in Jimei Dashe, a local resident responsible for enrolling students at Chen's Elementary School. Has frequent contact with local residents and has knowledge about various aspects. Has experienced the transformation of the lifestyle of Dashe residents during the coastal governance in Xiamen over the past twenty years. Previously, family members were engaged in fishing, thus having a good understanding of fishing and aquaculture. Has a detailed understanding of the changes in the coastline and believes that the beaches are now artificially filled, and local people are no longer engaged in marine occupations. Conducted using the focus interview method.	2023-05-30
10	M-g	Male	About 50 years old (Mr. Chen)	Resides in Jimei Dashe, a local resident who personally experienced the transformation of the local residents' way of life. Used to dig clams with friends on the	2023-05-29

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				beach as a child. Familiar with the changes in the coastline and has family members who used to be fishermen or engaged in aquaculture but have now switched to other occupations.	
11	F-d	Female	About 40 years old (Ms. Chen)	Resides in Jimei Dashe, a local resident and community staff member. Has a good understanding of the lifestyle of Dashe residents and is knowledgeable about the work arrangements for fishermen after coming ashore. Believes that local residents have security after coming ashore, and the scenery and ecological environment in Dashe have improved. Conducted using the focus interview method.	2023-05-30
12	F-e	Female	About 30 years old (Ms. Lin)	Resides in Jimei Dashe, a non-local resident who joined the community and is responsible for the labor security of Xunjiang community residents. Previously, helped unemployed fishermen find work before 2018, but in recent years, the employment situation of fishermen coming ashore has become more stable. Conducted using the focus interview method.	2023-05-30
13	F-f	Female	About 40 years old (Ms. Chen)	Resides in Jimei Dashe, a non-local resident who joined the community and is responsible for resolving disputes among Xunjiang community residents. Has knowledge of the work arrangements for fishermen in Dashe and is familiar with the current working methods in the area. Conducted using the focus interview method.	2023-05-30
14	F-g	Female	About 50 years old (Ms. Chen)	Resides in Jimei District, a long-standing community employee with a clear understanding of the development in Dashe. Experienced the entire process of implementing coastal governance policies in Xiamen and believes that the policies have been effective in improving water quality, managing fishermen, and protecting the ecological environment. However, there have been changes in the lifestyle of fishermen. Conducted using the focus interview method.	2023-05-30
15	M-h	Male	About 50 years old (Mr. Lin)	Resides in Xiamen Siming District, moved to Jimei Normal School with parents at the age of eight and attended Jimei Elementary School. Grew up and worked in Jimei District. Often went to the beach with friends when young and has a deep understanding of coastal development. Believes that the coastal zone before 1987 was better than it is now.	2023-05-31
16	M-i	Male	About 30 years old (Mr. Chen)	Resides in Jimei Dashe, a resident of the area and a sailing enthusiast. Grew up by the seaside and has firsthand experience of the changes in the coastline.	2023-05-31
17	M-j	Male	About 60 years old (Mr. Chen)	Resides in Jimei Dashe, a local resident. Engages in digging clams on a daily basis to supplement household income. Buys clams from friends, processes them, and sells them to nearby businesses. Has a good understanding of the development trends of seafood in Xiamen and has personally experienced the changes in the coastline over the past twenty years of coastal governance.	2023-06-04
18	F-h	Female	About 60 years old (Ms. Chen)	Resides in Jimei Dashe, a local resident and member of the Chen clan association. Familiar with the lifestyle changes of Dashe residents and has a deep experience of the entire process of coastal governance.	2023-06-04
19	M-k	Male	About 70 years old (Mr. Chen)	Resides in Jimei Dashe, a local resident. Member of the Chen clan association, knowledgeable about the lifestyle of Dashe residents, familiar with the local living culture, and aware of the changes in the fishing community's culture.	2023-06-04
20	F-i	Female	About 60 years old (Ms. Chen)	Resides in Jimei Dashe, a local resident. Engages in the sale of fish, familiar with the fishing trends in Jimei, including fishing methods and locations, and has witnessed the changes in fishing practices over the past twenty to thirty years of coastal governance.	2023-06-04
21	M-l	Male	About 70 years old (Mr. Chen)	Resides in Jimei Dashe, a local resident and retired high school teacher. Concerned about the shift in policy development, has a keen understanding of the changes in the coastline and intertidal flats, and holds a macroscopic view of the impact of policies on the lifestyle of local residents.	2023-06-04

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* The age of the interviewees is based on the year of the interview. As much as possible, inquire about the complete personal information of the interviewees. In accordance with research ethics, the interviewees are represented by codes. The code "F" represents female, "M" represents male, "F-A" represents female A, and "M-B" represents male B.

Table 1. Historical marine policies and scales

No.	Law/Regulations	Year	Level	Scale
1	To levy Java, temporarily ban merchants and navigators from Zhejiang, Guangdong, and Fujian. (Yuan Dynasty)	1292	National	National
2	Forbid merchants to go to sea. (Yuan Dynasty)	1303	National	National
3	Banning ships from going to sea. (Yuan Dynasty)	1311	National	National
4	Prohibition of coastal residents from contacting overseas countries privately. (Ming Dynasty)	1381	National	National
5	Sea ban imposed, coastal residents head inland. (Ming Dynasty)	1387	National	National
6	Lift the sea ban, adjust the overseas trade policy, and allow the private sector to sell far and wide. (Ming Dynasty)	1567	National	National
7	Move to Sea Order. (Ching Dynasty)	1661	National	National
8	Strictly ban access to the sea. (Ching Dynasty)	1662	National	National
9	The people migrated to the mainland, and the sea was strictly prohibited, and their traffic was cut off. (Ching Dynasty)	1678	National	National
10	lifting the ban on maritime trade. (Ching Dynasty)	1683	National	National
11	Nanyang Maritime Ban. (Ching Dynasty)	1717	National	National
12	Xiamen fishermen's union was established.	1956	Municipal	local
13	Convention on the Territorial Sea and the Contiguous Zone.	1958	International	International
14	Geneva Convention on the High Seas.	1962	International	International
15	Convention on the continental shelf.	1964	International	International
16	Convention on Fishing and Conservation of the Living Resources of the High Seas.	1966	International	International
17	Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Substances, 1972 (London Convention).	1972	International	International
18	Marine Environment Protection Law.	1982	National	National
19	Maritime Traffic Safety Law.	1983	National	National
20	Regulations on Administration of Environmental Protection in the Exploration and Development of Offshore Petroleum.	1983	National	National
21	The fishermen commune was reorganized as Xiamen second Marine fishery Company.	1984	Municipal	local
22	Regulations on Control of Dumping of Wastes in the Ocean	1985	National	National
23	Fisheries Law.	1986	National	National
24	Mineral Resources Law.	1986	National	National
25	Law on Land Resources Governance.	1986	National	National
26	Regulations Concerning Prevention of Environmental Pollution by Ship-breaking.	1988	National	National
27	Environmental Protection Law.	1989	National	National
28	Law on the Protection of Wildlife.	1989	National	National
29	Regulations Concerning Prevention and Control of Pollution Damages to the Marine Environment by Coastal Construction Projects.	1990	National	National
30	Regulations Concerning Prevention of Pollution Damage to the Marine Environment by Land-based Pollutants.	1990	National	National

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31	Law on the Territorial Sea and the Contiguous Zone.	1992	National	National
32	Implementation Regulations on Protection of Aquatic Wildlife.	1993	National	National
33	The United Nations Convention on the Law of the Sea (UNCLOS).	1994	International	International
34	Regulations of Natural Protected Reserves.	1994	National	National
35	Xiamen Marine Governance Office was established.	1996	Municipal	Regional
36	Marine function zoning of Xiamen City.	1996	Municipal	Regional
37	Xiamen sea area environmental protection provisions.	1997	Municipal	Regional
38	Xiamen shallow sea shoal aquaculture governance provisions.	1997	Municipal	Regional
39	Xiamen Chinese white dolphin protection provisions.	1997	Municipal	Regional
40	Law on Exclusive Economic Zones and Continental Shelves.	1998	National	National
41	Law on the Administration of the Use of Sea Areas.	2001	National	National
42	Xiamen Ocean and Fisheries Bureau was established.	2002	Municipal	Regional
43	Law on Evaluation of Environmental Affects.	2002	National	National
44	Notice of Xiamen Municipal People's Government on the Comprehensive regulation of aquaculture prohibition in the West Sea Area. ("Coastal Exclusion Policy")	2002	Municipal	Regional
45	Port Law.	2003	National	National
46	Provisions of Xiamen City on the Administration of the use of sea areas	2003	Municipal	Regional
47	Notice of Xiamen Municipal People's Government on Strengthening Aquaculture Governance in the East Sea area of Xiamen.	2003	Municipal	Regional
48	The General Office of Xiamen Municipal People's Government forwarded the notice of the Municipal Bureau of Marine Affairs and Fisheries on the second round of Xiamen Comprehensive Coastal Zone Governance (ICM) Strategic Action Plan.	2005	Municipal	Regional
49	Regulations Concerning Prevention and Control of Pollution Damage to the Marine Environment by Marine Construction Projects.	2006	National	National
50	Notice of the General Office of Xiamen Municipal People's Government on carrying out the work of maritime boundary demarcation in the city.	2008	Municipal	Regional
51	Law on the Protection of Offshore Islands.	2009	National	National
52	Regulations on Prevention and Control of Marine Environment Pollution from Ships.	2009	National	National
53	Provisions of Xiamen City on Marine environmental protection.	2009	Municipal	Regional
54	Measures for the Implementation of Xiamen Marine Aquaculture Exit Compensation.	2009	Municipal	Regional
55	Xiamen Marine and Fisheries Bureau is divided into Xiamen Marine Development Bureau, Xiamen Ecological Environment Bureau, and Xiamen Natural Resources and Planning Bureau.	2018	Municipal	Regional
56	Measures of Xiamen for the Administration of Marine ecological compensation.	2018	Municipal	Regional
57	Opinions of Xiamen Municipal People's Government on strengthening governance of sea-related tourism.	2018	Municipal	Regional
58	The coastal landscape construction is in charge of Xiamen Municipal Garden and Forestry Bureau.	2021	Municipal	Regional

3. Results

3.1 The changes in the governance of the coastal zone in Jimei Peninsula

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During the Yuan (1292-1368), Ming (1368-1644) and Ching (1644-1912) dynasties, the maritime governance policies in Fujian province were primarily focused on implementing maritime prohibitions (Table 2, No. 1-11)[54, 55]. Sailboats were not allowed to venture into the sea, and coastal residents were encouraged to relocate inland[43]. However, these policies had minimal impact on the use of Coastal zone by fishermen, as detailed regulations for coastal governance were not explicitly established in China during that time. During the Ming dynasty (1522-1566), the Coastal zones of Jimei Peninsula maintained a dynamic balance through the interactions among fishermen, local powers, and the government [56]. The tidal flats along the coast were enclosed by fishermen or residents and turned into productive fields known as "Haitian(means the fields in the sea)" which became valuable assets that could be bought and sold [57]. Conflicts over encroachment or trade occasionally occurred[58]. Despite the implementation of maritime prohibitions by the Ming rulers and the compliance of local authorities, the immense profits from smuggling trade strengthened the control of wealthy merchants along the Coastal zones of Fujian[59, 60]. Although there were instances of property disputes in the Coastal zones, fishermen implemented fishing bans during the spring and summer seasons to provide time for marine ecosystems to recover and ensure long-term harvests[56].

The governance pattern of the Coastal zone, characterized by multi-party interactions, underwent significant changes in 1625. On Jimei Peninsula, the Chen clan, with the emergence of a Jinshi (degrees in ancient China) by the named of Chen Wenrui, who entered the national bureaucratic system, promoted the growth of the clan's power and integrated the powers of the government and local elites. As a result, the Coastal zone of Jimei Peninsula began to be jointly managed by the clan and the fishermen[61]. There was competition among different clans for control over intertidal zones, with the Chen clan emerging victorious and entering a period of exclusive control over the Coastal zone[47]. The Chen clan held control over the land and governance of the Coastal zone, which continued until the early 20th century. Public infrastructure development in Jimei Peninsula required the purchase of land from the clan[62]. Although various political entities in the 16th to 19th centuries had policies for managing fishermen organizations, the semi-enclosed and remote geographical location of Jimei Peninsula hindered effective policy implementation. Therefore, the governance of the Coastal zone continued to be dominated by clan and kinship relationships[63]. As a result, the fishermen's organizations in the area did not go through the transition from fishermen associations and public offices to fishermen's cooperatives[60]. It was not until 1956, when natural resources were nationalized, that the Coastal zone came under unified government governance. Xiamen implemented fishery cooperatives and established the Fishing Union (M-k, F-h). The surrounding fishermen began to engage in fishery work organized by the government[43].

Regarding the political scale of Jimei Peninsula, it was limited to the local level until 1956, with overlapping roles between the government and the clan, and consistent scale. After the nationalization of natural resources, the political scale expanded to the national level, with the basis of administrative regulations by the state and the regional scale primarily executed by local governments[64]. Since then, the political scale of the Coastal zone in Jimei Peninsula consists of three dimensions: national, regional (including semi-regional), and local.

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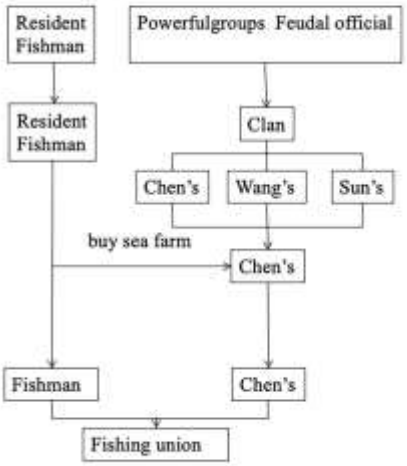
year	event	coding	governance patten
Before 1625	The government imposes a sea ban Smuggling at sea is hugely profitable	Multi-party battles	
1625	A Jinshi appeared in the Chen clan, integrating the power of the government and the powerful	Clan and Fisherman	
1913	The Chen clan controls the fishery tidal flat resources of Jimei Dashe and needs to buy land from them	Clan exclusive	
1956	The nature of the country has changed, natural resources have been nationalized, and the government has unified management	State-owned property rights Fishing union Blood family relationship	

Figure 3. Human ecological governance pattern (before the year of 1956)

3.2 The scale politics and functional shift in coastal zone governance

Before 1980, China's focus on resource utilization was primarily centered around land resources, with less attention given to marine resources[65]. Between 1982 and 1993, the government introduced a series of regulations(Table 2, No. 18-32) to provide guidance for coastal zone governance[36]. During this period, a top-down or centralized approach was still employed to manage natural resources. However, with rapid economic development, coastal cities and foreign investments intensified marine economic activities. These dense maritime activities led to issues such as disorder, overexploitation of marine resources, and environmental degradation[64].

Although the UNCLOS came into effect in 1994, the power and responsibility relationships regarding coastal zone governance in Xiamen City were unclear. Various departments had overlapping jurisdiction and functions, leading to conflicts and contradictions when addressing issues such as conflicts between fishing and maritime transport zones, disputes among fishermen, water quality degradation[43], and siltation of mudflats. In order to gain more benefits and avoid troublesome problems, these institutions competed with each other and shifted responsibilities[36].

However, in 1994, Xiamen City obtained legislative authority and became a pilot city for coastal zone governance under the United Nations Partnerships in the Environmental Governance for the Seas of East Asia (PEMSEA) organization[36]. As a result, the Xiamen municipal government and an expert team formed the Marine Integrated Governance Coordination Group to resolve coastal conflicts[36]. From 1996 to 2002, various regulations (Table 2, No. 36-44) were introduced for coastal demarcation, functional zoning, usage governance, and protection, aimed at achieving sustainable development of marine resources.

The year 2002 marked a turning point in coastal zone governance. The "Comprehensive Rehabilitation of Aquaculture in the Western Sea Area" policy, commonly known as the "Coastal Exclusion Policy" was implemented, completely prohibiting aquaculture activities in Xiamen Island, Jimei Peninsula, Xinglin, and Haicang, with the goal of protecting the marine ecological environment and enhancing the functionality of the western sea area as a shipping channel. In 2006, the prohibition on mudflat aquaculture was implemented in Jimei Peninsula, and fishermen who violated the ban were penalized[66]. Between 2010 and 2021, land reclamation plans and the marketization of marine resources were carried out in the coastal zone, with sea area usage rights being outsourced through

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bidding, auctioning, and listing processes. In 2021, the coastal line of Jimei Peninsula officially transformed into a tourism and recreational area through regulations (Table 2, No. 58).

The regulatory transitions from 1994 to 2021 brought two major changes: first, clarifying the responsibilities and ownership of coastal zone governance, and second, shifting the focus of the coastal zone from mudflat aquaculture to tourism and recreation. In 1994, Xiamen City, as a pilot city under the United Nations program, gained political support for sustainable development of marine resources, applying the principles of international maritime law to the western sea area and elevating the governance pattern of Jimei Peninsula from a joint governance at national, regional, and local levels to an international scale (Figure 4).

year	event	coding	governance patten
1956	The nature of the country has changed, atural resources have been nationalized, and the government has unified management	National scale	
1980	Pollution governance	National scale	
1982-1993	Union governance	National scale	
1994	UNCLOS	International scale	
1996-2002	Boundary survey Functional division Management and Protection	Local scale	
2002-2006	Regulation of aquaculture prohibition in the West Sea Area (Coastal Exclusion Policy)	Local scale	
2010	Reclamation of land and sea	Regional scale	
2019	Outsourcing Marketization	Regional scale	
2021	Sightseeing	Local scale	

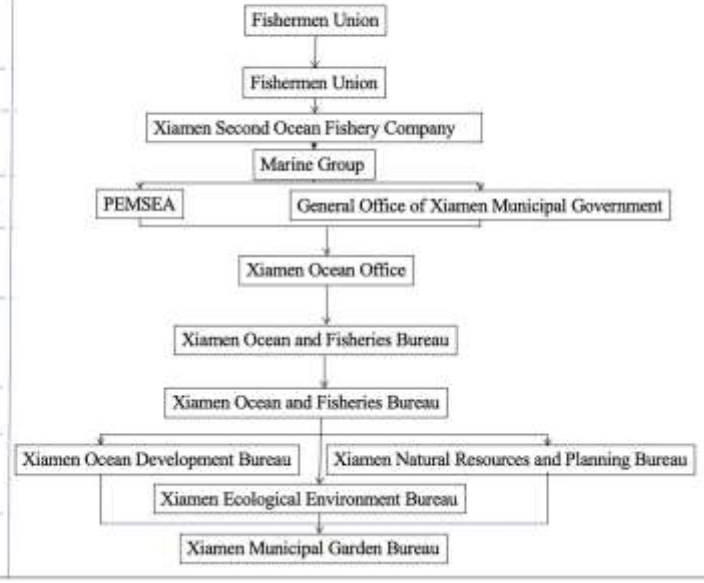

Figure 4. Political ecological governance pattern (after the year of 1956)

3.3 The effects of scale politics

Starting from 1994, coastal zone governance was implemented in Xiamen, focusing on measures such as shoreline restoration, reduction of land-based pollution, and protection of marine habitats to improve the water quality in Xiamen waters and restore the marine ecosystem (M-e) [36-38, 67]. The positive environmental restoration data validated Xiamen's role as a pilot city, and the governance pattern at the international scale received support and recognition. However, the effects of the disintegration at the local scale were overlooked.

In 1956, although the ownership of coastal zones belonged to the state, the actual governance was still carried out by the fishing cooperatives formed by fishermen and clans. To ensure long-term harvest, a governance pattern of timely fishing was implemented. For example, in Dashe Fishing Village at the southern tip of Jimei Peninsula, small fishing boats were mostly operated by individual households, with one or two people conducting fishing operations. Before the fishing season, especially before the first fishing trip after the Chinese New Year, they would collectively go to the Eastern Tianfei Temple and the Western Dragon King Temple for worship (F-h, M-k). This shared belief and customs enhanced the cohesion of local fishing communities[43, 61]. However, in 1994, the governance regulations at the international scale, implemented through the Coastal Exclusion Policy, reached the local level. The existing pattern of local joint gov-

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ernance disintegrated due to many fishermen accepting compensation for Coastal Exclusion Policy (M-d, M-j, M-g, F-a, F-b). Meanwhile, capable corporate fishing companies joined the fishing cooperatives, and the original fishing cooperatives integrated their resources to become Xiamen Second Marine Fisheries Company, which later became the Marine Group[68] . The fishing cooperatives moved away from the governance units and transformed into purely capitalist entities, changing the traditional fishing organizations that were primarily composed of fishermen and clans. The governance pattern of the coastal zone, which was based on shared beliefs and traditions, and local joint governance was lost. From the international to the local scale, the governance of the coastal zone now remained only at the international, national, and regional levels during the implementation of the Coastal Exclusion Policy.

Along with the disintegration at the local scale, the maritime culture also suffered. With the loss of fishermen and residents at sea, various skills related to the ocean gradually disappeared. For example, the craftsmanship of handmade wooden boats in Jimei[69] and the technique of fishing with extended ropes[70] slowly vanished. The inheritors of the boat-building craft lamented, "The scenery here is beautiful, but life is not easy" [69] . The loss of the sea had intensified the recognition and sense of belonging of fishermen and related professionals towards cultural heritage. The policy implementation did not pay attention to the cultural heritage of the local residents, resulting in a rupture in the centuries-old maritime culture of Dashe Fishing Village. The younger generation has limited knowledge about the ancestral way of life and various skills, which now only exist in the memories of the elderly (M-b, M-c, M-j, F-h).

The scale politics also overlooked the livelihoods of aquaculture and small-scale fishing communities that depended on the Coastal zone. After Coastal Exclusion Policy, the younger generation sought employment elsewhere, leaving the elderly to stay behind. Women often went to the coast to collect small marine organisms to supplement their income (M-f, M-h) [71]. "Young people work as security guards, middle-aged and elderly people work as cleaners" (F-d, F-e) [72] , or they took up property governance positions within the Jimei Academy Village (F-f, F-g) [36]. However, in the sample interviews conducted in the study area, there are individuals who have not received compensation for the cessation of fishing activities (M-c). The income of those affected by the cessation has decreased to a level that barely sustains their livelihoods (M-c). Unemployment issues are prevalent among female interviewees (F-d, F-e, F-f, F-g). The elderly, who have lost their livelihoods from fishing, are renting out their homes to make ends meet (M-a). The government provides temporary and mobile entrepreneurial opportunities to those who have received compensation for the cessation (F-a, M-f). Fishermen lack political assistance during the transition period following the cessation, resulting in feelings of exclusion and disillusionment regarding changes in their way of life and work environment (M-a, M-h, M-j, M-k, F-i). However, due to low subsidy rates and an inadequate social security system for fishermen (M-c, M-j, F-i), coupled with their limited skills, they are unable to engage in jobs other than fishing [73] . As a result, a small number of aquaculture farmers still take risks by cultivating flower clams (F-c, M-j, M-l), oysters, and other marine organisms near the Jimei Bridge. Some fishermen secretly operate unlicensed fishing boats or engage in illicit fishing during the fishing ban period, leading to a widespread phenomenon of impoverished fishermen returning to the industry [66] . The introduction of the cessation policy was aimed at mitigating and improving the depletion of marine resources [74] . However, local residents have observed environmental changes, such as the loss or reduction in the diversity of species (M-a, M-c), the shrinking of intertidal areas (M-b), the artificial replenishment of beaches (M-f), and the continuous reduction of marine protected areas (M-h, M-i).

After the implementation of the cessation policy, governance methods lacked the local scale, resulting in the disruption of the structural integrity of governance dimensions. This has not only undermined the stability of a comprehensive political scale but also eroded the traditions, culture, way of life, and ecological environment of the coastal zone.

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4. Discussion

4.1 Economic evolutionBut the Human Ecology Declines.

The coastal governance measures in Xiamen have facilitated the development of tourist landscapes. Coupled with the positioning of Xiamen as a "modern port scenery tourist city" [75] , the local government emphasizes the unique regional environment and culture of southern Fujian, making the scenic features of the coastline prominent. The implementation of coastal governance measures has improved the water quality in the sea, and the released Coastal zones have been developed into coastal tourism facilities in line with Xiamen's tourism-oriented urban development[76]. This has attracted a large number of external tourists[77] , resulting in significant economic benefits. In 1994, Xiamen's GDP was 18.7 billion (RMB) [78] , but by 2022, it had increased to 780.27 billion (RMB) [79] , with a large portion coming from the cultural and tourism industry [80].

Although studies indicate that Xiamen has implemented detailed protection and utilization measures for the Coastal zone from 1996 to 2016[36] , the governance of the coastal zone is marked by conflicts, particularly regarding the utilization of environmental resources[81] . The tourism industry not only brings economic benefits but also leads to changes in the coastal landscape. The Jimei Peninsula has been reclaimed and transformed, converting the original intertidal zones into artificial land, occupying all the coastal space in the name of a tourist city[43] . From the compiled images of the changes in the coastal zone of the Jimei Peninsula over the years (Figure 5), it can be observed that from 1964 to 2023, the area of the peninsula expanded by 75%, and the coastline length increased by 13.7%. This demonstrates that land reclamation has significantly altered the original appearance of the coastal zone, with the coastline of the Dashe fishing village at the southern end of the peninsula experiencing the least change.

While the improvement in economic figures has led to a tangible increase in living standards, the excessive emphasis on landscape benefits can easily overlook the impacts on local residents[67]. Currently, there is a gap between the tourism industry policies focused on economic growth and the theories of sustainable development in coastal governance[82] . Research indicates a lack of local residents' participation in the development and distribution of tourism resources[67] . Furthermore, it is often the vulnerable groups in the local community who bear the negative consequences of coastal tourism [27, 83, 84] . This study's sample revealed that residents who originally relied on the sea for their livelihoods had to seek alternative economic means after the cessation of fishing activities (M-a, M-c, F-b, M-j, F-i), or they had to follow policies and invest in offshore tourism projects[85].

The phenomenon of human ecology decline in the Jimei Peninsula reveals that Xiamen City, through its coastal governance, has achieved economic progress but lacks the transformation and preservation of local characteristics. The premise of sustainable development is that economic stability must take priority over growth and should not come at the expense of the rights and interests of others.

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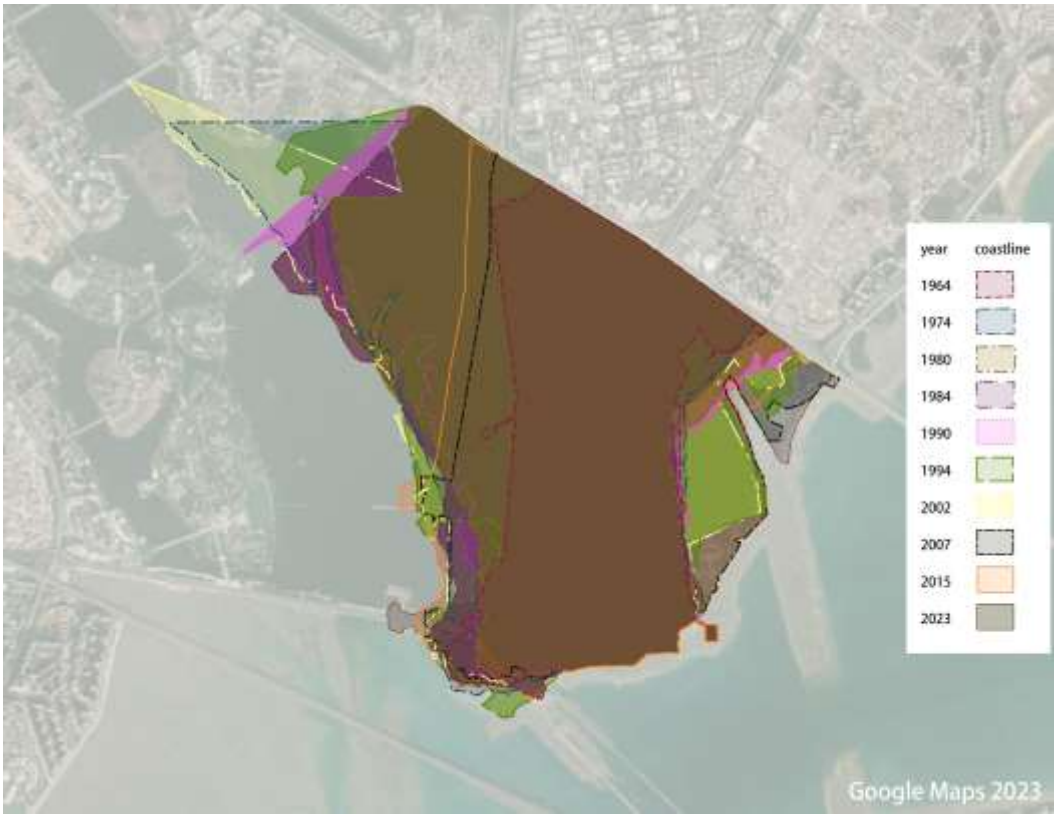

Figure 5. Spatial overlay map of coastal line changes in the study area

4.2 Natural ecological degradation: Imbalance in governance

As a focus of coastal economic development, marine tourism relies on coastal governance measures to protect endangered ecosystems and maintain biodiversity. There is a balance to be struck between conservation and utilization, finding ways to generate economic benefits from marine areas while providing protective benefits [86] . However, under the dominant influence of Xiamen City, the Jimei Peninsula has heavily emphasized tourism development, resulting in the gradual degradation of the original coastal ecosystem, where scenic beauty has become the city's main attraction [36].

During the rapid economic development process in the surrounding waters of the Jimei Peninsula, various issues have emerged[87] , including sedimentation in the ocean [88] , heavy metal pollution[89, 90] , reduction in species diversity[91] , habitat compression for protected animals[39] , embryonic deformities in fish[92, 93] , overfishing [94] , as well as concerns regarding residents' health[95, 96] and food safety[91, 97] . As a pilot city recognized by the United Nations, Xiamen's coastal governance must focus on the protection and utilization of marine resources [17, 23, 36, 37, 98] , aiming to enhance positive outcomes such as the recovery of fishery resources and the restoration of marine species[99].

Prior to 1956, coastal governance and the allocation of marine resources in the Jimei Peninsula were controlled by clans and fishermen, with local communities overseeing coastal utilization from a long-term perspective that considered the protection and utilization of coastal ecosystems. For example, there was an understanding that fish and shrimp needed suitable habitats for shelter and food, and their capture would be limited if their size was too small (M-a, M-b, M-c).

During the process of human survival and development, knowledge is acquired through conceptualizing and observing experiences, which allows for a better understanding, interpretation, and prediction of nature[100] . Traditional wisdom, as a part of culture, recognizes the resilience of coastlines to adapt to various changes, which is a key

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attribute of sustainable development[101] . Traditional wisdom can also provide institutional memory for the governance of ongoing ecosystem changes, restoration, governance, and complex adaptive social-ecological systems[101-103] .

However, the conflict in coastal zone governance arises from the comprehensive replacement of the previous resource allocation system with new institutions. During the human governance of the coast, the role of the clan in coastal governance is accompanied by the involvement of the government, creating a state of co-management. In the case of the Jimei coastline, the coastal ecological environment is well maintained, with harmonious coexistence of various marine species, and the economic activities of fishermen have not caused irreversible harm to the coastal ecosystem[43].

However, the policy of Coastal Exclusion Policy has severed all activities of the peninsula's fishermen related to the ocean, leading to the withdrawal of local residents from coastal governance. The wisdom of traditional coastal governance has been neglected, and fishermen have gradually become marginalized. The phenomenon of environmental degradation reflects the imbalance between human governance and political governance.

4.3 Marginalization of human ecology: Functional shift

The human-ecological system of the Jimei Peninsula is influenced by education, and the spatial pattern formed by the integration of village and school exhibits stable complementarity. The relationship between humans and the sea is stable and close, and these complementarities maintain the balance of the coastal ecosystem of the peninsula[47] . From the perspective of human ecology, the characteristics of the spatial pattern of the Jimei Peninsula can be explained.

However, after 1994, the governance reform of the Jimei Peninsula's coastal zone was top-down, with strong political power completely covering the entire Coastal zone, while the local communities were powerless to respond. Although the original spatial pattern was maintained, the human, natural, and political ecological systems have lost balance under the intervention of scale politics. Unlike the successful public participation through online media in the 2007 Xiamen PX project[104], the cross-scale political behaviors and strategic shifts have resulted in the absence of actors in scale policies [53] . This study examines the governance policies promulgated in Xiamen City over the past twenty years and finds that 76% of the regulations focus on the governance of coastal resources, particularly the privatization and commercialization of the coastal zone [27, 28] , in line with the regulations aimed at positioning the city as a tourist destination. This has led to a transformation in the users of the coastal zone from fishermen and residents to tourists, and a shift in the function of the coastal zone from intertidal aquaculture to tourism and recreation, which is the main cause of the marginalization of the human-ecological system.

From the changes in coastal zone governance, this study finds that the original groups in the Jimei Peninsula have faced the severe consequences of scale politics, where drastic policies of Coastal Exclusion Policy have severed the connection between fishermen and the ocean. Displaced fishermen face the dilemma of marginalization, poverty in income, lack of voice, insufficient social participation, and their professional value not being recognized, leading to their gradual marginalization. Their economic income has declined, and their rights and power are not protected. The primary producers who used to rely on the sea for their livelihoods have gradually disintegrated and become workers in the tertiary sector, assimilating into the general population.

4.4 Transformation of governance patterns

The land use changes in the Coastal zone of the Jimei Peninsula are influenced by strong global interactions. The reform is achieved through the process of scaling and intersecting scales, with weak responses from the local level. Scale politics is a real existence without conflicts, but it has led to various environmental declines. The key to the declines lies in the transition of governance patterns (Figure 6).

Between the regional and semi-regional scales, the key lies in the transformation of scales and governance patterns. In this process, the human and political ecologies are unidirectionally pushed downward, and the strong reform policies have eroded the local

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scale. It is difficult to form a theoretical framework of scale politics as proposed by scholars, and there is a lack of complete roles of structure, behavior, and actors [52]. This study found that once actors are absent in scale politics, top-down scale politics can be smoothly implemented according to the will of the governance authorities, leading to a complete transformation of governance patterns. Finally, this study argues that the governance pattern of Jimei Peninsula has changed from humanities to institutions.

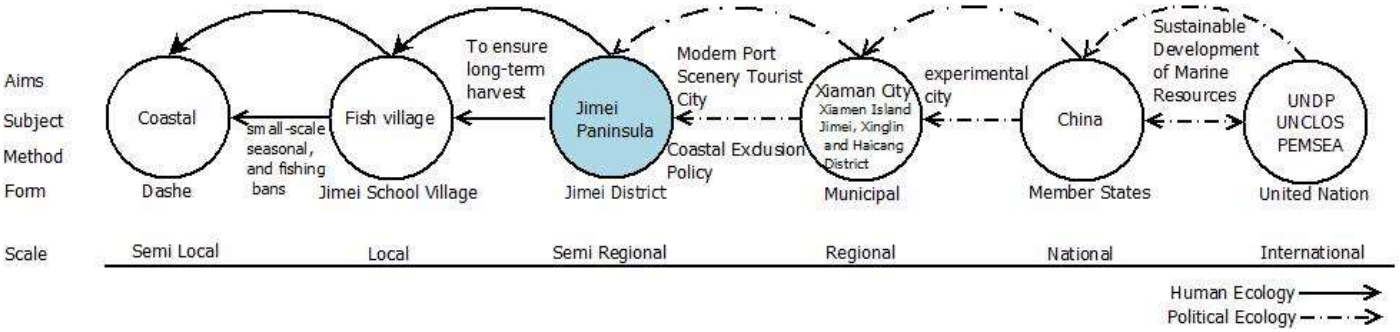

Figure 6. The pattern of coastal governance in Jimei Peninsula

5. Conclusions

The purpose of this study is to explain the relationship between the scale variation of coastal governance patterns and ecological degradation. The research findings indicate that in 1994, the political scale of Jimei Peninsula connected the local level to the international level, forming a complete governance scale from the local to the international level. However, the implementation of the Coastal Exclusion Policy in 2002 led to the dissolution of local-scale governance, leaving only three scales: international, national, and regional (semi regional). Under the operation of scale politics, the functions of the coastal zone shifted from traditional intertidal aquaculture to tourism and recreation. The dissolution of the local scale and the shift in functions have been the main causes of economic evolution, natural ecological degradation, and marginalization of human ecology in the Coastal zone of Jimei Peninsula.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "conceptualization, S.-C. T. and Y.-U. Z; methodology, S.-C. T.; software, Y.-U. Z.; validation, S.-C. T. and S.-H. L. and Z.Z.; formal analysis, Y.-U. Z; investigation, S.-C. T. and; resources, Y.-U. Z; data curation, Y.-U. Z.; writing—original draft preparation, Y.-U. Z; writing—review and editing, S.-C. T. and Z.Z.; visualization, Y.-U. Z.; supervision, S.-C. T.; project administration, Z.Z.; funding acquisition, Z.Z. All authors have read and agreed to the published version of the manuscript."

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