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Fishing Problems In The Area Of An Offshore Wind Farm On The Example Of Baltic Power*

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Abstract

This article discusses the most advanced offshore wind project in Poland, implemented in the maritime area of the Republic of Poland, within the Polish Exclusive Economic Zone, and particularly the impact of Baltic Power on Polish fisheries. The study outlines one of the world's first farms to install 15 MW wind turbines, in the context of both the significant opportunities for Poland's energy transition and the constraints on the functioning of fisheries concentrated around the ports of the Central Coast of Poland.
The aim of the article was to illustrate the challenges faced by marine fisheries in the offshore wind farm investment area, using Baltic Power as an example. For the purposes of this research, a two-stage analytical process was employed. This involved determining the general and specific locations for the Baltic Power investment. The research process was based on literature research and data sources contained in specialist reports. Consequently, the collected data was processed using GIS tools and statistical analysis. The presented research results focus on showing the limitations in fishing in the standard fishing grounds of the Baltic Sea carried out by Polish fishing vessels, as well as indicating the threats related to the movement of vessels in the offshore area.

Keywords: wind energy, fisheries, sustainable development.

Introduction

One of the most important energy investments currently underway in Poland is the construction of an offshore wind farm, known as Baltic Power. It is a joint venture between ORLEN and the Canadian energy producer Northland Power. The wind farm is one of the most advanced offshore wind projects in Poland, being implemented in the South Baltic Sea, specifically within the maritime areas of the Republic of Poland, within the Polish Exclusive Economic Zone (Baltic Power", General non-specialist summary, online, 2025).

The Baltic Power wind farm is the first investment of its kind to deliver offshore energy to Poland. With an expected capacity of approximately 1.2 GW, the wind farm will be able to produce 4 TWh of energy annually, providing energy for over 1.5 million households. The production of this clean energy will be able to meet approximately 3% of the country's current electricity demand. However, it should be noted that this energy demand is primarily for consumers located in coastal areas (Baltic Power", General non-specialist summary, online, 2025.

The Baltic Power investment covers a designated 131.08 km² maritime area, approximately 23.5 km from the coast, where 76 wind turbines will be installed, along with approximately 120 km of cable routes and two offshore power stations. The investment itself is one of the most complex projects involving the development of offshore wind farms, which will operate in an area designated in the maritime development plan around the Słupsk Bank, Central Bank, and Oder Bank, potentially prime fishing grounds for marine fish species in the Baltic Sea (Fig. 1) (Offshore Wind Farm Development Program, 2025).

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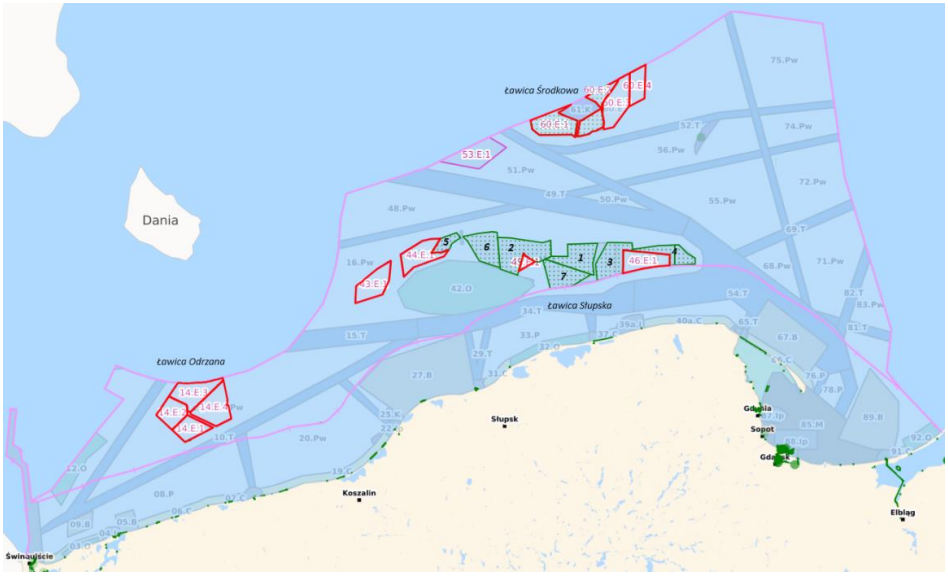

Figure 1. Location of Baltic Power in the Baltic Sea.
Source:www.gov.pl/web/morska-energetyka-wiatrowa/program-rozwoju-morskich-farm-wiatrowych.

The analysis of the above figure shows that the Baltic Sea area north of the seaports of Ustka and Łeba is undoubtedly a "maritime construction site," which will enable the development of the domestic supply chain and will likely contribute to the creation of new, high-paying jobs. It is estimated that approximately 34,000 full-time positions will be needed during the investment phase of offshore wind farms, while the target number will be approximately 29,000 during the operational phase. The share of local suppliers in construction and operation alone could reach almost 50% for projects implemented after 2030, which could undoubtedly impact the development of the Polish economy (Bojadżijewa, I., and others, 2024). The defined areas and projects, as well as the entities implementing the project, with separate investors, are presented in the table. 1.

Table 1. Investment areas located in the Exclusive Economic Zone of Poland

Area	Project name/ company implementing the project	Investor	Power
Phase I of the support system			
1	Baltica 3/ Wind Power Plant Baltica 3	PGE Baltica/Orsted	1050 MW
2	Baltica 2/ Wind Power Plant Baltica 2	PGE Baltica/Orsted	1500 MW
3	Baltic Power/Baltic Power	Orlen/Northland	1200 MW
4	BC-Wind/C-Wind Polska	Ocean Winds	500 MW (2 x 250 MW)
5	FEW Baltic II/Baltic Trade and Invest	RWE Renewables	440 MW
6	MFW Bałtyk II/MFW Bałtyk II	Polenergia/Equinor	720-1200 MW
7	MFW Bałtyk III/MFW Bałtyk III	Polenergia/Equinor	720-1200 MW
Phase II of the support system			
14.E.1	Energa MFW 1/Energa MFW 1	Orlen	812 MW
14.E.2	Energa MFW 2/Energa MFW 2	Orlen	896 MW
14.E.3	Orlen Neptun 14.E.3/Orlen Neptun III	Orlen	1204 MW
14.E.4	Orlen Neptun 14.E.4/Orlen Neptun IV	Orlen	1204 MW
43.E.1	Baltica 7/PGE Baltica 4	PGE/Tauron	990 MW
44.E.1	Baltica 9/ Wind Power Plant Baltica 9	PGE	975 MW
45.E.1	Baltica 2+/ Wind Power Plant Baltica 2	PGE/Orsted	210 MW
46.E.1	Orlen Neptun 46.E.1/Orlen Neptun VIII	Orlen	966 MW
60.E.1	MFW Bałtyk I/MFW Bałtyk I	Polenergia/Equinor	1560 MW
60.E.2	Baltica 1/ Wind Power Plant Baltica 1	PGE Baltica	900 MW
60.E.3	Baltica 1+/ Wind Power Plant Baltica 1	PGE	1185 MW
60.E.4	Baltica 5/ Wind Power Plant Baltica 5	PGE/Enea	555 MW
53.E.1	The proceedings are pending		

Source: own study based on (Offshore Wind Farm Development Program, 2025).

As can be seen from the above figure and the investment areas presented, the largest concentration of construction is located near the Słupsk Bank. This area is crossed by, among other things, the shipping route connecting the ports of the Bay of Gdańsk with the Strait of Bornholm, used primarily by tankers and merchant ships. Based on AIS (Automatic Identification System) data, approximately 600 vessels voyage through the Baltic Power Functional Area each year. For many years, this route has been a component of the Polish Maritime Administration's planned deepwater route of strategic importance for large tankers and gas carriers. South of the Baltic Power Area runs the second most heavily used customary shipping route, leading from the Danish Straits to Polish, Lithuanian, and Russian ports in the southern Baltic Sea. Based on the AIS system, an average of approximately 16,000 vessels pass through this route each year. A traffic separation system is in place on this route, based on two sections connecting the ports of Łeba-Rowy and Ustka-Jarosławiec. North of Baltic Power, a shipping route connects the port of Klaipėda with ports on the southern Baltic Sea, primarily Świnoujście and Sassnitz-Mukran. The main users of this route are freight-rail ferries and cargo ships. (Opioła and others, 2022).

In addition to the regular movement of vessels, including recreational vessels, fishing activities are conducted within the Baltic Power area. The fishing areas are defined by the so-called fishing squares, which cover approximately 400 km². Considering the Baltic Power development area, which is located unevenly within four fishing squares: N8, O8, N7, and O7, it can be considered an obstacle to fishing, as shown in Figure 2.

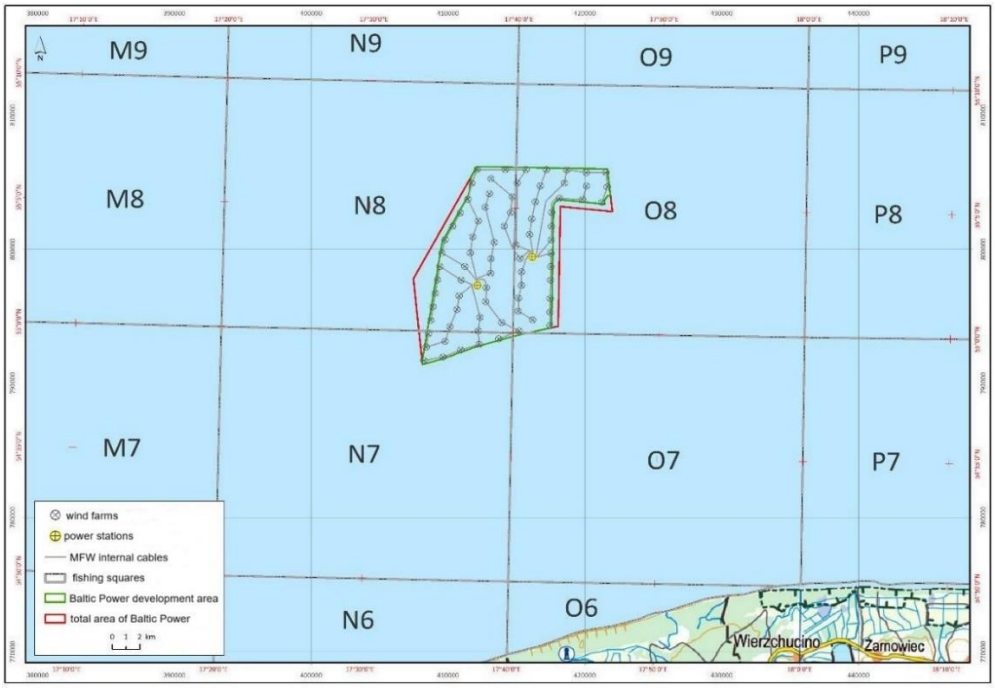

Figure 2. Area occupied by Baltic Power in individual fishing areas.
Source: prepared based on (Opioła and others, 2022).

Analysis of the above figure indicates that the area occupied by Baltic Power excludes, to a certain extent, the maritime area associated with fishing activities. This applies particularly during the wind farm construction phase, where the density of vessels involved is significantly higher. Restrictions may apply to both the turbines themselves and other utility and service infrastructure. Reports indicate that economic use of the waters was taken into account in the process of determining the location of offshore wind farms as part of maritime spatial planning, reducing the negative impact of wind infrastructure. This situation sometimes results in fishing being permitted at relatively close distances to the wind turbines, using small vessels or passive fishing methods. However, the movement of vessels involved in the construction and operation of wind farms at sea may translate into a higher risk of accidents and vessel collisions, as well as higher insurance costs. Therefore, considering the average areas of key fishing squares occupied by Baltic Power: N8 - 19.93%, O8 - 12.89%, N7 - 2.37%, O7 - 0.04%, it should be recognized that a fishing problem exists in this region. And the restrictions may be felt especially by small fishing vessels with smaller ranges and storage capacities, located on Poland's Central Coast. This refers to fishing

ports such as Ustka and Łeba, which are forced and will ultimately be forced to bypass energy infrastructure, which leads to increased fuel consumption and longer work hours for fishermen. (Bojażdżewa and others, 2024).

Research Materials And Methods

Considering the specific nature of offshore wind farm construction (Łopuszyński, 2015), (Kmiecik, 2019), it can be noted that this is mainly due to the occurrence of very difficult hydrometeorological conditions and problems related to embedding wind turbines in the ground (Adamiec, 2023). In the marine environment, the main problem is a stable seabed, therefore, areas with favorable access from the construction perspective are used. It is also worth noting that, in terms of spatial development, wind turbines are currently located in shallow waters, where it is relatively safe in terms of communication, i.e., where vessel traffic is the lowest. Furthermore, it is recommended to build wind farms at a safe distance from the coast (Flaszyński, 2021). According to a report issued by WindEurope, European wind farms are located at an average depth of 44 m, at an average distance of 52 km from the coast (Palmowski, 2023), (Pilip, 2018). Such orientation creates, on the one hand, great opportunities related to the energy security of the country and the use of renewable energy sources, alternative to those that affect the global warming of the Earth (Herdzik, 2018), and on the other hand, it limits the fishing opportunities for fishermen, mainly those who own very small vessels, but their business is culturally linked to the place of residence and the heritage resulting from the takeover of the business in the "from father to son" formula.

To illustrate the fishing problems in the area of the Baltic Power offshore wind farm, it was deemed appropriate to use the hypothesis that fishing in the Southern Baltic Sea region of the central Polish coast is related to ongoing offshore construction and investments, along with the accompanying difficulties resulting from the lack of access to fishing grounds. Initial work involved exploring the issues related to the location of fishing grounds and the location of offshore wind farm investments. Based on this, the research objective was formulated, focused on: demonstrating the problems of marine fishing in the offshore wind farm investment area, using the example of Baltic Power.

For research purposes, the analytical process was divided into two stages:

- Stage 1 – involved determining the general and specific location of the Baltic Power investment. The research process was based on literature research, data sources contained in specialist reports, and data obtained from the Seaport Authorities located on the central Polish coast.
- Stage 2 – consisted of the selection of research tools, in particular based on the processing of GIS data and statistical data from the resources of statistical portals.

Research Results

Analyzing available fisheries statistics, including the aforementioned fishing rectangles: N8, O8, N7, and O7, it can be concluded that the average annual catch in these areas is approximately 133 tons. The multi-year average share of catches from the four rectangles in the total Baltic Sea catch between 2014 and 2022 ranged from 0.2% to 0.4%. The estimated annual catch in the Baltic Power Area between 2014 and 2020 was approximately 11 tons of fish. The largest share of catch volume and value in the four analyzed fishing rectangles compared to the total Baltic Sea catch is accounted for by vessels registered in ports located closest to the analyzed area, i.e., those docked at the fishing ports of Łeba and Ustka (Opioła and others, 2022). The collected data indicate that the area of the analyzed rectangles is characterized by relatively low fishing productivity. The average catch per km2 in the four fishing squares is approximately 170 kg annually. This represents approximately 6-8% of the average fishing productivity, which in other areas (fishing squares) is approximately 800 kg. The highest productivity was recorded in square O8, which includes a small (12.9%), north-eastern part of the Baltic Power OWF Area, followed by squares N7, O7, and N8 (Opioła and others, 2022).

The average share of fish caught in the years 2014-2018 in the areas of the fishing rectangles located in the area of the planned Baltic Power investment project in relation to the total Polish catch in the Baltic Sea was negligible and amounted to 0.2%. Analyzing the relative importance of the area of fishing rectangles, which are to be partially occupied by the Baltic Power investment area, as a fishing spot for fishing vessels located in various ports, it can be seen that it is rather crucial for vessels stationed in Łeba (Opioła and others, 2022). For vessels registered in the other ports, catches in the area of the four analyzed rectangles can be considered insignificant, their relative volume for none of them exceeds 1% per year (Table 2.).

Table 2. Average catch volume in the Baltic Sea

Seaport	Fishing in fishing squares: N8, N7, O8, O7 [t]	Fishing in the Baltic Power area [t]	Baltic Sea	Participation [%]	
				fishing squares	Baltic Power area
Łeba	103,8	4,1	2478,7	4,2	0,2
Władysławowo	76,9	0,0	16 159,1	0,5	0,0
Ustka	42,3	4,6	42 287,0	0,1	0,0
Dziwnów	32,5	0,1	5664,1	0,6	0,0
Świnoujście	7,0	0,7	4019,2	0,2	0,0
Hel	2,2	0,1	35 912,9	0,0	0,0
Kołobrzeg	2,3	0,2	11 645,6	0,0	0,0
Darłowo	2,9	0,0	951,3	0,3	0,0
Inne	1,8	0,8	18 299,7	0,0	0,0
Razem	271,7	10,5	137 417,9	0,2	0,01

Source: own study based on (Opioła and others, 2022).

Analyzing the table above, it can be concluded that the volume of fish caught in the individual fishing areas encompassed by the Baltic Power investment area varies. However, fishing within the Baltic Power investment area is cyclical due to shallow waters, which are attractive to fishermen. The same applies to fish habitats, which often choose shallow waters and undulating bottoms. This fact influences fishermen's activities in this area, which becomes a reliable fishing ground, and the implementation of an offshore wind farm, or even a single wind turbine, is perceived as a negative impact, creating a barrier to the free passage of fishing vessels. The lack of free space allowing vessels to move within the designated fishing areas will lengthen fishing boats' routes to productive fishing grounds located north of the Baltic Power offshore wind farm in the Słupsk Trough area. This will result in additional costs, mainly for fishing boats stationed in the ports of Ustka (approximately 60 boats) and Łeba (approximately 30 boats), resulting from the increased fuel consumption and time required to reach the fishing grounds. Figure 3 shows the location of the Baltic Power offshore wind farm and the existing and potentially extended routes to fishing grounds in the vicinity of the Słupsk Trough (Opioła and others, 2022).

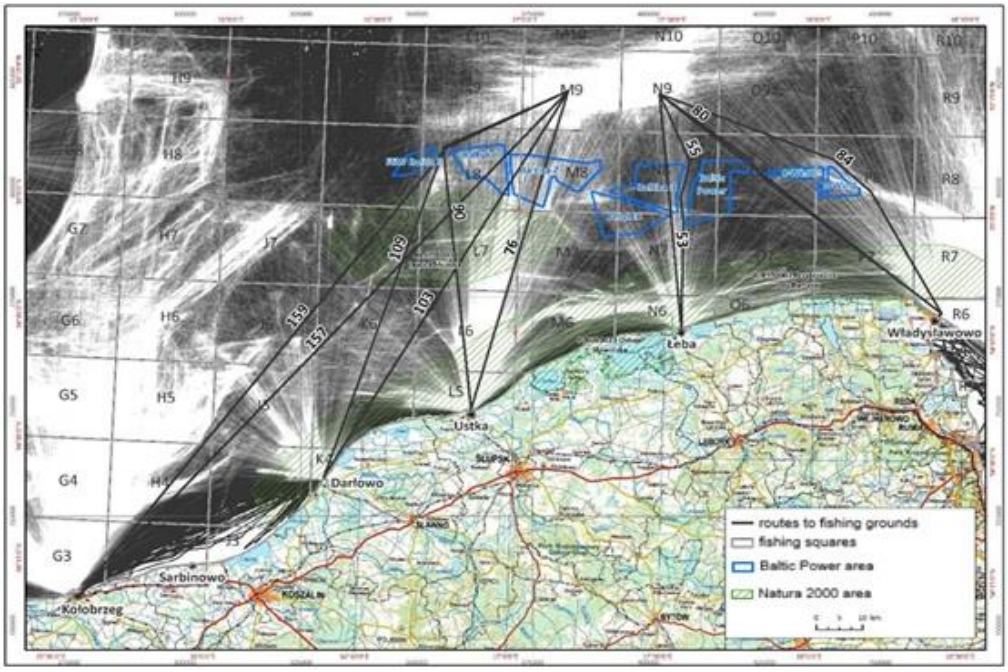

Figure 3. Current and potentially extended routes to fishing grounds in the Słupsk Trough area.

Source: prepared based on (Opioła and others, 2022).

Analyzing the above figure, it can be concluded that fishermen from every fishing port on Poland's Central Coast: Kołobrzeg, Darłowo, Ustka, Łeba, and even Władysławowo, wanting to fish near the Słupsk Bank, are forced to avoid wind farm construction sites, including the largest investment, Baltic Power. The analysis presented in the "Report on the Environmental Impact of the Baltic Power Offshore Wind Farm" (Opioła and others, 2022) indicates that the need to bypass the offshore wind farm for fishing vessels departing and returning to the ports of Kołobrzeg, Darłowo, Ustka, Łeba, and Władysławowo, and fishing in the fishing grounds in the Słupsk Trough area, will increase fuel costs by approximately 100,000 PLN annually. The extended time it takes to reach and return from the fishing grounds could generate additional labor costs of approximately 150,000 PLN annually. Due to the significant importance of fishing grounds in the Słupsk Trough region for fishermen based in Ustka, as well as the greatest extension of the route (28 km in both directions), fishermen from this port will incur the greatest increase in costs resulting from having to bypass the area where the offshore wind farm is located. The additional costs for fishermen resulting from bypassing the offshore wind farm are illustrated in Table 3.

Table 3. Additional costs for fisheries resulting from bypassing the offshore wind farm in the Słupsk Trough fishing grounds

Year	Port	Number of ships	Average crew size	Number of cruises	Additional flow time [h]	Extra working time [h]	Additional fuel cost [PLN]	Additional labor cost [PLN]	Together [PLN]
2017	Darłowo	2	4,0	4	4	17	642	674	1316
	Kołobrzeg	8	4,0	17	6	24	575	955	1529
	Łeba	12	4,0	192	69	276	5 400	10 757	16 157
	Ustka	30	4,3	316	796	3454	82 685	134 722	217 407
	Władysławowo	30	4,9	68	49	248	8 487	9660	18 147
Total in 2017		**82**	**4,4**	**597**	**925**	**4020**	**97 788**	**156 768**	**254 556**
2018	Darłowo	1	3,4	5	5	18	231	716	947
	Kołobrzeg	9	4,0	10	4	14	372	562	934
	Łeba	14	3,8	113	41	160	3 187	6253	9441
	Ustka	29	4,3	283	713	3119	82 408	121 631	204 039
	Władysławowo	15	4,8	44	32	154	5 378	6020	11 398
Total in 2018		**68**	**4,3**	**455**	**795**	**3466**	**91 576**	**135 183**	**226 759**
2019	Darłowo	1	4,0	1	1	4	80	168	248
	Kołobrzeg	6	4,8	8	3	13	438	517	954
	Łeba	11	3,8	99	36	139	2 356	5417	7773
	Ustka	26	4,3	339	854	3736	95 076	145 710	240 785
	Władysławowo	7	5,0	33	24	118	4 223	4583	8806
Total in 2019		**51**	**4,4**	**480**	**918**	**4010**	**102 172**	**156 394**	**258 567**
Mean		**67**		**511**	**879**	**3832**	**97 179**	**149 448**	**246 627**

Source: own study based on (Opioła and others, 2022).

Conclusions and Recommendations

Considering the cumulative negative impact of the need to extend fishing vessel routes to fishing grounds, the problem for Polish fisheries is quite serious. Furthermore, there is a growing public demand for marine fish, which does not necessarily translate into an interest in restoring fisheries. Indeed, after Poland's accession to the European Union, many shipowners decided to scrap vessels – cutters – in exchange for EU subsidies (Zieziula, 2004). This resulted in a 30% reduction in the number of fishing vessels in Polish ports (Kubicki, 2019). Furthermore, this limited the functioning of seaports, particularly in the development of ports on Poland's Central Coast, where fishing functions were gradually minimized in favor of, for example, the development of tourism functions. And it is not only about fishing itself, but also about minimizing

employment in the fishing sector, cyclical reduction of catches related to the adopted limits and minimizing the number of vessels in ports, which influences the change in the perception of the port itself, no longer as a logistics hub, but as a tourist attraction for the average tourist (Fig. 4.).

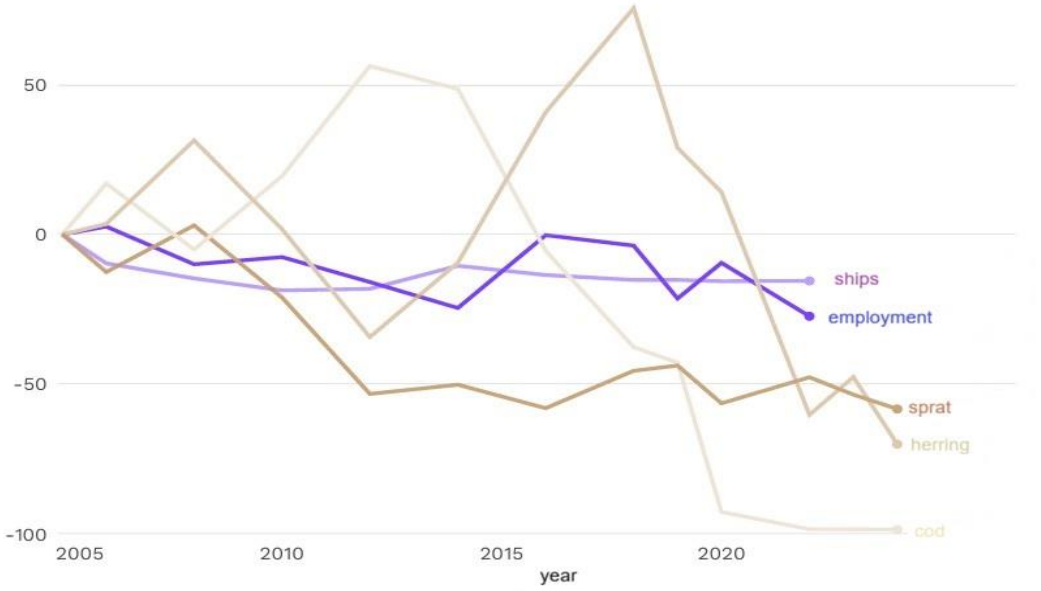

Figure 4. Changes in catch volume, units and employment in the years 2005-2025 in Polish fisheries.
Source: own study based on (Opioła and others, 2022).

The analysis of the above figure shows that the directionality associated with reduced catches and, consequently, a reduction in the number of vessels is not necessarily a successful EU trend (Rosciszewski-Dodgson, Cirella, 2025). Currently, although the importance of the fisheries sector in the economy is gradually being restored, for example by generating additional EU funds for fishermen, this is a very slow process. Maintaining catch limits (Langlet, 2023) is preferred over rebuilding the fleet. This has resulted in Polish sea fishing currently being a small sector in the national economy. This contributes to the gradual decline of this important sector, although it is estimated that Polish fishermen are the largest group operating in the Baltic Sea, and Polish vessels recorded the highest fish landings in the Baltic Sea in 2021 (Bojażdżewa and others, 2024).

Analyzing the above, it can be concluded that the conditions for the development of fisheries are very unfavorable. Furthermore, the contemporary development of wind energy in Polish maritime areas will result in a radical change in the use of maritime space, particularly in the field of fisheries (Musiał, 2023). The mere presence of waterside infrastructure in the open sea will cause significant difficulties in navigation. Avoiding the entire wind farm zone will significantly increase the time it takes to reach the desired fishing grounds. However, shortening the route by sailing between wind farms, especially in windy weather and a sea state above 2 degrees, may result in maritime accidents, including the loss of human life.

Implementing the planned barriers around offshore wind farms to prevent the free passage of vessels, including fishing boats, will be a significant challenge. Locating other wind farms to the east and west of the Baltic Power wind farm without a designated shipping corridor will pose a significant safety issue and will significantly lengthen fishing boats' routes to the fishing grounds located to the north in the Słupsk Trough region. This situation will significantly impact the total fishing costs, for example, for fishing boats based in the ports of Ustka and Łeba. This will result from increased fuel consumption, increased time spent sailing to the fishing grounds, increased operations at the fishing grounds, and a longer return to their home port.

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