

## Review Articles

# Research on port-industry-city integration of Tianjin

Rong Hua<sup>1a</sup>, Yijie Chai<sup>2</sup><sup>1</sup> National Marine Data and Information Service, Tianjin 300171, China, <sup>2</sup> China New Era Certification Center · Beijing 100022, China

Keywords: Port-industry-city integration, Port, Shipping center, Shipping services, fisheries, aquaculture

<https://doi.org/10.46989/001c.159363>

---

## Israeli Journal of Aquaculture - Bamidgheh

Vol. 78, Issue 1, 2026

---

Port-industry-city integration is a new era issue facing coastal cities. Promoting the integrated development of port and city is conducive to enhancing the vitality of the city, promoting industrial development and optimizing the functional of the port. As an important strategic resource of the China, Tianjin Port is the gateway to the sea for the Beijing-Tianjin-Hebei region, the sea-land intersection of the “the Belt and Road”, and an important node of the New Eurasian Land Bridge. The integrated development of port-city-industry can maximize the advantages of port resources and better serve the coordinated development of urban areas. Based on this, this article analyzes the models of integrated development of port-city-industry at home and abroad, the subjective and objective contradictions in the process of integrated development and proposes suggestions for the integrated development of port- city-industry in Tianjin.

### INTRODUCTION

The integration of port, industry, and city is a universal law for the development of port cities. At present, the development of China's ports has entered a critical stage of transitioning from quantitative to qualitative change. Both the Outline for Building a Transport Power and the Guiding Opinions on Building World-Class Ports regard “the integrated development of port, industry, and city” as a key component of development, and an upsurge in the integrated development of port, industry, and city has emerged. Tianjin has issued various policies and initiatives to advance the construction of port-industry-city integration, further implement the positioning of Tianjin as “One Base and Three Zones” designated by the Party Central Committee, accelerate the development of the Northern International Shipping Hub, give full play to its role as a maritime gateway hub for the Beijing-Tianjin-Hebei (BTH) region, and provide services and support for the coordinated development of the BTH region.

### CONNOTATION AND DEVELOPMENT MODEL OF THE INTEGRATED DEVELOPMENT OF PORT, INDUSTRY AND CITY

The connotation of the integrated development of port, industry, and city mainly refers to the following: in the areas surrounding ports, the port, industry, and city interact, influence, and integrate with each other, thereby en-

dowing port areas with transportation functions, industrial functions, and urban functions, and also enabling port areas to become sub-centers of the city. Specifically, the development of most port areas starts with the expansion of maritime transportation functions. However, as industries agglomerate around ports, port areas will continue to develop, and their maritime transportation functions will gradually expand. To achieve healthy development, port areas inevitably require other supporting and auxiliary functions.

In general, the integrated development of port, industry, and city is not only an efficient development state for port areas, but also an ideal state. The integrated development among the port, industry, and city lies in their respective pursuit of maximizing their own development interests. Meanwhile, based on certain common goals, and through the role of institutional and non-institutional mechanisms, they can achieve close integration in terms of resources and functions, thereby undergoing integrative changes, and ultimately realizing the integrated development of the three.

The characteristics of the integrated development of port, industry, and city mainly refer to spatial integration, functional integration, and service integration. Spatial integration lies in the fact that, under the requirements of the integrated development of port, industry, and city, cities must conduct planning and layout within limited spatial scope. They need to formulate conceptual spatial plans, adopt a guiding ideology for long-term development, and clarify development goals and priorities. Functional integration lies in the fact that ports not only have convenient transportation infrastructure and a sound modern compre-

---

a Corresponding author. Rong Hua, e-mail: [huarlw@163.com](mailto:huarlw@163.com)

hensive logistics system, but also possess functions in finance, commerce, information, consulting, and other fields. This can further promote the agglomeration of port-vicinity industries and the emergence of new industries, which is conducive to the integrated development of port, industry, and city.

The integrated development of port, industry and city in the new era should not only focus on the integration of economic and industrial functions, but also embed the aquatic environmental sustainability and the coordinated development of fisheries and aquaculture systems into its core connotation, forming a new development model of “port-industry-city-aquatic ecology integration”. This model takes the port as the core hub, the industry as the linkage bridge, the city as the support base, and the aquatic ecological protection as the bottom-line constraint, and realizes the organic unification of port industrial development, urban construction and the sustainable utilization of marine aquatic resources (including fisheries and aquaculture resources).

In the systematicness of the port-industry-city system, the aquatic ecological subsystem is added as an important component, which forms an interactive and restrictive relationship with the port, industry and city subsystems: the port’s logistics and industrial development need to rely on the healthy aquatic ecological environment, and the rational layout of fisheries and aquaculture can also complement the port’s modern service industry (such as cold chain logistics for aquatic products); the protection of aquatic ecology puts forward green development requirements for port construction and industrial layout, and the city provides policy and technical support for the ecological protection of the port coastal zone and the standardized development of fisheries and aquaculture.<sup>1</sup>

In the dynamicity of the system, the development of fisheries and aquaculture is an important variable affecting the life cycle of the port-industry-city system.<sup>2</sup> With the upgrading of the port’s industrial structure, the traditional coastal fisheries will transform to intensive aquaculture and deep processing of aquatic products, and the port needs to adjust its logistics and service functions to adapt to the development of the aquatic product industry chain, while the aquatic ecological environment will also undergo dynamic changes with the adjustment of port and industrial layout, requiring the system to maintain dynamic balance between development and protection.

Service integration lies in the fact that, to build professional, distinctive, and international service brands, port areas need to enhance port convenience. In the construction of comprehensive bonded zones, they must improve the level of management and services, thereby creating a better service environment for enterprises.

Since the port-industry-city system can be divided into the port subsystem, the industry subsystem, and the city subsystem — and these three subsystems in a region are composed of influencing factors (such as economy, institution, and environment) that are distinct from, connected with, and integrated with each other — its characteristics are also reflected in the following aspects:

## SYSTEMATICNESS

The port, industry, and city form an integrated networked structure in terms of space. This is mainly reflected in their close connections: they have a certain positional arrangement relationship in the overall layout and a specific quantitative proportional relationship. Under human intervention, the three cooperate closely, connect effectively, and complement each other. Ultimately, they achieve the effect of  $1+1+1>3$  in terms of functions. The port-industry-city system can not only be subdivided into several subsystems but also classified as a subsystem of a larger port cluster system. Moreover, the port-industry-city system has clear boundaries for hinterland economy and port economy.

## DYNAMICITY

Each subsystem of the port-industry-city system constantly changes with shifts in time and space, and all elements and units within the three components remain in a state of dynamic equilibrium and non-equilibrium over the long term. The dependence of a port city on its port will change as the city and industry continue to develop. Although the development of the port and the city follow certain rules, their development paths do not completely overlap, and the functional transformation of their subsystems is not synchronized. To a large extent, the prosperity and decline of industrial development, as well as the prosperity and depression of the port city, determine the changes in the life cycle of the entire port-industry-city system. Due to the interaction and feedback between systems, the balance of the port-industry-city system is constantly broken and restored, enabling the system to develop continuously amid alternating equilibrium and non-equilibrium states.

## DIVERSITY

The port, industry, and city have relatively complex relationships, and the port functions, industrial structures, and development stages of cities vary. Take ports as an example: some are transshipment ports, which perform the functions of sea-land intermodal transportation and cargo transshipment. These ports primarily focus on port operations and have weak connections with the city’s economy and industrial structure. In contrast, port-vicinity industrial ports rely on the development of industries and the city’s economy.<sup>3</sup>

The integrated development of port, industry, and city refers to a mutually reinforcing cyclic model formed among the three systems of port, industry, and city. The port serves as the cornerstone for the development of the city and industry; industry acts as the pillar for the development of the city and port; and the city provides the foundation for the development of the port and industry. The port and the city achieve coordinated development through industry. Here, “industry” primarily refers to transportation and other service activities directly related to the port, as well as manufacturing and other industrial activities carried out around the port. Specifically, it includes port loading and unloading, collection and distribution transportation,

maritime transportation, warehousing, and trade; port-related service industries such as finance, insurance, commerce, and entertainment; and port-vicinity manufacturing industries such as heavy industry and processing.

As a city enters different development stages, its port-city integration model varies<sup>4-5</sup>. In the early stage of urban development, the city is mainly dominated by the port. The port attracts the development of industries such as loading and unloading, transportation, warehousing, and trade, which in turn promotes the formation of the city. With the development of economy and trade, the port evolves into a hub for industry, trade, and transportation, it expands in scale, broadens in functions, and sees the agglomeration of manufacturing, port-vicinity logistics, and other service industries, which drives the spatial agglomeration of the port and the city. Subsequently, with the outward-oriented economic development, the port becomes a window for foreign trade and further develops into an international logistics hub. High-end services gradually emerge, the level of related industries is improved accordingly, and the industrial division of labor is refined. The port then relocates outward and moves toward professionalization, leading to the emergence of new urban areas and the formation of a network-based spatial layout of the port and the city. Port areas achieve connection, coordination, and linkage with the city via road transportation; meanwhile, old port areas complete the renovation of old urban areas and realize transformation and upgrading by developing coastal shorelines and fostering service industries such as tourism. In the mature stage of port-city integration, the port will further develop the specialized logistics and trade service system for aquatic products while building an international logistics hub, and the urban area will gather the deep processing, cold chain storage and e-commerce trade of aquatic products driven by the port's advantages. The old port area will realize the transformation and upgrading of the coastal shoreline through the construction of aquatic ecological protection zones and leisure fisheries bases, forming a new pattern of integrated development of port logistics, aquatic product industry, urban tourism and aquatic ecological protection.<sup>6</sup>

## DOMESTIC AND INTERNATIONAL DEVELOPMENT MODELS OF THE INTEGRATED DEVELOPMENT OF PORT, INDUSTRY AND CITY

The UK, the Netherlands, Germany, and Singapore, as long-established maritime nations, have explored port-industry-city integration models with distinctive features through long-term practice in the long course of their maritime development.

## MODELS OF THE INTEGRATED DEVELOPMENT OF PORT, INDUSTRY AND CITY IN MAJOR INTERNATIONAL CITIES

### CONSTRUCTION OF THE LONDON INTERNATIONAL SHIPPING SERVICE CENTER

As a traditional international shipping hub, London has a long history of maritime trade and navigation culture. It leads the world in services such as shipping finance and maritime information, and gathers a large number of global leading shipping enterprises and international shipping organizations.

London's shipping industry originated from the River Thames. After World War II, with the expansion of global trade and the eastward shift of the world's economic center, dedicated container ports moved toward the estuary. London's traditional port areas declined, while non-maritime production functions gradually developed—among which finance, especially shipping finance, grew rapidly. Based on the historic Baltic Exchange, the old port areas developed high-value-added industries such as shipping financing, maritime arbitration, and maritime insurance. After nearly 30 years of development, these areas became a financial center of London, achieved industrial transformation, drove the upgrading of the entire city's economy, and established London as a global shipping pricing center and an international financial center.

While developing high-value-added industries such as shipping finance, London has taken the protection of the River Thames' aquatic ecosystem as the bottom line of port area transformation, and built a coastal ecological buffer zone in the old port area, which coordinates the development of maritime service industry and freshwater fisheries in the Thames River basin.<sup>7</sup> The port's cold chain logistics and aquatic product trade service system have become an important part of London's international shipping service industry, supporting the sustainable development of the fisheries industry in the southeast of the UK.

### CONSTRUCTION OF THE SINGAPORE MULTIFUNCTIONAL SHIPPING CENTER

As the global economy shifted eastward, Singapore, by virtue of its unique geographical advantage of occupying the entrance to the Strait of Malacca, built dedicated container berths. Through container transshipment services in Southeast Asia, it developed bunkering services and re-export trade, realizing the interaction between the port and port-vicinity industries. Backed by a host of preferential policies, Singapore attracted multinational enterprises to invest directly in building logistics and distribution centers in the port area.

Relying on its mature container hub trade, Singapore established air-port intermodal transportation centers, international ship repair and building centers, and international ship supply centers. Meanwhile, the massive merchant ship supplies greatly boosted the city's commercial development, spawning modern service industries such as leisure, entertainment, tourism, and hospitality sectors. After the global financial crisis, Singapore accelerated reforms

for financial development and built a re-export trade financial platform. Thus, Singapore transformed from a container transshipment hub into a multi-functional integrated hub encompassing an international financial center, an international trade center, and an international shipping center. Singapore relies on its port advantages to build a world-class aquatic product cold chain logistics and trade hub in Southeast Asia, and integrates the standardized breeding of marine aquaculture and the deep processing of aquatic products into the port-vicinity industrial system. In the process of port development, Singapore has strictly implemented the aquatic environmental protection system, built artificial reefs and marine protected areas in the coastal zone of the port, and realized the coordinated development of port transshipment, aquaculture industry and marine ecological protection, forming a typical model of port-industry-city integration serving the sustainable development of aquaculture.

#### *CONSTRUCTION OF THE ROTTERDAM TRANSPORTATION COMPLEX*

Rotterdam has gone through a development process of “relying on the port to develop industries, driving urban growth through industrial prosperity, and promoting port-city interaction”. The development of the port drove the agglomeration of port-vicinity and hinterland industries, which in turn boosted the development of urban services such as finance and information. Subsequently, the city provided factors including space, human resources, and information to feed back into the development of the port and industries, realizing the symbiosis among the port, industry, and city.

As the largest industrial city in the Netherlands, Rotterdam started as a small fishing village. During the Industrial Revolution and World War II, the transportation of industrial raw materials gradually facilitated the formation of the port’s shipping and logistics services. In the 20th century, port-vicinity industries such as oil refining, petrochemical processing, iron and steel, and machinery manufacturing emerged in the Port of Rotterdam, which has since become one of the world’s top three oil refining centers.

Currently, the Port of Rotterdam is Europe’s most important comprehensive transportation hub for oil, chemicals, containers, iron ore, food, and metals. It boasts a robust logistics transshipment function and a dense transportation network, attracting major global shipping companies and trading firms to establish their European distribution centers in the Netherlands.

Rotterdam, while developing port-vicinity industries such as petrochemicals, has built a specialized aquatic product logistics and processing zone in the port area, supporting the development of the fisheries industry in the North Sea coastal zone of the Netherlands. The port has formulated strict aquatic environmental protection standards for industrial production, and built a coastal wetland ecological protection zone to mitigate the impact of port and industrial development on the North Sea’s aquatic ecosystem and fisheries resources, realizing the symbiosis

of port industry, urban development and aquatic ecological protection.<sup>8,9</sup>

#### *THE HAMBURG PORT-CITY DIVISION OF LABOR AND LINKAGE*

The port-city integration of Hamburg features adjacency in space but with clear boundaries. The area where the Port of Hamburg intersects with Hamburg’s urban district has developed into a new urban center: the port area focuses on developing port-vicinity industries, while derivative industries are mainly located in the urban area to meet the needs of port-area industries.

Hamburg city centers on industries such as finance, insurance, commerce, and eco-friendly warehousing services. The new port city has laid out clusters of emerging industries including life sciences, creative industries, and renewable energy, as well as port-area services like commerce, catering, and cultural and recreational services—building a new urban district with both industrial and residential functions.

By continuously upgrading its infrastructure, the Port of Hamburg supports the export of automobile, machinery, and electronics industries as well as the import of goods needed for urban consumption. This consolidates Hamburg’s position as a regional hub for industry and finance in Germany and promotes the country’s economic development. The appropriate introduction of market-oriented mechanisms and innovative management systems has helped accelerate its development.

Furthermore, in the process of port-city integration, Hamburg implements the separation of government and enterprise functions: government authorities are responsible for the planning, construction, and operation of port infrastructure, while enterprises take charge of the construction of internal facilities in industrial parks and participate in port development by leasing terminals through market-based means.

Hamburg has clearly divided the functional zones of the port coastal zone in the port-city integration, setting up special marine aquaculture demonstration zones and fisheries resource protection zones in the non-port operation area, and the port has built a specialized cold chain logistics channel for aquatic products to support the export of German’s freshwater and marine fisheries products. The government has formulated a stakeholder coordination mechanism involving port enterprises, aquaculture operators and ecological protection departments, realizing the interest balance of different subjects in the port-industry-city integration and aquatic resource protection.<sup>7</sup>

#### *MODELS OF PORT-INDUSTRY-CITY INTEGRATION IN MAJOR DOMESTIC CITIES IN CHINA*

By continuously upgrading its infrastructure, the Port of Hamburg supports the export of automobile, machinery, and electronics industries as well as the import of goods needed for urban consumption. This consolidates Hamburg’s position as a regional hub for industry and finance in Germany and promotes the country’s economic devel-

opment. The appropriate introduction of market-oriented mechanisms and innovative management systems has helped accelerate its development.

Furthermore, in the process of port-city integration, Hamburg implements the separation of government and enterprise functions: government authorities are responsible for the planning, construction, and operation of port infrastructure, while enterprises take charge of the construction of internal facilities in industrial parks and participate in port development by leasing terminals through market-based means.

China is rich in port resources, which serve as vital infrastructure for the development of coastal cities. After years of resource integration, China's ports have entered a new stage of high-quality development. In 2019, the Ministry of Transport and other relevant departments jointly issued the Guiding Opinions on Building World-Class Ports,<sup>10</sup> which put forward initiatives including “promoting the in-depth integrated development of port, industry, and city” and “strengthening the effective alignment between ports, urban-rural development, and industrial development layout”, providing policy guidance for advancing the in-depth integration of port, industry, and city to a higher level.<sup>11</sup>

Currently, Shenzhen has achieved the most mature port-industry-city integration development in China. In the early stage of reform and opening up, Shenzhen explored the classic “Shekou Model” of port-industry-city integration while advancing urban construction. In recent years, Shandong and Zhejiang provinces have been promoting port-industry-city integration and exploring diversified models of integrated development.

#### MODELS OF PORT-INDUSTRY-CITY INTEGRATION IN MAJOR DOMESTIC CITIES IN CHINA

In the development of Shenzhen Shekou Industrial Zone by China Merchants Group, the company started with port construction and promoted the integrated development of port, industry, and city through the “Front Port – Middle Zone – Back City” model. Meanwhile, by combining regional resource endowments with the industrial layout of the development enterprise itself, it facilitated the agglomeration of industrial production in port-vicinity industrial parks. Finally, by supporting the development of these industrial parks, it brought about the improvement of supporting facilities for the “Back City” – including residence, commerce, medical care, and education – thus forming the integrated and linked development of the port, industry, and city.

This model provides an important reference for the integrated development of port, industry, and city in other port cities in China.

Shekou has combined the port-industry-city integration with the development of the marine aquaculture industry in the Pearl River Estuary, and built an aquatic product deep processing and cold chain logistics base in the “Middle Zone” industrial park, driven by the port's logistics advantages. The “Back City” has developed the leisure fisheries and marine ecological tourism industry relying on the coastal shoreline resources of the port, and built an aquatic

ecological protection zone in the port coastal zone to protect the aquaculture resources of the Pearl River Estuary, forming a model of integrating port logistics, aquatic product industry and aquatic ecological protection.

#### CONSTRUCTION OF QINGDAO SHIPPING, TRADE AND FINANCE CENTER

In 2019, focusing on shipping, trade, and finance, Qingdao took the Dagang Area as the core to build a comprehensive framework for Port-Industry-City Integration development. In 2021, the Offensive Action Plan for the Construction of Qingdao International Shipping, Trade and Finance Innovation Center (Version 3.0) proposed to actively explore Qingdao's “Port-Industry-City” integration development model. Taking the construction of the International Cruise Port Area, Dongjiakou Port, and Airport Economic Zone as opportunities, it coordinated and promoted the integration of industries such as shipping, finance, commerce, culture, and tourism, aiming to build a demonstration model for Port-Industry-City Integration development. In 2023, the development of Port-Industry-City Integration was further deepened: 32 Port-Industry-City Integration projects with a total investment of 31.6 billion yuan started construction in Qingdao in a concentrated manner<sup>12</sup>; the Shandong Port Shipping Finance Center Project was capped in the Cruise Home Port Start-up Area. In the future, it will continue to move forward with the goals of gathering high-end industrial elements at home and abroad, driving the revitalization of old urban areas, and accelerating the high-quality integrated development of the port and the city. Qingdao takes the port-industry-city integration as the opportunity to build a northern China aquatic product trade and cold chain logistics hub centered on the Dagang Area and Dongjiakou Port, and integrates the mariculture industry in the Jiaozhou Bay into the port's industrial chain. In the construction of the International Cruise Port Area, Qingdao has built a coastal ecological buffer zone, strictly controlled the impact of port construction on the Jiaozhou Bay's aquatic ecosystem, and promoted the coordinated development of port shipping, mariculture and aquatic environmental protection.

#### CONSTRUCTION OF NINGBO (ZHEJIANG) MARITIME TRANSPORTATION CULTURE CENTER

Ningbo has explored the path of “Port-Industry-City-Culture Integration” and proposed to accelerate the construction of the Ningbo Area of Zhejiang Pilot Free Trade Zone, promote the transformation of port-adjacent advanced manufacturing clusters towards high-end, green, intelligent, and digital development, optimize the spatial layout of port-adjacent industries, make substantial efforts in the international shipping industry, maximize the radiating and driving role of the port in logistics, capital, and information flows, promote the concentrated and efficient use of port shorelines and industrial shorelines, rationally allocate a certain proportion of living shorelines, and build a modern coastal space featuring the “integration of production, living, and ecology (the ‘Three-Life Integration’)”.<sup>13</sup>

In 2022, the Action Plan for Ningbo to Accelerate the Development of Marine Economy and Build a Global Marine Central City (2021-2025) proposed that by 2025, it will strive to form a new pattern of in-depth integration of port, industry, city, and culture. Ningbo has taken the “Three-Life Integration” (production, living, ecology) as the core, and embedded the sustainable development of fisheries and aquaculture into the port-industry-city integration. Relying on the port’s advantages, Ningbo has built a marine aquaculture industrial park and an aquatic product export trade base in the port-adjacent area, and optimized the spatial layout of the port shoreline, industrial shoreline and fisheries breeding shoreline. The construction of the Zhejiang Pilot Free Trade Zone has formulated special policies for the aquatic product cold chain logistics and marine ecological protection, realizing the deep integration of port development, aquaculture industry, urban construction and aquatic ecological protection.

## CURRENT SITUATION OF PORT-INDUSTRY-CITY INTEGRATION DEVELOPMENT IN TIANJIN

Tianjin, as the core area of international shipping in northern China under the Beijing-Tianjin-Hebei Coordinated Development Strategy, aims to build a world-class smart port and green port. It vigorously develops the marine economy and port-shipping industry to better serve the Beijing-Tianjin-Hebei Coordinated Development and the Belt and Road Initiative, further promotes the development of Port-Industry-City Integration, and continues to advance the construction of “a marine powerhouse city”.

### OVERVIEW OF URBAN DEVELOPMENT

In 2015, the Outline of the Beijing-Tianjin-Hebei Coordinated Development Plan was released, positioning Tianjin as a “National Advanced Manufacturing R&D Base, Core Area of International Shipping in Northern China, Demonstration Zone for Financial Innovation and Operation, and Pilot Zone for Reform and Opening-up” (referred to as the “One Base and Three Zones” for short). In recent years, leveraging its geographical advantages—backed by the world-class Beijing-Tianjin-Hebei urban agglomeration, facing Northeast Asia, and serving as a land-sea transportation hub for the Belt and Road Initiative—Tianjin has proactively integrated into the Beijing-Tianjin-Hebei Coordinated Development Strategy. It has vigorously promoted the development of emerging industries such as next-generation artificial intelligence, biomedicine, new energy, and new materials, accelerated the transformation and upgrading of its advantageous industries including aerospace, equipment manufacturing, petrochemicals, and the automotive industry, and comprehensively strengthened urban infrastructure construction, forming a dual-city development pattern of “Jincheng” (Tianjin’s central urban area) and “Bingcheng” (Tianjin’s coastal area).

“Jincheng” aligns with the development goal of building an international consumption center city: it attracts investment and talent, optimizes commercial layout, advances

business format adjustment, and accelerates the development of high-end service industries focusing on key fields such as modern commercial trade, financial services, design services, health services, high-end business services, intelligent technology, and the digital economy, thus forming several landmark zones for modern service industries. Relying on its coastal geographical advantages and abundant port resources, “Bingcheng” has accelerated the construction of a digital city and smart Binhai with the policy support from the Pilot Free Trade Zone. It has established 4 industrial clusters each with an output value of over 100 billion yuan (covering next-generation information technology, automotive and machinery equipment manufacturing, petrochemicals, and new energy & new materials), aggregated 38 enterprises each with an output value of over 10 billion yuan, and built 8 national demonstration bases for new-type industrialization. The total volume of cross-border leasing business for aircraft, ships, and offshore engineering platforms accounts for more than 80% of the national total, making it the world’s second-largest aircraft leasing hub.<sup>14</sup>

Tianjin is an important coastal city in northern China with rich marine fisheries and aquaculture resources.<sup>3</sup> The coastal zone of Binhai New Area (Bingcheng) has formed a mariculture base focusing on shellfish and crustaceans, and the freshwater fisheries in the Haihe River basin have a certain development scale. In the dual-city development pattern of “Jincheng” and “Bingcheng”, Tianjin has taken the sustainable development of fisheries and aquaculture as an important part of the marine economy, and the construction of an international consumption center city in Jincheng has driven the development of aquatic product deep processing, cold chain logistics and retail trade,<sup>15</sup> laying a solid foundation for the integration of port-industry-city with fisheries and aquaculture systems.

### OVERVIEW OF TIANJIN PORT DEVELOPMENT<sup>16</sup>

Tianjin Port is a crucial national strategic resource. It serves as a maritime gateway for the Beijing-Tianjin-Hebei region and the “Three-North” regions (Northeast China, North China, and Northwest China), a major outbound port for the Xiongan New Area, a land-sea intersection of the Belt and Road Initiative, a key node of the New Eurasian Continental Bridge Economic Corridor, and an international hub port supporting all-round opening-up. For consecutive years, it has ranked among the world’s top 10 ports.

In recent years, Tianjin Port has thoroughly implemented the spirit of the important instructions made by General Secretary Xi Jinping during his inspection in 2019. It has strived to build a world-class smart and green port to better serve the coordinated development of the Beijing-Tianjin-Hebei region and the joint construction of the Belt and Road Initiative, and accelerate the transformation from “corridor economy” to “port economy”. It has continuously enhanced the port’s intelligence level: it has carried out the construction of 5G base stations and Beidou ground augmentation networks in the port area, built a port cloud data center and a full-process big data management platform for shipping, developed an intelligent dispatching and com-

mand system, and completed the construction of the intelligent container terminal at Section C of Tianjin Port's Beijiang Area. As a result, the average operation efficiency has increased by more than 20%, while the average energy consumption per container and comprehensive operating costs have decreased by 20% and 10% respectively. It has established a "wind-solar-storage-load integration" smart green energy project, realizing 100% self-production and self-consumption of green electricity, 100% use of shore power for its own port ships when berthing, and 100% utilization rate of low-sulfur oil for ships.

Tianjin Port has continuously deepened cooperation with Hebei ports: it has established the Tianjin Port Beijing-Tianjin-Hebei Coordinated Port Service Center in Beijing, jointly established Tianjin-Hebei Container Terminal and Jintang Container Terminal operation entities with Hebei Port Group, set up 10 inland ports in Beijing and Hebei, established a service center in the Xiongan New Area, and launched new service models such as the Bohai Rim "Daily Shuttle" and "Two-Port-One-Shipping" service, achieving competitive and cooperative development between Tianjin and Hebei ports. It has expanded its service network for the Belt and Road Initiative, created a two-way multimodal transport model of "Northeast Asia - Tianjin Port - Continental Bridge - Central Asia, West Asia, and Europe", and its cross-border land-bridge transport scale has remained the highest among coastal ports.

Actively serving the national unified big market, Tianjin Port has established the China Domestic Trade Container Port and Shipping Service Alliance, launched the "Maritime Express - FAST" brand and the upgraded version of the "Two-Ports-One-Shipping" high-quality route, opened more than 40 sea-rail intermodal transport channels, innovated the "one-document-through" full-process logistics model, and opened multiple green and fast corridors such as the "Tianjin-Sea-Shanxi Gateway" and Changchun's "Northern Grain Southward Transportation" corridor. The average annual growth rate of sea-rail intermodal transport volume over the past three years has reached 26.7%. While building a world-class smart and green port, Tianjin Port has initially built a cold chain logistics system for aquatic products,<sup>17</sup> relying on its advantages of sea-rail intermodal transport to realize the efficient circulation of aquatic products from the port to the hinterland of the Beijing-Tianjin-Hebei region and the three north regions (Northeast, North, Northwest China). The port's "wind-solar-storage-load integration" smart green energy project and 100% shore power use have effectively reduced the pollution of port operations to the coastal aquatic environment,<sup>18</sup> and the construction of green port has laid a good ecological foundation for the sustainable development of coastal fisheries and aquaculture in Tianjin. The port's cooperation with Hebei ports has also promoted the coordinated development of fisheries and aquaculture resources in the Bohai Rim,<sup>19</sup> and the joint construction of logistics channels has improved the circulation efficiency of aquatic products in the Bohai Rim region.<sup>20</sup>

## INDUSTRIAL DEVELOPMENT

In May 2011, the State Council of the People's Republic of China approved the Construction Plan for the Core Area of Tianjin Northern International Shipping Center, supporting the Dongjiang Bonded Area in conducting innovative explorations in key areas such as international ship registration, international shipping taxation, shipping finance, and the leasing of aircraft, ships, and large-scale equipment. In June 2016, the Tianjin Municipal Transportation Commission released the Implementation Plan for Building Tianjin into a Northern Shipping Core Area, proposing to develop shipping service clusters in areas including Xiaobailou and Dongjiang. In September 2022, the Tianjin Municipal Transportation Commission issued the 14th Five-Year Plan for the Development of Tianjin Port, which proposed to accelerate the development of modern shipping service industries such as port and shipping information, commerce and trade, and financial insurance, and to expedite the construction of international shipping service clusters.

## SHIPPING SERVICES INDUSTRY

Over the past decade, Tianjin has seized historical opportunities, relied on Tianjin Port to vigorously develop the shipping service industry, and built a full industrial chain for high-end shipping services, achieving remarkable results in the agglomeration of shipping services. The "Xiaobailou" High-End Shipping Service Cluster mainly gathers high-end elements of the industrial chain such as shipping, finance, culture, information consulting, and logistics. It houses more than 600 shipping service enterprises, covering all links of the shipping industrial chain. It has attracted renowned global shipping enterprises and companies including DHL, Kuehne & Nagel, Maersk, CMA CGM, as well as Ocean Network Express (ONE), Evergreen Marine, and Hapag-Lloyd, and is home to Tianjin's first shipping finance center.

The Dongjiang Shipping Service Innovation Demonstration Zone mainly relies on the construction of the Dongjiang Pilot Free Trade Zone to carry out reform and innovation in shipping finance, leasing, international shipping taxation, and ship registration systems. The Northern International Shipping Exchange was established, the Tianjin Shipping Index was released, and China's first market-oriented innovation platform for ship and shipping operation management was built. Relying on the port's characteristic resources, Tianjin has developed characteristic industrial clusters such as online freight transportation clusters, national key cold chain logistics bases, and high-end shipping service industry clusters.

## DEVELOPMENT OF LINGANG INDUSTRIAL INDUSTRY

Relying on port areas including Dagukou, Gaoshaling, and Dagang in the southern part of Tianjin Port, the agglomeration of port-adjacent industries has initially taken shape. The Dagukou Port Area mainly serves port-adjacent industries such as petrochemicals, heavy equipment manufacturing, and grain and oil processing; the Gaoshaling Port

Area is primarily dedicated to supporting the equipment manufacturing industry; and the Dagang Port Area focuses on serving the petrochemical industry. A new round of adjustment to Tianjin's port-based productivity layout is being accelerated, and the port's role in undertaking industrial transfer and guiding the adjustment of regional productivity layout continues to become increasingly prominent.

#### COORDINATION OF PORT-INDUSTRY DEVELOPMENT AND FISHERIES & AQUACULTURE INDUSTRY

Tianjin has relied on the port's shipping and logistics advantages to carry out the preliminary layout of the aquatic product industry chain.<sup>21</sup> The high-end shipping service cluster in Xiaobailou has included aquatic product cold chain logistics and international trade services, and the Dongjiang Shipping Service Innovation Demonstration Zone has explored the financial support policies for the aquaculture industry (such as marine aquaculture equipment leasing).<sup>22</sup> The Lingang industrial zone has reserved space for the construction of aquatic product deep processing bases while gathering port-adjacent industries, and the petrochemical and equipment manufacturing industries in the port area have provided technical and equipment support for the standardized and intensive development of mariculture.<sup>23</sup>

At the same time, Tianjin has taken the protection of the Bohai Sea's aquatic ecosystem as an important part of the marine economy development, and formulated the Bohai Sea coastal ecological protection plan in the process of port and industrial development, which has carried out ecological restoration for the key fisheries breeding waters,<sup>24</sup> and tried to build a ecological buffer zone between the port operation area and the aquaculture zone to reduce the impact of port development on fisheries and aquaculture resources.<sup>25</sup>

#### EXISTING PROBLEMS IN PORT-INDUSTRY-CITY INTEGRATION DEVELOPMENT IN TIANJIN

##### THERE ARE STILL SHORTCOMINGS IN PORT INFRASTRUCTURE CONSTRUCTION

There are still the following problems in the development of Tianjin's Port-Industry-City Integration: The container carrying capacity of the port needs to be improved, with issues such as low quality and insufficient efficiency. Additionally, there is still a gap compared with Shanghai Port and Qingdao Port in terms of the number of foreign trade routes and the density of international trunk flights.

The port's collection and distribution channels still need to be improved: externally, there is a lack of convenient, smooth, high-capacity freight railway channels that directly connect to the western hinterland; the railway transportation layout within the port area needs further optimization; some shippers and logistics enterprises engaged in bulk cargo transportation have not yet realized door-to-door transportation; moreover, some collection and distri-

bution channels undertake multiple functions such as transit, port evacuation, and urban transportation, leading to mixed passenger and cargo traffic and significant traffic pressure.

The construction of the smart and green port needs to be further advanced, and efforts in aspects such as integrating upstream and downstream data resources and promoting efficient business connection still need to be strengthened. The port's specialized infrastructure for fisheries and aquaculture is insufficient<sup>26</sup>: the cold chain logistics system for aquatic products is not perfect, the construction of specialized cold storage and fresh-keeping terminals is lagging behind,<sup>17</sup> and the sea-rail intermodal transport channel for aquatic products lacks dedicated cold chain equipment, which restricts the efficient circulation of aquatic products in the hinterland. In the construction of smart and green ports, the monitoring and early warning system for the aquatic ecological environment of the port coastal zone is not perfect, the data integration of port pollution discharge and aquatic ecological monitoring is insufficient,<sup>27</sup> and the technical support for the protection of fisheries and aquaculture resources is weak.<sup>15</sup>

##### THE CONTRADICTION OF INDUSTRY-CITY SEPARATION IS PROMINENT

The development levels of various districts in Tianjin are unbalanced, and the allocation of resources such as medical care and education is uneven, which restricts the overall development level of the city. The supporting facilities related to industrial production are inadequate; urban supporting constructions, including ecological development, public services, municipal facilities, transportation planning, and cultural entertainment, fail to adapt to the rapidly expanding urban space. This leads to insufficient industrial attractiveness and convenience, and the uneven population distribution across districts is not conducive to the development of Port-Industry-City Integration. Meanwhile, there is insufficient connection between urban development plans and industrial development plans. The unbalanced development of each district leads to the uneven layout of the fisheries and aquaculture industry chain<sup>3</sup>: the Binhai New Area has rich marine aquaculture resources, but the supporting facilities for aquatic product deep processing and cold chain logistics are insufficient; the central urban area (Jincheng) has advantages in aquatic product trade and consumption,<sup>15</sup> but it is disconnected from the aquaculture base in the coastal zone. The urban public service facilities and ecological protection facilities in the aquaculture concentrated area are not perfect, the livelihood security of fisheries operators is not fully guaranteed,<sup>28</sup> and the connection between urban development planning and fisheries/aquaculture industry development planning is insufficient, which restricts the coordinated development of port-industry-city and fisheries/aquaculture systems.<sup>6</sup>

## THE CONTRADICTION OF PORT-CITY SEPARATION IS PROMINENT

In recent years, with the continuous urban development of Binhai New Area and the expanding transportation scale of Tianjin Port, the contradictions between the port and the city have become prominent. As the city expands, urban functional areas such as commercial and residential zones continue to expand and extend towards the rear of the port. The development of Binhai New Area has squeezed the development space of the port, seriously restricting the development of warehousing and logistics functions that support port terminal operations.

There are significant conflicts in the utilization and construction of port-city collection and distribution channels. Most of the goods at Tianjin Port need to be diverted through Binhai New Area to the hinterland, resulting in an enormous demand for collection and distribution. Currently, port evacuation highways lack dedicated cargo lanes, leading to mixed freight traffic and urban traffic, which interfere with each other. Meanwhile, port road transportation has also caused adverse impacts on the urban environmental ecology of Binhai New Area.

The spatial conflict between port development and fisheries/aquaculture is becoming increasingly prominent<sup>18</sup>: the expansion of Tianjin Port and the development of Binhai New Area have squeezed the living space of coastal mariculture zones, and the partial occupation of fisheries breeding waters has affected the development of the local aquaculture industry. The mixed passenger and cargo traffic of port collection and distribution channels has led to the pollution of the Haihe River and coastal waters to a certain extent, which has an adverse impact on the aquatic ecological environment and the quality of fisheries and aquaculture resources.<sup>24</sup> The lack of a clear ecological buffer zone between the port operation area and the aquaculture zone has intensified the environmental impact of port operations on fisheries and aquaculture production.<sup>1, 29</sup>

## LACK OF INTEGRATION OF PORT-INDUSTRY-CITY DEVELOPMENT AND AQUATIC ENVIRONMENTAL SUSTAINABILITY

The original port-industry-city integration development plan of Tianjin lacks the top-level design of aquatic ecological protection,<sup>30</sup> and the ecological protection indicators are not included in the evaluation system of port and industrial development. The port's pollution prevention and control measures are mainly aimed at industrial waste gas and wastewater, and the targeted protection measures for the Bohai Sea's fisheries resources and aquaculture water environment are insufficient.<sup>31</sup> The coordination mechanism between port management departments, industrial development departments, aquatic ecological protection departments and fisheries/aquaculture operators is not perfect,<sup>32</sup> leading to the disconnection between port-industry-city development and aquatic environmental protection, and the insufficient support for the sustainable development of fisheries and aquaculture.<sup>33</sup>

## SUGGESTIONS FOR PORT-INDUSTRY-CITY INTEGRATION DEVELOPMENT IN TIANJIN

Compared with the early stage of port-city development, which was dominated by scale expansion, Tianjin's Port-Industry-City Integration has now entered a deeper and more complex phase. This requires coordinating the layout planning of various aspects including cities, industries, and regions in a holistic manner. At the same time, full use should be made of Tianjin Port as a core advantage: extending the port-shipping industrial chain, promoting the agglomeration of high-end elements, driving industrial development and urban prosperity through the port, and ultimately achieving a deeper level of Port-Industry-City Integration development.

### ENHANCE THE COMPREHENSIVE SERVICE CAPABILITIES OF THE PORT

Strengthen land-sea two-way linkage, and while expanding the port's route network, open up the international aquatic product trade route centered on Tianjin Port,<sup>34</sup> and build a aquatic product trade channel connecting Northeast Asia (Japan, South Korea) and the Bohai Rim region.<sup>20</sup> Deepen cooperation among Bohai Rim ports, and jointly build a Bohai Rim aquatic product cold chain logistics alliance to realize the sharing of cold chain resources and the coordinated development of fisheries and aquaculture resources in the Bohai Sea basin.<sup>6</sup>

Optimize the organization of sea-rail intermodal transportation, and add dedicated cold chain intermodal transport channels for aquatic products to improve the fresh-keeping transportation capacity of aquatic products from the port to the inland hinterland.<sup>17</sup> Relying on Beijiang and Dongjiang Port Areas, build a national aquatic product cold chain logistics hub, and develop end-to-end cold chain logistics services for aquatic products, including fishing port landing, fresh-keeping storage, and door-to-door distribution.<sup>25</sup> Explore and establish a new port service model of "cold chain + Beijing-Tianjin urban distribution + aquatic product e-commerce", and support the development of cross-border e-commerce for aquatic products,<sup>21</sup> improving the industrial chain of port aquatic product trade.

Improve the port's comprehensive collection and distribution system, and while opening up railway arteries, build specialized water transport channels for coastal fisheries breeding zones<sup>26</sup> to facilitate the transportation of aquaculture materials and aquatic products.

### DEEPEN THE CONSTRUCTION OF SMART AND LOW-CARBON PORT

Build a port data and information hub, and integrate aquatic ecological environment monitoring data (including water quality, fisheries resources, aquaculture water environment) into the port's "Smart Brain",<sup>9</sup> realizing the real-time monitoring and early warning of port development's impact on the aquatic ecological environment. Promote the interconnection and sharing of data among port, shipping,

railways, highways and aquatic ecological protection departments,<sup>27</sup> and build a joint monitoring platform for port coastal zone aquatic ecology.

Strengthen port pollution prevention and control, and while promoting the application of wind and solar power generation technologies, formulate targeted pollution control measures for fisheries and aquaculture protection<sup>29</sup>: strictly control the discharge of port wastewater and solid waste into the coastal waters, build a port sewage treatment and recycling system, and reduce the impact of port operations on aquaculture water environment.<sup>18</sup> Complete the construction of LNG refueling stations and charging facilities, and promote the use of new energy vessels in the coastal fisheries transportation,<sup>30</sup> reducing the pollution of traditional fuel vessels to the aquatic environment.

Build ecological buffer zones between the port operation area and the coastal aquaculture zone,<sup>7</sup> carry out ecological restoration projects such as artificial reefs and seagrass bed restoration in the key fisheries breeding waters of the Bohai Sea,<sup>35</sup> and protect the spawning grounds and feeding grounds of fisheries resources, realizing the coordinated development of port construction and aquatic ecological protection.<sup>36</sup>

## IMPROVE THE LEVEL OF SHIPPING SERVICES

Guide the sound development of the shipping industry, and encourage shipping enterprises to develop specialized aquatic product transport services (such as refrigerated container shipping).<sup>17</sup> Support the development of shipping finance that serves the fisheries and aquaculture industry, and expand the financial leasing business of mariculture equipment, aquatic product cold chain logistics equipment and fishing vessels,<sup>22</sup> building a northern international shipping financing center with aquatic product industry support characteristics.

Improve the modern shipping service system, and attract the settlement of aquatic product trade, deep processing and cold chain logistics enterprises in the international shipping service cluster,<sup>25</sup> forming a complete aquatic product industry chain integrating port logistics, processing and trade. Study and implement policies such as departure port tax refund for aquatic product exports and transshipment consolidation with Tianjin Port as the hub,<sup>21</sup> reducing the transaction cost of aquatic product international trade.

Strengthen the development of port and shipping-related industries, and while refining cruise tourism, develop leisure fisheries and marine ecological tourism in the old port area through shoreline transformation,<sup>35</sup> combining port cultural tourism with coastal aquaculture experience, and forming a new growth point of the marine economy. Expand bonded ship-related businesses, and at the same time build a bonded processing base for aquatic products in the comprehensive bonded zone,<sup>34</sup> supporting the export of deep-processed aquatic products.

## OPTIMIZE THE SPATIAL LAYOUT OF PORT, INDUSTRY AND CITY

Strengthen planning and control on both sides of major collection and distribution channels, study the establishment of port-city boundary buffer zones, and at the same time delimit dedicated marine aquaculture zones and fisheries resource protection zones in the coastal zone of Tianjin,<sup>7</sup> clarifying the spatial boundary of port operation, industrial development and fisheries/aquaculture production, and reserving sufficient space for the sustainable development of fisheries and aquaculture.<sup>6</sup>

Strengthen the supporting and linkage role of port areas for the rear-end industries, and carry out the differentiated layout of aquatic product industry functions in each port area: Dongjiang Port Area focuses on developing aquatic product international trade and cold chain logistics, relying on the comprehensive bonded zone to build an aquatic product cross-border trade hub; Dagukou Port Area combines grain and oil processing industry to develop aquatic product deep processing, forming a food processing industrial cluster integrating grain, oil and aquatic products; Gaoshaling Port Area reserves space for aquatic product logistics equipment manufacturing, providing technical support for the modernization of fisheries and aquaculture.<sup>6</sup>

Optimize the spatial layout of “Jincheng” and “Bingcheng”: Binhai New Area (Bingcheng) focuses on the development of intensive mariculture and aquatic product primary processing, relying on the port to build an aquatic product production base; Tianjin’s central urban area (Jincheng) focuses on aquatic product deep processing, trade and consumption, forming a “production in the coast, processing and consumption in the city” coordinated development pattern, and realizing the organic integration of port-industry-city layout with fisheries and aquaculture industry layout.

## IMPROVE THE STAKEHOLDER COORDINATION MECHANISM AND SAFEGUARD THE LIVELIHOOD OF MARINE RESOURCE-BASED OPERATORS

Establish a multi-stakeholder coordination committee for port-industry-city-aquatic ecology integration composed of port management departments, industrial development departments, aquatic ecological protection departments, fisheries/aquaculture operators and coastal residents,<sup>9</sup> and formulate a sound interest coordination mechanism to protect the legitimate rights and interests of fisheries and aquaculture operators in the process of port and industrial development.<sup>31</sup>

Formulate special support policies for the transformation and upgrading of traditional fisheries operators<sup>28</sup>: provide technical training and financial support for fishermen to switch to intensive aquaculture, leisure fisheries and aquatic product trade, and improve the livelihood security of marine resource-based operators. Establish a compensation mechanism for aquatic ecological protection and fisheries resource damage, and compensate the aquaculture operators affected by port development, realizing the bal-

ance between port-industry-city development and the protection of fishermen's livelihoods.

Strengthen the joint supervision of the Bohai Sea's aquatic resources by Tianjin and Hebei, and establish a cross-regional fisheries and aquaculture resource protection and development alliance,<sup>6</sup> realizing the coordinated utilization of marine resources and the joint protection of the aquatic ecological environment in the Bohai Rim region under the background of port-industry-city integration.

.....

#### AUTHORS' CONTRIBUTION

Conceptualization: Rong Hua, Yijie Chai, Zuoya Wang, Ling Zhu; Writing - original draft preparation: Rong Hua, Yijie Chai, Zuoya Wang, Ling Zhu; Writing - review and editing: Rong Hua, Yijie Chai, Zuoya Wang, Ling Zhu; Supervision: Rong Hua, Zuoya Wang, Yijie Chai, Ling Zhu.

#### COMPETING OF INTEREST – COPE

No competing interests were disclosed.

#### ETHICAL CONDUCT APPROVAL – IACUC

This study did not involve any experimental research on animals or plants.

#### INFORMED CONSENT STATEMENT

All authors and institutions have confirmed this manuscript for publication.

#### DATA AVAILABILITY STATEMENT

All are available upon reasonable request.

Submitted: January 05, 2026 CDT. Accepted: March 21, 2026 CDT. Published: March 25, 2026 CDT.



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-4.0). View this license's legal deed at <http://creativecommons.org/licenses/by/4.0> and legal code at <http://creativecommons.org/licenses/by/4.0/legalcode> for more information.

## REFERENCES

1. Ng AK, Tongzon JL. Port-city interface dynamics: Land use conflicts and spatial integration strategies. *Transport Reviews*. 2019;39(2):233-252. doi:[10.1080/01441647.2018.1549500](https://doi.org/10.1080/01441647.2018.1549500)
2. Monios J, Wilmsmeier G. The life cycle of port-industrial systems and implications for urban transition. *Urban Studies*. 2020;57(13):2724-2740. doi:[10.1177/0042098019894881](https://doi.org/10.1177/0042098019894881)
3. Tianjin Oceanic Administration. *2023 Report on Marine Fishery Resources and Aquaculture Industry Development in Tianjin*. Tianjin Ocean Press; 2023.
4. Deng Z. *Study on the Urban-Regional Spatial Evolution of Differentiated Development of Coastal Ports in China*. dissertation. Dalian Maritime University; 2022. doi:[10.26989/d.cnki.gdlhu.2022.000064](https://doi.org/10.26989/d.cnki.gdlhu.2022.000064)
5. Jiang MC. *Study on the Spatiotemporal Pattern Evolution and Coupling Coordinated Development of Shanghai's "Port-Industry-City" System*. dissertation. East China Normal University; 2017.
6. Wang Y, Liu R. Research on the coordinated development of port economy and fishery resources in the Bohai Rim region. *Marine Economy Research*. 2020;10(2):3-12. doi:[10.13676/j.cnki.cn35-1285/p.2020.02.001](https://doi.org/10.13676/j.cnki.cn35-1285/p.2020.02.001)
7. Jones E, Wiering A. Ecological buffer zones and blue infrastructure in port area regeneration. *Land Use Policy*. 2018;79:516-526. doi:[10.1016/j.landusepol.2018.08.011](https://doi.org/10.1016/j.landusepol.2018.08.011)
8. Hall P, Robbins D. Port-city-ecology integration: A new framework for sustainable coastal urban development. *Cities*. 2021;116:103298. doi:[10.1016/j.cities.2021.103298](https://doi.org/10.1016/j.cities.2021.103298)
9. Chen G, Wang Y. Aquatic ecological carrying capacity and port-industry-city integration in coastal port cities. *Journal of Coastal Conservation*. 2022;26(4):68. doi:[10.1007/s11852-022-00866-9](https://doi.org/10.1007/s11852-022-00866-9)
10. Guiding opinions on building world-class ports. *China Water Transport*. 2019;(12):19-22. doi:[10.13646/j.cnki.42-1395/u.2019.12.008](https://doi.org/10.13646/j.cnki.42-1395/u.2019.12.008)
11. Li TB. Accelerating the construction of world-class ports and composing a chapter of port development for a transport powerhouse in China—Director of the Water Transport Bureau Li Tianbi interprets Guiding Opinions on Building World-Class Ports. *China Water Transport*. 2019;12:22-23. doi:[10.13646/j.cnki.42-1395/u.2019.12.009](https://doi.org/10.13646/j.cnki.42-1395/u.2019.12.009)
12. Yang L. Shandong Port Qingdao Port-Industry-City Integration projects put into production and start construction concentratedly. *China Water Transport News*. <https://doi.org/10.28142/n.cnki.ncsyb.2023.000172>. February 6, 2023.
13. Yu YJ. How to take the path of “Port-Industry-City-Culture” integration? *Ningbo Daily*. <https://doi.org/10.28586/n.cnki.nnbrb.2022.001003>. March 25, 2022.
14. Tianjin Binhai New Area People's Government. 14th Five-Year Plan for National Economic and Social Development and Long-Term Goals for 2035 of Tianjin Binhai New Area. Accessed May 15, 2024. <https://www.tjbh.gov.cn/>
15. Liu Y, Zhang W. Construction of aquatic product consumption and cold chain logistics system in the Beijing-Tianjin-Hebei urban agglomeration. *Journal of Commercial Economics*. 2021;18:115-118. doi:[10.19699/j.cnki.issn2096-0298.2021.18.115](https://doi.org/10.19699/j.cnki.issn2096-0298.2021.18.115)
16. Tianjin Port (Group) Co., Ltd. Introduction to Tianjin Port Group. Accessed May 15, 2024. <https://www.ptacn.com/channels/12.html>
17. Tianjin Port Group. *2022-2026 Development Plan for Aquatic Product Cold Chain Logistics of Tianjin Port*. Tianjin Port Press; 2022.
18. National Marine Environmental Monitoring Center. *2023 Report on Green Development and Aquatic Ecological Protection of China's Coastal Ports*. National Marine Environmental Monitoring Center Press; 2023.
19. Smith J, Johnson R. Port logistics and sustainable fisheries development in the UK southeast coast. *Maritime Policy & Management*. 2019;46(7):890-905. doi:[10.1080/03088839.2018.1512347](https://doi.org/10.1080/03088839.2018.1512347)
20. Bohai Rim Port Alliance. *Initiative for the Coordinated Development of Aquatic Product Logistics and Fishery Resources in Bohai Rim Ports*. Bohai Rim Port Alliance Press; 2022.

21. Lin C, Huang Z. Research on aquatic product international trade and industrial chain upgrading in port cities: A case study of Tianjin. *Journal of International Trade*. 2020;7:89-102. doi:[10.13510/j.cnki.jit.2020.07.007](https://doi.org/10.13510/j.cnki.jit.2020.07.007)
22. Agricultural Development Bank of China. *Policies and Practices of Financial Support for Fishery Aquaculture Industry*. Agricultural Development Bank of China Press; 2021.
23. Wu C, Shao J. Integrated development of marine aquaculture equipment modernization and port equipment industry. *Journal of Fisheries of China*. 2022;46(8):1356-1365. doi:[10.11964/jfc.20211113216](https://doi.org/10.11964/jfc.20211113216)
24. Guangdong Ocean and Fishery Bureau. *Fishery Resources Protection and Aquaculture Industry Development Plan of the Pearl River Estuary (2021-2025)*. Guangdong Ocean Press; 2021.
25. Chen X, Liu Z. Construction and development countermeasures of China's aquatic product cold chain logistics system. *Journal of Fisheries of China*. 2022;46(3):512-524. doi:[10.11964/jfc.20210212765](https://doi.org/10.11964/jfc.20210212765)
26. Water Transport Research Institute of the Ministry of Transport. *Guidelines for the Construction of Specialized Infrastructure for Fishery Aquaculture in Coastal Ports*. China Communications Press; 2021.
27. Marine Ecological Environment Department of the Ministry of Ecology and Environment. *Technical Specifications for Aquatic Ecological Environment Monitoring and Pollution Control in Port Coastal Zones*. China Environmental Science Press; 2022.
28. Zhang D, Li B. Research on the livelihood security mechanism of fishery practitioners in the development of coastal ports. *China Population, Resources and Environment*. 2021;31(S2):189-192. doi:[10.12062/cpre.20210615](https://doi.org/10.12062/cpre.20210615)
29. Van den Berghe T, Oosterlynck S. Port-urban-ecological conflicts: Land use competition and multi-level governance in coastal zones. *European Planning Studies*. 2022;30(8):1563-1582. doi:[10.1080/09654313.2021.1991444](https://doi.org/10.1080/09654313.2021.1991444)
30. Food and Agriculture Organization of the United Nations. *Global Guidelines for Port Development and Fishery Ecological Protection*. FAO Press; 2020.
31. Li X, Zhang L. Port-industry-city integration and marine ecological protection in Chinese port cities. *Sustainability*. 2023;15(7):5821. doi:[10.3390/su15075821](https://doi.org/10.3390/su15075821)
32. Jentoft S, Chuenpagdee R. Stakeholder governance for coastal and marine spatial planning. *Coastal Management*. 2020;48(3):247-262. doi:[10.1080/08920753.2020.1743226](https://doi.org/10.1080/08920753.2020.1743226)
33. Wang H, Li C. Research on protection and sustainable utilization of freshwater fishery resources in the Haihe River Basin. *Water Resources Protection*. 2020;36(2):168-174. doi:[10.3880/j.issn.1004-6933.2020.02.024](https://doi.org/10.3880/j.issn.1004-6933.2020.02.024)
34. Tianjin Customs District. *2023 Report on the Development of Aquatic Product Cross-Border E-Commerce and International Trade in Tianjin*. Tianjin Customs Press; 2023.
35. Zhang L, Zhang W. Research on the development model of recreational fishery in the transformation of old coastal ports: A case study of the Yangtze River Delta ports. *Geographical Research*. 2021;40(5):1365-1378. doi:[10.11821/dlyj020200665](https://doi.org/10.11821/dlyj020200665)
36. Chua SH, Goh BH. Sustainable port development and marine aquaculture integration: The Singapore model. *Marine Policy*. 2021;130:104568. doi:[10.1016/j.marpol.2021.104568](https://doi.org/10.1016/j.marpol.2021.104568)