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Conflicts of interest in the coastal area of Tonkin Gulf (Vietnamese part)

Cao Thi Thu Trang*, Tran Duc Thanh, Nguyen Van Bach

Institute of Marine Environment and Resources, VAST, Vietnam

Email: trangct@imer.vast.vn

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ABSTRACT

Based on the analysis of relevant information on the socio-economic development characteristics of 11 provinces and cities in the Gulf of Tonkin, ten (10) conflicts of interest have been listed, analyzed, and evaluated. Conflicts of interest are classified into conflicts between sectors, development and conservation, localities, and countries. The conflicts of interest are related to disputes on marine space and resources and negatively impact the environment. Understanding the nature of conflicts of interest in the region to have reasonable solutions, especially for antagonistic conflicts, is very important in the sustainable development of the Gulf of Tonkin.

Keywords: Conflict of interest, Gulf of Tonkin, aquaculture, industry, tourism.

*Corresponding author at: *Institute of Marine Environment and Resources, 246 Da Nang, Ngo Quyen, Hai Phong, Vietnam. E-mail addresses: trangct@imer.vast.vn*

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INTRODUCTION

The Tonkin Gulf is a shared sea area surrounded by the coastlines of the northern provinces of Vietnam and the southern regions of China, along with Hainan Island. Tonkin Gulf plays a critical strategic position for Vietnam and China both in terms of social - economy and defense - security. The length of the coastline on the Vietnamese side is 763 km, running through 11 provinces and cities, including: Quang Ninh, Hai Phong, Thai Binh, Nam Dinh, Ninh Binh, Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri, and Thua Thien Hue. Quang Ninh province and Hai Phong city are located on two economic corridors linking Vietnam and China: Kunming - Lao Cai - Hanoi - Hai Phong - Quang Ninh and Nanning - Lang Son - Hanoi - Hai Phong - Quang Ninh. Tonkin Gulf is also an area for marine economic development, international trade, marine logistics, and exploitation of marine resources such as oil and gas and other biological and microbial resources. In the Tonkin Gulf, there are many extensive fishing grounds, providing an essential source of seafood for people's lives. Therefore, the management, use, and exploitation of the Gulf are crucial in economic development and defense security protection. However, in the coastal area of Tonkin Gulf, there are conflicts of interest related to the use of marine resources and marine space, which can lead to a reduction in the value of economic development activities and even create conflicts.

This article is the research result of the National project “Research and development of marine spatial planning in the Gulf of Tonkin”, coded KC.09.16/16–20. The article presents the analysis and clarifies conflicts of interest in the TG to help readers, managers, economists, and environmentalists recognize conflicts of interest, from that making solutions to reducing conflicts.

MATERIALS AND METHOD

The main method of the study is to synthesize and analyze information that

provides assessments related to conflicts of interest in the Tonkin Gulf. The main data for evaluation and analysis of conflicts of interest come from the Statistical Yearbook of Vietnam 2016 [1], 2020 [2], and local bulletins. Identifying conflicts of interest in the region is mainly based on research documents of some authors: Tran Duc Thanh (1997) [3], Nguyen Thi Phuong Hoa (2009) [4], and Cao Thi Thu Trang (2012) [5]. The conflicts are analyzed in terms of the nature, the stakeholders in the conflict, and the classification of the contest. The classification of conflicts is done following the guidelines of Chandrasek (1996) [6] and Candoret (2009) [7].

The study area is the entire Gulf of Tonkin, the Vietnamese part (Figure 1).

CONFLICTS OF INTEREST IN THE GULF OF TONKIN

Conflicts of interest in the use of marine space are understood as disputes between sectors, the damages, and the loss of this industry caused by other industries. Coastal areas are attractive locations in many areas of commerce, tourism, industry, seaports, etc. In the coastal areas of Tonkin Gulf, there are various types of conflicts, including conflicts between development and conservation, conflicts between sectors, disputes between localities, and conflicts between communities and interest groups. These types of contests will be analyzed in detail.

Types of conflicts of interest in the Gulf of Tonkin

Conflicts of interest between sectors

Conflict of interest between industry and fisheries

In the coastal plain of Tonkin Gulf, many industrial parks and industrial clusters are developed and expanded. The industries are also very diverse, such as the port, heavy, chemical, etc., along with the infrastructure and logistics serving industry. Most of the industrial parks are conveniently located for port, road, and railway traffic. Currently, there are nearly

one hundred industrial parks distributed throughout the provinces and cities of Tonkin Gulf. Among them, some industrial parks are operated efficiently, with high occupancy rates, such as Dinh Vu Industrial Park (Hai Phong), Nghi Son Industrial Park (Thanh Hoa), Hai Yen Industrial Park (Quang Ninh), etc., but many ones are still under construction or in

planning. Many provinces arranged land for industrial zones but did not operate, causing land waste. The preliminary statistics show that the area of industrial parks in Tonkin Gulf's coastal is more than 59 thousand hectares (Table 1), which does not mention industrial clusters and coastal economic zones that also have industrial activities.

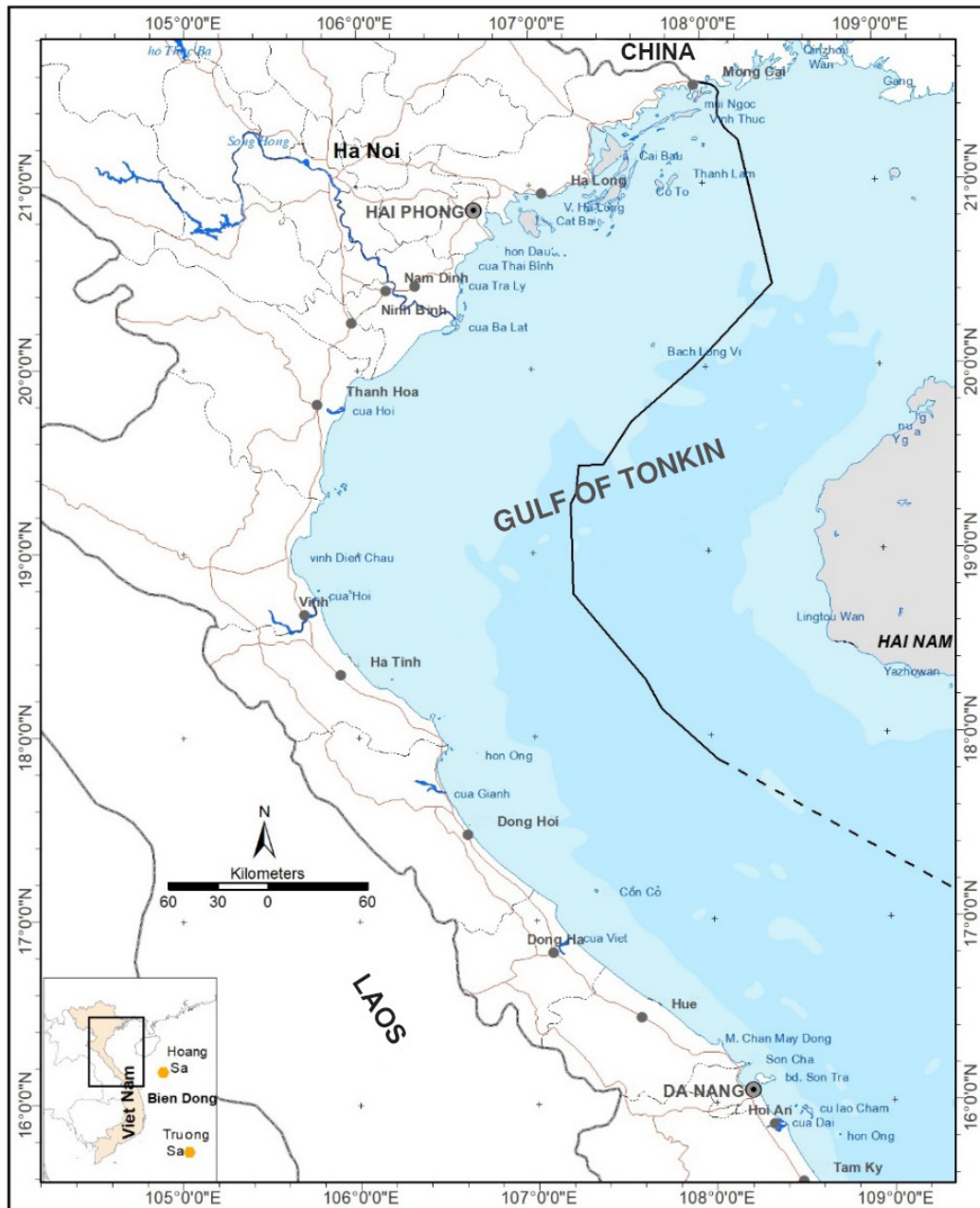


Figure 1. Study area - Gulf of Tonkin

Table 1. Area of coastal industrial parks and economic zones in Tonkin Gulf

No.	Province, cities	Area of industrial parks (ha)
1	Quang Ninh	12,302
2	Hai Phong	9,112
3	Thai Binh	1,175.6
4	Nam Dinh	2,238
5	Ninh Binh	1,355.6
6	Thanh Hoa	1,178
7	Nghe An	4,764
8	Ha Tinh	22,431
9	Quang Binh	2,025
10	Quang Tri	864.65
11	Thua Thien Hue	1,683
Total		59,128.85

Source: Compiled from websites of industrial parks and local People's Committees

The area of coastal land for the industry increased, which has narrowed the ground for the salt marsh, fishery logistics, etc. In addition, the industrial sector's water surface area also limited the scope of aquaculture. For example, the development of the port industry in Hai Phong with the expansion of Lach Huyen port has affected aquaculture activities. Hai Phong's aquaculture area decreased from 13,487 hectares in 2011 to 11.7 thousand hectares in 2018, a decrease of about 13%. The establishment and operation of cement factories and thermal power plants and the strong development of industrial and export processing zones in Quang Ninh, such as Nam Duong 10 Industrial Park (Uong Bi), Tien Phong Industrial Park (Quang Yen), etc. are factors that degraded the quality of water environment, reducing the area of aquaculture in the regions.

The fast-growing industry in conditions of poor technical infrastructure and outdated production technology has generated a large amount of waste. Most of them (including hazardous waste) are not appropriately handled before being discharged into the environment or buried in coastal landfills. Industrial waste pollutes the environment and affects fishery activities. Typically, the Formosa incident happened in 2016 due to the discharge of wastewater containing toxic chemicals from the Formosa Ha Tinh steel corporation (Ha Tinh province). The phenomenon of fish deaths in series began to appear on the coast of Vung

Ang (Ha Tinh), then spread to the waters of Quang Binh, Quang Tri, and Thua Thien - Hue [8]. This incident greatly affected coastal aquaculture activities, sea tourism, production, and the daily life of 200,000 people in the Central region of Viet Nam. Formosa Company then had to compensate the government and local people with 500 million USD for economic losses, job change support, and environmental pollution remediation.

Waste oil from ships, the coastal port, and the shipbuilding industry also affect the environmental quality of the fishery industry, especially the coastal fisheries. Oil pollution negatively affects the surrounding marine environment and can cause the death of aquatic species, resulting in significant economic losses to the fishery industry.

Conflicts between industrial and aquaculture development will increase continuously in the coming time because when industrial activities are promoted, it will lead to related consequences such as disputes over human resources, increasing environmental pollution, and affecting aquaculture.

Conflict between industrial and tourism development

Industrial development also has a significant impact on the tourism sector. In 2018, the number of visitors to 11 provinces and cities in the Gulf of Tonkin region reached more than 58.6 million (Table 2), and

the number of visitors will increase in the coming time. Coastal tourist areas and hotels are competing for space, giving way to industrial parks.

Table 2. Population and tourists of provinces and cities in the Gulf of Tonkin region

No.	Province/city	Population (2020) (Thousand people)	Tourists by year (*) (Thousand visitors)
1	Quang Ninh	1,337.6	12,200
2	Hai Phong	2,053.5	7,792
3	Thai Binh	1,870.3	575
4	Nam Dinh	1,780.3	2,547
5	Ninh Binh	993.9	7,300
6	Thanh Hoa	3,664.9	8,250
7	Nghe An	3,365.2	6,000
8	Ha Tinh	1,296.6	4,000
9	Quang Binh	902	3,900
10	Quang Tri	637.3	1,820
11	Thua Thien Hue	1,133.7	4,300
Total		19,035.3	58,684

Source: General Statistics Office, 2020; (*) Summary from local news in 2018.

The revenue of the tourism sector of the provinces and cities in the Gulf of Tonkin region is constantly increasing, including the areas of Quang Ninh, Hai Phong, Ninh Binh, Quang Binh, and Thua Thien Hue (Table 3). As the number of tourists increases, the demand for services increases, leading to the

need to build high-class coastal resorts. In the short term, when the land area is still available, the competition for space is still at a low level. However, afterward, with the development of both tourism and industry, the competition for space may increase and push into conflict.

Table 3. Tourism revenue of provinces and cities in the Gulf of Tonkin region (VND billion)

Province/city	2010	2012	2014	2015	2020
Quang Ninh	103.8	311.0	391.7	434.8	622.5
Hai Phong	79.2	104.8	127.4	132.2	183.2
Thai Binh	1.5	0.9	5.8	8.3	4.6
Nam Dinh	5.5	13.4	13.6	13.9	11.3
Ninh Binh	4.3	5.5	18.8	8.5	4.4
Thanh Hoa	21.5	43.3	60.0	73.1	75.7
Nghe An	38.1	51.8	48.8	53.1	54.7
Ha Tinh	2.8	5.2	10.8	16.4	12.2
Quang Binh	15.8	54.3	94.6	179.9	125.4
Quang Tri	15.5	34.4	27.0	29.2	6.7
Thua Thien Hue	81.4	110.8	141.4	134.9	83.7

Source: General Statistics Office 2016, 2020.

Competition for human resources for industry and tourism can also increase conflicts. The labor structure in Vietnam's industries and tourism is constantly growing, demonstrating the rising demand for labor in these sectors (Table 4). On average, one resident serves 3.2 tourists in the whole region, especially in Quang Ninh and Ninh

Binh, one resident has to serve 10 and 7.7 tourists, respectively. With the number of tourists constantly increasing, the demand for human resources for tourism also increases. Meanwhile, operations in industrial zones have attracted a large number of workers serving there. In addition, the requirements for the quality of human resources are

increasingly demanding regarding challenging problem for the sectors facing qualifications and techniques, which will be a development needs.

Table 4. Labor structure in the industry - tourism in Vietnam (%)

Sector	2010	2013	2015	2016	2020
Mining industry	0.6	0.5	0.5	0.4	0.3
Manufacturing and processing industry	13.5	13.9	15.3	16.6	21.1
Construction	6.3	6.3	6.5	7.1	8.8
Accommodation and food services	3.5	4.2	4.6	4.7	5.1
Arts and entertainment	0.5	0.5	0.6	0.6	0.5

Source: General Statistics Office 2016, 2020.

Industrial waste pollutes the water and sediment environment and affects the quality of aquatic products and tourism services. Besides, industrial waste seriously affects the tourism sector. After the 2016 Formosa incident, the number of tourists visiting and swimming in the four central coastal provinces decreased significantly.

Conflict between tourism and fishery development

In the Gulf of Tonkin, especially the coastal area, there has been a conflict between fishery and tourism due to disputes over water surface space and coastal land area. The extent of sea-encroachment land for tourism has increased to construct resorts, which means a decrease in the area of wetlands, mangroves, and nurseries for aquaculture. The most potent sea encroachment process took place in two localities of Quang Ninh province and Hai Phong city. From 1994 to 2008, the area of sea-encroachment land in Ha Long Bay - Cam Pha was up to 1,267 ha [9], which mainly aimed to build new urban areas with tourism services. In recent years, the speed of sea encroachment in the Hai Phong - Quang Ninh area has become stronger. Some tourism-related encroaching projects are Quang Hanh luxury hot spring resort (43.63ha), Green Dragon City Cam Pha Urban Area Project (100ha), Ha Long - Cam Pha seawall project, etc. In addition to the narrowing aquaculture water surface areas, sea encroachment activities have shallow water area, increased turbidity, and affected coastal aquaculture activities.

Although tourism development partly promotes seafood consumption, tourism waste (and waste from other industries) has significantly impacted the seafood industry.

The conflict between aquaculture and fishing activities

This conflict is an internal conflict within fishery sector. Fishery development is one of the strengths of the coastal provinces. Total fishery production in 2020 in 11 provinces and cities reached 1.49 million tons of aquatic products, an increase of 2.1 times compared to 2010. The area of aquaculture in the region in 2020 reached 149.2 thousand hectares, an increase of 1.2 times compared to 2010, accounting for 13.2% of the aquaculture area of Vietnam. However, with the application of advanced techniques, aquaculture production in the provinces of the Gulf of Tonkin in 2020 has increased 2.2 times compared to 2010, reaching 655,097 tons. The localities with high aquaculture production are Thai Binh, Nam Dinh, Thanh Hoa, Quang Ninh, Hai Phong, Ninh Binh, and Nghe An. However, due to the slight increase in aquaculture area, mainly due to water and land surface competition with other sectors such as tourism and industry, aquaculture is aiming to raise the sea and reach out to further marine areas.

While fishing in the Gulf of Tonkin brings excellent benefits, with the total number of fishing boats in the coastal provinces of the Gulf of Tonkin reaching tens of thousands, of which the number of offshore fishing vessels (with a capacity of over 90 CV) of 11 coastal provinces and cities in 2020 was 7,937 ships

with a total capacity of over 90 CV vessels of 2.7 million CV. The fishing output in 2020 was 831,364 tons, an increase of 2 times compared to 2010, but the number of offshore fishing vessels increased by 2.7 times, and the total capacity increased by 6.6 times compared to 2010. In recent years, annual fishing catch intensity in the Gulf of Tonkin increased continuously. In addition to the fishing boats of the above provinces, there are also boats from other places. According to Nguyen Phi Toan et al. (2016) [10], the maximum sustainable fishing yield in the Gulf of Tonkin was 24,984 vessels. The fishing exploitation speed of the area has exceeded the maximum sustainable fishing yield of about 21.05%, corresponding to 5,260 ships. Thus, the fleet structure in the Gulf of Tonkin has exceeded the allowable exploitation threshold, so it is necessary to have appropriate adjustment and reduction solutions to ensure sustainable exploitation. On the other hand, according to a study by the Research Institute of Marine Fishery [11], the fishery reserves in the Gulf of Tonkin are currently 681,200 tons, and the possibility of exploitation is 272,500 tons/year. But the data show that the actual exploitation in 2020 reached 831,364 tons, so it overexploited by more than three times.

Overfishing has led to a decrease in the productivity of offshore fishing and fishermen switching to near-shore fishing, creating the risk of resource depletion. Despite the increase in the fishing fleet, the exploitation reserves are limited, so the exploitation productivity is reduced, not commensurate with the investment scale for the fishing fleet. If fishers continue to exploit at this rate, the resources will be exhausted. Therefore, conflicts arise in the investment in the fisheries sector. The urgent problem of the fishery industry today is to reduce the offshore fishing capacity and focus on investing in infrastructure for offshore aquaculture.

Conflict between economic development and natural conservation

Economic development and natural conservation is the principal conflict in the

process of socio-economic development. Economic development in coastal water leads to environmental and land-use change, sea dredging, and environmental pollution. In offshore waters, oil extraction, material burial, mining and overfishing are potential threats.

Conflict between industrial development and environmental protection

The industry is an important economic sector, making the most significant contribution to the state budget, becoming a major export sector with a high growth rate. The total GDP of the provinces in the Gulf of Tonkin in 2018 reached 989.7 trillion VND, accounting for about 18% of the country's total GDP (5,533 trillion VND). The total value of industrial production - construction in the whole region was about 388.1 trillion VND; the main contribution was from industry - construction of Hai Phong (21.96%), Quang Ninh (18.9%), and Thanh Hoa (14.9%).

The industry develops rapidly in the condition of inadequate technical infrastructures, especially the infrastructure for the environment and waste treatment, which has led to a large amount of waste generated. Most of them (including hazardous waste) are not appropriately handled properly before being discharged into the environment or are only buried in coastal landfills.

According to the data of the Vietnam Environment Administration, the amount of common solid waste generated from industrial activities was estimated at 25 million tons/year and about 8.1 million tons/year from industrial zones alone. According to the assessment, the composition of industrial solid waste tends to change in the direction of increasing hazardous waste, which is the result of growing industrialization and chemical use [12]. Typically, Industrial Parks will sign contracts with companies in the collection and treatment of solid waste (including hazardous waste); however, monitoring the activities of these companies is a problem while human resources of the environmental industry in Vietnam are still limited.



Figure 2. A “mountain” of untreated Gyps waste, polluting the environment from DAP-VINACHEM Joint Stock Company (Dinh Vu Industrial Park) - photo took in 2017

The volume of wastewater from industrial zones and clusters is also an urgent problem to be solved. According to statistics from the Ministry of Natural Resources and Environment, the volume of industrial wastewater in Vietnam was 550,000 m³/day, of which 12% of industrial parks and 83% of industrial clusters did not have a centralized wastewater treatment system; 48 establishments have industrial waste sources with discharge volumes of more than 1,000 m³/day, 175 establishments have industrial waste sources with discharge volumes from 200 m³/day to 1,000 m³/day [13]. In addition, the cooling water of the system of thermal power plants and factories also has a significant impact on the marine ecosystem due to the large volume of discharge. That puts tremendous pressure on the environmental protection of Vietnam in general and the Gulf of Tonkin in particular.

Besides, the development of industrial parks and coastal economic zones (Hai Ha, Van Don, Dinh Vu - Cat Hai, Nghi Son, Vung Ang, Chan May - Lang Co, etc.) has also significantly narrowed the area of the natural tidal flats, causing reduction of resources, increase in sedimentation of port channels, the narrowing of exploitation space of coastal communities.

Additionally, mining activities such as coal mining, oil extraction, salt mining, construction

material mining, ore mining, etc., also significantly impact on the environment, of which the most notable are coal and sand mining activities and construction material exploitation activities.

Coal mining and trading have destroyed the natural environment. Coal mining takes place mainly in Quang Ninh province. On average, coal mines of Vietnam National Coal and Mineral Industries Group have discharged into the environment up to 182.6 million m³ of soil and rock and about 70 million m³ of mine wastewater, polluting some areas of Quang Ninh province at alarming levels such as Mao Khe, Uong Bi, Cam Pha, etc. [14]. According to Vinacomin’s assessment, soil erosion at the coal mining site has caused accretion in the riverbed, narrowing the riverbed due to the high proportion of alluvial soil. The riverbeds of streams in Quang Ninh, such as Vang Danh stream (Uong Bi), Khe Cham stream, Lep My stream, and Mong Duong river, have been increased by 1–3 meters due to sedimentation from coal mine wastewater. Waste rock in mining is also an indirect cause of environmental harm, causing environmental degradation in the mining area. In coal mining, there are often high levels of elements Sc, Ti, Mn, etc., in coal. The sulfide minerals in coal also contain Zn, Cd, and Hg, etc., which are toxic to the health of coastal ecosystems. The most worrying thing is that small-scale mining

and mineral processing happens. Due to the limited investment capital of these enterprises, manual exploitation, semi-mechanization, outdated technology, and especially the pursuit of profit, the sense of law observance is not high, so the owners of the establishments are rarely interested in environmental protection, labor safety, protection of mineral resources, leaving many negative consequences on the environment.

Construction material exploitation activities such as sand, gravel, etc., occur in almost provinces in the Gulf of Tonkin region. Sand mining in rivers and coastal areas is causing subsidence and deformation of river beds, causing coastal erosion, dyke and embankment breaking, and affecting national irrigation works. In addition, lowering the riverbed and reducing the water level in rivers also lead to insufficient water supply for supporting rivers, leading to “dead” rivers.

It is forecasted industrial development will continue to increase enormously in the Gulf of Tonkin region in the coming years due to the open-door policy to attract foreign investment

and the promoting policy of the formation of the development cooperation “Two Corridors, One Belt” in the region.

Conflict between port and water way development and protection of environment and biodiversity

Along the coast of the Gulf of Tonkin, there are many large ports such as Cua Ong, Cai Lan, Hai Phong, Lach Huyen, Cua Lo, Nghi Xuan, Vung Ang, Chan May, and hundreds of other fishing ports, tourist ports, and other specialized ports. The groups of northern ports (group I) and most of the ports in the North Central group of ports (group II) are located entirely in the Gulf of Tonkin, in which the large ports such as Hai Phong, Cai Lan, Cam Pha, Nghi Son, Vung Ang, etc. Only a few large ports in the provinces of Quang Ninh, Hai Phong, Thanh Hoa, Nghe An, and Ha Tinh, the volume of goods passing through these ports in 2018 reached 250.6 million tons, an increase of more than 30% compared to 2017 (Table 5).

Table 5. Cargo volume through some major ports in the Gulf of Tonkin (tons/year)

Locality	2017	2018
Quang Ninh	67.21	81.79
Hai Phong	92	109
Thanh Hoa		23
Nghe An	6.2	9.5
Ha Tinh	>11.2	27.3

Source: Compiled from local news.

Although the probability of an oil spill is small, the environmental consequences are severe. Port and waterway operations cause significant impacts on the coastal environment due to activities of reclamation, construction, channel dredging, cargo loading, unloading, and discharge of waste from ships, etc. In addition, some ports are also a place to import foreign organisms, garbage, and toxic waste across the border. Some ports have been causing environmental problems for sensitive areas such as heritage sites and nature reserves; for example, Cai Lan port with Ha Long Bay, Lach Huyen deep-water port with Cat Ba Biosphere Reserve, Chan May port with Hai

Van - Son Cha Marine Protected Area. The expansion of Lach Huyen port and construction of Nghi Son deep-water port has changed marine biodiversity, adversely affecting water quality and sediment in these areas. An area of wetland ecosystems, mangroves, aquaculture ponds, etc., disappeared, replaced by ports and port logistics.

Dredging and dumping of dredged material activities occur mainly in the ports of Hai Phong city. The traditional and long-standing ports of Hai Phong are mainly located along the Cam and Bach Dang rivers. These activities are not only costly but also damaging to the environment. Rivers - creeks

with a depth of about 5.7–7.8 m are gradually narrowing and need to be dredged regularly to ensure designed depth. The dredged material is usually dumped in a deeper area off Cat Ba Island, on the banks of Ruot Lon River or Nam River. Every year, there are about 2.5–3.5 million m³ of dredged mud in the waters of Hai Phong port. Pollutants that accumulate in sediments come back to water and affect nearby ecosystems and biodiversity at dredging and dumping sites. However, studies on the effects of this activity on biodiversity and ecosystem safety are limited, and further research is required.

Conflict between urbanization and environmental protection

The coastal plain of the Gulf of Tonkin (in Vietnam) has more than 19 million people, accounting for nearly 20% of the total population of Vietnam; the average population density was about 300 people/km² [2]. The population is concentrated in

towns/districts (Do Son, Cua Lo) and coastal cities (Mong Cai, Sam Son, Ha Long, Hai Phong, Nam Dinh, Thanh Hoa). The areas of Hai Phong, Thai Binh, and Nam Dinh have the highest population density (about 1,110–1,268 people/km²), four times higher than the average population density in the country. Urbanization is expressed as an index of the ratio of the population living in urban areas to the total population or the increase in the urban area to the entire region. In the Gulf of Tonkin, there are three provinces and cities with high urbanization rates, namely Hai Phong - urbanization rate of 60.60%; Quang Ninh - 61.56%; Thua Thien Hue - 50.30%.

According to statistics of the Vietnam Environment Administration 2015, the volume of municipal solid waste collected in 11 provinces and cities in the Gulf of Tonkin in 2014–2015 was about 6,292–7,045 tons/day, of which the proportion of treated solid waste up to standards ranged from 16.67% (in Thanh Hoa) to 96.80% (in Nam Dinh), an average of 77.77% - Table 6.

Table 6. Municipal solid waste volume of provinces and cities in the Gulf of Tonkin region

Locality	Amount of collected solid waste (tons/day)		Rate of solid waste treated hygienically (%)	
	2014	2015	2014	2015
Quang Ninh	737	737	78.43	79.65
Hai Phong	1,380	1,408	72.32	70.88
Thai Binh	307	307	35.83	35.83
Nam Dinh	219	219	96.80	96.80
Ninh Binh	128	128	56.25	57.03
Thanh Hoa	407	762	3.93	16.67
Nghe An	366	640	69.40	62.03
Ha Tinh	149	149	90.60	90.60
Quang Binh	204	204	-	45.10
Quang Tri	89	187	33.71	35.29
Thua Thien Hue	292	289	68.49	84.43
Total	6,292	7,045	73.41	71.77

Source: Vietnam Environment Administration, 2016 [15].

The volume of solid waste that is not collected, together with the amount of solid waste that is not treated hygienically (about 2,000 tons/day), has overloaded temporary landfills coastal and roadside landfills. Most of these landfills are buried, do not meet hygiene

standards, and leachate is not treated thoroughly, which has a high risk of polluting coastal waters, affecting economic activities in the Gulf of Tonkin and surrounding areas. There are many such landfills in the area, so waste treatment is an urgent issue in many coastal cities.

Along with the speed of urbanization, domestic wastewater generated in the Gulf of Tonkin region also increases. According to urban water supply standards, the amount of water supplied for urban activities is about 125 liters/person/day, of which the amount of domestic wastewater is estimated at 80% of the supply water (100 liters/person/day). With nearly 4 million people living in urban areas in the Gulf of Tonkin, the volume of domestic wastewater in the whole region is up to 132 million m³ per year. Meanwhile, domestic wastewater treatment capacity is not adequate; the proportion of urban domestic sewage treated in Hanoi and Ho Chi Minh City has only reached 20.62% and 13%, respectively. Thus, most of the wastewater in urban areas is not treated, poured directly into the sewer system, into canals, rivers, lakes, or directly into the sea, causing pollution (organic matter, nutrients, pathogens) in some areas such as Ha Long coastal area, Cua Cam - Bach Dang area (Hai Phong), Cat Ba bay area, etc.

Conflict between tourism development and environmental and ecological protection

In the Gulf of Tonkin area, there are many beautiful landscapes, such as Ha Long bay World Natural Heritage, Cat Ba Biosphere Reserve, Xuan Thuy National Park, Phong Nha - Ke Bang National Park, the Imperial City of Hue, etc. In addition, there are also many beautiful beaches in the region, such as Tra Co, Ha Long, Cat Co, Do Son, Sam Son, Cua Lo, Lang Co, etc. With more than 58.6 million visitors visiting provinces and cities each year and a tourism development orientation of 9–11%/year, it is forecasted that in the coming years, the number of visitors to towns and regions in the Gulf of Tonkin will increase.

The increase in tourists leads to a rise in tourism wastewater and solid waste while the waste treatment capacity in the area is limited. On peak days, garbage pollution in tourist areas affects urban beauty and causes air pollution. In addition, the amount of domestic wastewater from restaurants and hotels serving tourism is currently not treated, polluting coastal waters.

Tourism - service activities also increase the amount of oil in seawater due to the number of boats serving tourism. In addition, ecosystems and environments are susceptible and vulnerable to the pressures of tourism development. Sensitive ecosystems such as coral reefs, seagrass beds, mangroves, and many landscapes, especially in coastal areas, islands, nature reserves, and national parks, have been changed or reduced with the development of tourist areas. In addition, tourism development reduces biodiversity because many species of organisms, including rare and precious wildlife such as corals, Hawksbill Sea turtle, etc., are illegally exploited for the demand of tourists for food, souvenirs, trading samples, etc. More than 5,000 species of animals and plants of different groups have been discovered in the waters of Tonkin islands, of which 62 species of animals and 61 species of plants in coastal islands are threatened at different levels, and 73 species of flora and fauna in the coastal areas of the Red River Delta are recorded in the Red Book of Vietnam [16]. In addition, the lives and habits of wildlife living can be affected by large numbers of tourists arriving at different points in the life cycle (migration, foraging, breeding, nesting, etc.) of wild animals in nature reserves and national parks.

The tourism sector and related agencies have not yet taken measures to manage waste and wastewater. Most of the coastal tourist areas have shown signs of being overloaded with debris and polluting the surrounding water environment, such as Cat Ba and Do Son tourist areas, which have become two of the eight critical environmental pollution centers of Hai Phong city. Besides, the landfill in Sam Son city, 2.7 hectares wide with a capacity of 25 tons of garbage/day and night, has no space to store. The littering of tourists at sea (mainly plastic bags) can affect the living activities of marine animals. Visiting corals in islands and bays also could destroy corals by improperly mooring ships or causing more turbidity in the waters.

Conflicts between localities

The conflict between localities and management entities is an emerging reality in

Vietnam. While any responsible unit does not manage many fields, many other places and sectors have disputed in management, leading to conflicts and must be settled by force. Disputes occur in many forms, either existing or potential. Many localities often manage the seas and rivers. Administrative boundaries are only a formal hierarchy; for example, the downstream area is often the recipient of pollution sources from the upstream rivers, but the management of these rivers belongs to different localities. Or Ha Long Bay - Cat Ba area is a bay-sea and island area related to each other in terms of topography, geology, tectonics, hydrology, and biodiversity, but the management belongs to two localities, Quang Ninh province, and Hai Phong city. The control by administrative units leads to overlapping or omitting some issues, creating conflicts between localities and management entities.

The conflict related to the responsibility of the management entity and the monitoring organization is one of the core issues leading to conflicts of interest and the use of the marine space of the Gulf of Tonkin. Up to now, the seas, islands, and coastal areas of Vietnam in general and the Gulf of Tonkin, in particular, are still mainly managed according to an open approach and primarily driven by sectors through sectoral laws and policies. There is still a lack of basic rules on the sea to institutionalize integrated and unified state management of seas and islands. This situation has led to the overlap in direction between the ministries, departments, and sectors on the sea. The management policies are not synchronized, there are many overlapping points in the existing laws, and the enforcement is low. The participation of local communities in the management process is still very passive, and the ownership/user of coastal land and coastal water surface has not been clarified.

Due to the inconsistent and unclear management agencies between different marine economic sectors (seaports, maritime, fishing, tourism, mineral exploitation, industrial development, etc.) have led to the ineffective and unsustainable exploitation and use of seas and islands in the Gulf of Tonkin because many marine economic sectors still exploit

spontaneously and do not comply with sea and island plans, giving rise to many conflicts of interest in multidisciplinary use.

Conflicts between countries in exploiting marine resources

Vietnam faces tough challenges regarding security protection and sovereignty over sea and islands, exploitation of natural resources and protection of the marine environment, marine environmental pollution, etc. Therefore, the protection of sea and island security, environmental protection, and response to climate change is regular and crucial tasks of the people.

The Gulf of Tonkin has rich natural resources and high biodiversity with many unknown and not fully exploited minerals such as oil and gas, coal, sand, gravel, limestone, metals, and ores, thus causing the maritime space dispute between Vietnam and neighboring countries. Especially in 2004, Vietnamese scientists discovered the location of oil and gas fields in the Gulf of Tonkin with reserves of up to 700–800 million barrels of oil and 4 billion m³ of gas (*The newly discovered oil field in the Gulf of Tonkin has excellent potential, Tuoi Tre online newspaper on October 20, 2004*), which has increased conflicts in the region. Typically, the recent events of China bringing the oil rig close to the demarcation line of the Gulf of Tonkin showed a relatively large contradiction, which, if not resolved thoroughly, can lead to conflict. On the other hand, the waters of the Gulf of Tonkin, in particular, and the sea of Vietnam in general have rich resources and are one of the ten centers of marine biodiversity in the world. Hence, the potential for conflict in fishing catch in the overlapping areas is very high. To resolve conflicts of this kind, the use and improvement of understanding of international laws and conventions are essential in effectively exploiting this resource [17].

Forms and levels of conflicts of interest and spatial conflicts of exploitation and use of planned waters in the Gulf of Tonkin

Table 7. Forms and levels of conflicts of interest in the Gulf of Tonkin

Name of the conflict	Forms of conflicts				Correlations of conflicts			Levels of conflicts			
	Space dispute	Resource dispute	Investment Disputes	Negatively impact on the environment	One-way	Two-way	Multi-way	Temporary	Long-term	Antagonistic	High Conflict
Conflict between industrial and fishery development	x	x	x	x			x		x		
Conflict between industrial and tourism development	x	x	x	x			x		x		
Conflict between tourism and fishery development	x	x	x	x			x		x		
Conflict between aquaculture and fishing	x	x	x			x			x		
Conflict between industrial development and environmental protection	x	x	x	x		x				x	
Conflict between port and water way development and environmental and biodiversity protection	x	x	x	x		x			x		
Conflict between urbanization and environmental protection	x	x	x	x		x			x		
Conflict between tourism development and environmental protection	x	x	x	x		x			x		
Conflict between localities	x	x	x	x		x			x		
Conflicts between countries in exploiting marine resources, territorial disputes	x	x		x		x				x	

According to Tran Duc Thanh (1997) [3], conflicts in the Gulf of Tonkin belong to the types of spatial and resource disputes which negatively impact the environment. Most contests fall into the investment disputes category, meaning that investment in one sector can reduce investment in another, especially conflicts between sectors in economic development related to the sea. In addition, investment disputes are also reflected in the conflict between economic growth and environmental protection, reflected in the increase in investment expense for the development of sectors, but investment expense for environmental protection decreased or kept constant.

Regarding the correlation of conflicts, most conflicts have a two-way correlation, such as the type of conflict between economic development and environmental protection, because, as economic industries develop, the negative impact on the environment increase; conversely, when environmental protection is ensured, it can promote the growth of economic sectors and fields. The conflicts between industrial development and tourism, between industry, and fisheries, is classified as a multi-dimensional correlation because these sectors and areas are affected by many other sectors.

Regarding the level of conflict, according to the classification of Chandrasekharan (1996) [6] and Cadoret (2009) [7], most conflicts are classified as “long-term” because conflicts can hardly be resolved thoroughly. Some of them are at the stage of forming conflicts, such as conflicts between aquaculture and fishing or between industry and fisheries, because industrial parks have not yet come into operation. However, some conflicts are at the antagonistic level, such as conflicts between industry and environmental protection or conflicts between countries in disputes over territory and resources. The 2016 Formosa incident in four central coastal provinces is a form of hostile conflict, and the event of the Chinese oil rig on the demarcation line in the Gulf of Tonkin is also a form of antagonistic conflict. When encountering antagonistic conflicts, it is necessary to

consider each specific case, properly understand the nature of the conflict, and then, based on the current law in combination with flexible and pliable conciliation measures to remove each knot and proceed to resolve the conflict. These conflicts, if not resolved thoroughly, can lead to force.

CONCLUSIONS

Ten conflicts of interest in the coastal area of the Gulf of Tonkin divided into three groups have been listed and analyzed. The main conflict groups are conflicts between economic sectors, conflicts between economic development and environmental protection, and conflicts between countries in disputes over resources and territories. All conflicts are related to a disagreement over space and resources and negatively impact the environment. Most contests have a two-way correlation; the others have a multi-way correlation. Most of the conflicts are at the “long-term” level and hard to resolve thoroughly; some are just at the stage of conflict formation. However, some disputes are at the antagonistic level, which, if not resolved thoroughly, can lead to conflicts of interest.

In the process of development, conflicts inevitably arise. Understanding the nature of conflicts of interest in the region, from which to have reasonable solutions, especially for antagonistic conflicts, is very important in the sustainable development of the coast of the Gulf of Tonkin.

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