

Russia's 'Shadow Fleet' as a Military, Economic and Environmental Threat to the Black Sea

Російський «тіньовий флот» як чинник військових, економічних та екологічних загроз у Чорноморському регіоні

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Received: June 13, 2026 | Revised: June 21, 2026 | Accepted: June 30, 2026

UDC 355.02:327.5:656.61

DOI: <https://doi.org/10.33445/sds.2026.16.3.4>

Purpose. To analyse the military, economic, and environmental threats posed by Russia's *shadow fleet* in the Black Sea region, assess its role in circumventing international sanctions and financing military operations, and identify approaches to countering this phenomenon.

Method. The study employs a qualitative research design based on document analysis, case study methodology, comparative analysis, and qualitative content analysis of reports produced by international organisations, government institutions, analytical centres, and expert sources.

Findings. The findings demonstrate that Russia's *shadow fleet* has become a key instrument for sustaining energy export revenues despite international sanctions. Its activities weaken sanctions, increase military, maritime, and environmental risks, and may facilitate hybrid operations against critical infrastructure. The operation of ageing and poorly regulated tankers significantly increases the likelihood of maritime accidents and environmental disasters, while existing international legal and institutional mechanisms remain insufficient to address these challenges effectively.

Theoretical implications. The study advances understanding of the *shadow fleet* as a multidimensional security phenomenon by integrating military, economic, environmental, and legal perspectives.

Practical implications. The findings support the development of more effective monitoring, sanctions enforcement, maritime surveillance, environmental protection, and critical infrastructure security measures.

Value. The study offers a comprehensive assessment of Russia's *shadow fleet* as an instrument of hybrid influence and identifies key challenges for international security.

Paper type. Theoretical.

Мета дослідження. Проаналізувати військові, економічні та екологічні загрози, які становить російський «тіньовий флот» у Чорноморському регіоні, оцінити його роль в обході міжнародних санкцій і фінансуванні військових операцій, а також визначити можливі підходи до протидії цьому явищу.

Метод дослідження. У дослідженні використано якісний дизайн дослідження, що ґрунтується на аналізі документів, методі кейс-стаді, порівняльному аналізі та якісному контент-аналізі звітів міжнародних організацій, державних установ, аналітичних центрів і експертних джерел.

Результати дослідження. Встановлено, що російський «тіньовий флот» став одним із ключових інструментів підтримання доходів від експорту енергоносіїв попри міжнародні санкції. Його діяльність знижує ефективність санкцій, посилює військові, морські та екологічні ризики, а також може сприяти проведенню гібридних операцій проти об'єктів критичної інфраструктури. Експлуатація застарілих і недостатньо контрольованих танкерів істотно підвищує ймовірність морських аварій та масштабних екологічних катастроф, тоді як чинні міжнародно-правові й інституційні механізми залишаються недостатньо ефективними для протидії цим викликам.

Теоретична цінність дослідження. Дослідження поглиблює розуміння «тіньового флоту» як багатовимірного безпекового явища шляхом інтеграції військового, економічного, екологічного та правового підходів.

Практична цінність дослідження. Отримані результати можуть бути використані для вдосконалення механізмів моніторингу діяльності «тіньового флоту», посилення санкційної політики, морського нагляду, захисту довкілля та критичної інфраструктури.

Цінність дослідження. Дослідження пропонує комплексну оцінку російського «тіньового флоту» як інструменту гібридного впливу та визначає ключові виклики для міжнародної безпеки.

Тип статті. Теоретична.

Key words: Shadow Fleet, Black Sea, Maritime Security, Economic Sanctions, Environmental Security, Economic Security, Hybrid Warfare.

Ключові слова: тіньовий флот; Чорне море; морська безпека; економічні санкції; екологічна безпека; економічна безпека; гібридна війна.

Introduction

Armed conflict affects numerous aspects of societal life, often in ways that are long-lasting and difficult to reverse. First and foremost, it results in the loss of human life and causes serious harm to people's health, affecting both soldiers on the battlefield and civilians who become victims of hostilities, bombings, or deliberate attacks on the civilian population. War also triggers severe economic crises by destabilising local and regional markets. The destruction of infrastructure, workplaces, and transport networks, coupled with workforce depletion, leads to declining production and the disruption of economic systems. As a consequence, populations in affected regions face food shortages and limited access to healthcare and other essential services.

At the same time, armed conflicts generate large-scale migration, both internal and cross-border. People forced to leave their homes become refugees, often deprived of basic necessities. War-induced migration also has significant consequences for host countries, which must cope with increased pressure on their social and economic systems. Equally important is the devastating impact of war on cultural heritage. Works of art, historical monuments, and places of worship are frequently destroyed during armed conflicts, either unintentionally or deliberately, as part of military strategies aimed at undermining the identity and morale of affected communities. Such losses are often irreversible and constitute a profound loss to humanity as a whole.

Armed conflict also inflicts severe damage on the natural environment. The destruction of industrial infrastructure, the release of toxic substances, the use of chemical weapons, and the devastation of agricultural land result in long-term environmental degradation. Such degradation adversely affects both human well-being and the resilience of ecosystems, many of which may require decades to recover.

The aim of this article is to examine the risks associated with the so-called *shadow fleet*, which the Kremlin uses to circumvent Western sanctions, conduct acts of sabotage, and finance its war against Ukraine. The article also explores potential measures to counter this practice.

The aim of this study is to analyse the military, economic, and environmental threats posed by Russia's *shadow fleet* in the Black Sea region. The study also seeks to examine the mechanisms through which the *shadow fleet* circumvents international economic sanctions, assess its impact on maritime security, environmental protection, and regional stability, and identify potential legal and institutional measures to counter this phenomenon.

Literature review

The issue of circumventing international economic sanctions through maritime transport has gained increasing scholarly and policy attention following the introduction of restrictive measures on oil exports from Iran, Venezuela, and, more recently, the Russian Federation. Existing studies and analytical reports indicate that so-called *shadow fleets* have become one of the principal mechanisms enabling sanctioned states to preserve access to global energy markets despite international trade restrictions (Budris, 2025; Khokhlov, 2025). The operation of these fleets is typically based on complex ownership structures, frequent changes of vessel registration, the use of flags of convenience, and deliberate concealment of the origin and destination of transported cargo (Budris, 2025; Khokhlov, 2025).

Researchers and maritime security analysts emphasise that contemporary maritime threats extend far beyond conventional naval operations. Increasing attention has been devoted to hybrid threats involving civilian shipping, including sabotage against critical maritime infrastructure, intelligence gathering, electronic interference, and the circumvention of international sanctions. Recent incidents in the Baltic Sea have demonstrated that vessels associated with the Russian *shadow fleet* may also pose risks to underwater communication cables and other elements of critical infrastructure (Lebedeva, 2025; Polivan & Gudev, 2025).

Environmental security represents another important dimension of the existing literature. Numerous analytical reports indicate that the extensive use of ageing tankers operating outside internationally recognised safety standards substantially increases the probability of maritime accidents and large-scale oil spills (Radchuk, 2025; Davydova, 2025). The environmental consequences are particularly severe in enclosed and semi-enclosed seas, such as the Black Sea, where limited water exchange considerably slows ecosystem recovery and prolongs the effects of pollution (BBC Russian Service, 2025; Davydova, 2025).

Despite the growing body of publications addressing sanctions circumvention and maritime security, relatively few studies adopt an integrated approach that simultaneously examines the military, economic, and environmental implications of Russia's *shadow fleet*. Consequently, the phenomenon should be analysed not merely as a mechanism for bypassing international sanctions but as a multidimensional challenge affecting regional security, environmental sustainability, international maritime governance, and the resilience of the global sanctions regime.

Materials and Methods

This study employs a qualitative research design to examine the military, economic, and environmental implications of Russia's *shadow fleet* in the Black Sea region. The research is based on a systematic analysis of documentary sources, comparative analysis, case study methodology, and qualitative content analysis.

The empirical material consisted of reports published by international organisations, analytical papers, official documents issued by governmental institutions, and publicly available materials concerning the operation of Russia's *shadow fleet*, the mechanisms used to circumvent international economic sanctions, and the associated implications for regional and international security. Particular attention was devoted to sources addressing maritime security, environmental protection, sanctions enforcement, and hybrid threats in the Black Sea and Baltic Sea regions.

Document analysis was employed to identify the principal characteristics of the *shadow fleet*, including its organisational structure, operating practices, ownership arrangements, flag registration strategies, and methods used to evade international sanctions. Comparative analysis was applied to examine different analytical assessments of the scale of the *shadow fleet*, estimates of its operational capacity, and evaluations of its economic and security implications presented in various official and analytical sources.

The case study method was used to investigate selected incidents illustrating the risks associated with the operation of Russia's *shadow fleet*. Particular emphasis was placed on the environmental disaster in the Kerch Strait in December 2024, which served as an illustrative case for assessing the environmental, economic, and security consequences of accidents involving ageing oil tankers operating outside internationally recognised safety standards.

The collected material was subsequently subjected to qualitative content analysis in order to identify the principal military, economic, and environmental threats associated with the activities of the Russian *shadow fleet*. The analytical process focused on establishing the relationships between sanctions circumvention mechanisms, maritime security challenges, environmental risks, and their broader implications for regional stability and international security.

Results

The Shadow Fleet

The term *shadow fleet* refers to tankers used to circumvent international sanctions and other restrictions imposed on the trade in crude oil and petroleum products. This phenomenon first emerged in 2018–2019, following the significant tightening of United States sanctions against Iran and Venezuela, which aimed to restrict their oil exports to key international markets without resorting to direct military measures. Following Russia's launch of its full-scale invasion of Ukraine, the number of vessels involved

in sanction-evasion activities increased substantially. This development was largely a response to the measures adopted by the G7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States), together with the European Union and Australia. Acting within the framework of the price cap coalition, these countries introduced a maximum price of USD 60 per barrel for Russian seaborne crude oil. These restrictions entered into force on 5 December 2022, simultaneously with the embargo on Russian oil imports imposed by coalition members. In response, Russia and entities affiliated with it began acquiring large numbers of ageing oil tankers, resulting in the rapid expansion of its *shadow fleet*, which currently exceeds in size the comparable fleets previously operated by Iran and Venezuela (Budris, 2025).

Estimates of the size of Russia's *shadow fleet* vary considerably, ranging from approximately 700 to as many as 1,400 tankers, depending on the source. According to Sergei Vakulenko of the Carnegie Endowment for International Peace, these discrepancies result from the fact that many of these vessels constitute an integral yet difficult-to-identify component of the global tanker fleet. An analysis of the operational routes of hundreds of vessels classified as belonging to the *shadow fleet* indicates that most do not specialise exclusively in transporting Russian oil but instead undertake such shipments only periodically. By contrast, estimates provided by AXSMarine suggest that only about 150 tankers directly linked to Russian entities are primarily engaged in transporting Russian crude oil (Khokhlov, 2025).

According to data published in early 2025, Russia's *shadow fleet*, used to export oil in circumvention of international sanctions, includes approximately 230 tankers that previously belonged to companies based in the United States and Europe. This information emerged from an investigation conducted by an international consortium of journalists, the findings of which were presented on 4 February 2025 by the German broadcasters NDR and WDR. The investigation established that all of these vessels, representing more than one-third of Russia's *shadow fleet*, were sold after the beginning of the full-scale invasion of Ukraine. These transactions occurred during a period in which the prices of second-hand tankers had more than doubled compared with the pre-war period. The sales generated billions of euros in profits for their former owners, including several German shipping companies. Between 2022 and 2024, eleven tankers formerly owned by German shipping companies were transferred to Russian operators and subsequently became part of the Russian *shadow fleet*. According to the investigation, German shipowners alone earned approximately EUR 200 million from these transactions. The report specifically identified sales conducted by the Hamburg-based companies Schulte and Chemikalien Seetransport GmbH, as well as Salamon AG of Dortmund (Lebedeva, 2025).

It should be noted that no universally accepted definition of the term *shadow fleet* has yet been established, nor has a comprehensive set of criteria been developed to classify specific vessels as belonging to this category. According to the European Commission, the *shadow fleet* consists primarily of ageing vessels owned by anonymous individuals or companies that conceal their beneficial ownership. These vessels transport sanctioned oil using a variety of deceptive practices, including disabling automatic identification systems (AIS) and falsifying location data in order to conceal the origin and destination of their cargoes (Budris, 2025).

The analytical companies Windward Maritime AI and Vortexa have developed a three-tier classification system for tankers transporting Russian oil. They distinguish three categories of vessels:

- **Cleared fleet** – vessels that comply with international sanctions and operate in accordance with applicable legal and regulatory requirements.
- **Grey fleet** – vessels used to circumvent sanctions through the concealment of ownership structures and the frequent re-registration of ships under different flags. These vessels often change their flag states and ownership records, making them difficult to identify and monitor. In April 2023, more than 900 such vessels were identified, accounting for approximately 10% of the global tanker fleet.

- **Dark fleet** – vessels engaged in deliberate illegal practices, including disabling automatic identification systems, manipulating voyage data, and falsifying shipping routes in order to conceal the origin of transported oil and evade international sanctions (Budris, 2025).

According to analyses conducted by Vortexa and Windward Maritime AI, vessels classified as part of the *dark fleet* most frequently sailed under the flags of Panama, Liberia, Russia, Malta, and the Marshall Islands during 2023. These flag states generally maintain relatively flexible ship registration regimes. At the same time, the owners of many of these vessels were registered in jurisdictions such as the United Arab Emirates, Greece, and Hong Kong, thereby facilitating the circumvention of international sanctions and regulatory oversight (Budris, 2025).

Particularly noteworthy is the fact that certain Ukrainian business entities were allegedly involved in supporting the operation of Russia's *shadow fleet*. In January 2025, the Ukrainian news outlet *New Voice* reported that representatives of a Ukrainian holding company had been detained by the Security Service of Ukraine (SBU) on suspicion of facilitating the circumvention of Western sanctions imposed on Russian energy exports. According to the investigation, between 2023 and 2024 the detained individuals participated in the construction of a liquefied gas production facility in Rostov Oblast, from which the products were subsequently loaded onto vessels belonging to Russia's *shadow fleet* for export to international markets. During the investigation, the SBU also detained engineers responsible for designing the facility, as well as a business partner of the holding company who allegedly owned a network of petrol stations in the temporarily occupied territories of Ukraine and supplied fuel to the Russian armed forces (Vidomenko, 2025).

War, the Environment, and the Law

A well-established *shadow fleet*, operating beyond the effective control of international regulatory institutions, gives rise to numerous political, economic, legal, and environmental challenges. This system enables Russia to continue exporting crude oil and petroleum products despite international sanctions, thereby generating substantial revenues that contribute to financing its military operations against Ukraine (Kurbangaleyeva, 2024).

According to Andriy Ryzhenko, former Deputy Chief of Staff of the Ukrainian Navy (2004–2020), vessels operating within the *shadow fleet* generate monthly revenues of approximately USD 32–35 billion for the Russian Federation. President Volodymyr Zelenskyy has presented more conservative estimates, stating that Russia receives between USD 10 and 12 billion per month through the operation of the *shadow fleet* (Zoryk, 2025).

The largest volumes of Russian crude oil are exported through the Baltic Sea ports of Ust-Luga, with an annual handling capacity of approximately 120 million tonnes, and Primorsk, with an annual capacity of around 60 million tonnes. In the Black Sea region, Novorossiysk serves as Russia's principal export terminal, handling up to 150 million tonnes of cargo annually. From these ports, Russian oil is transported primarily to countries that have not joined international sanctions. Nevertheless, part of these exports subsequently enters European markets through indirect supply chains, despite the sanctions formally imposed by European states (UATV, 2025).

According to data published by Windward Maritime AI, China and India became the principal importers of Russian crude oil by the end of 2023, followed by Türkiye. To conceal the origin of exported crude oil and complicate the identification of companies involved in sanction-evasion schemes, ship-to-ship (STS) transfer operations are frequently conducted during transit. However, such operations substantially increase the risk of accidental oil spills and other maritime incidents (Important Stories, 2024).

A significant proportion of imported Russian crude oil is refined in importing countries and subsequently re-exported as petroleum products, including to European markets. According to *The Independent*, imports of Russian crude oil to India increased by approximately 140% during 2023, while exports of refined petroleum products from India to European Union countries rose by approximately 115% over the same period. Supply-chain monitoring organisations emphasise that

it is practically impossible to determine with certainty which crude oil was used to produce individual petroleum products, including petrol, diesel fuel, and aviation kerosene. A similar mechanism appears to operate in Türkiye. According to *Politico*, between February 2023 and February 2024, Turkish imports of Russian crude oil increased by approximately 105%, while exports of petroleum products from Türkiye to the European Union rose by approximately 107%. By relying on its *shadow fleet*, Russia has been able to sell crude oil above the USD 60 price cap established by the G7 coalition. According to data published by the Russian Ministry of Finance, the average price of Urals crude reached USD 62.99 per barrel during 2023 (Important Stories, 2024).

Despite its effectiveness in circumventing international sanctions, the *shadow fleet* operates at considerably higher economic and operational costs. First, shipping companies engaged in transporting Russian oil charge higher freight rates because of the increased risk associated with sanctions. Second, export routes from the Baltic and Black Sea ports to India are substantially longer than traditional routes to European markets, resulting in significantly higher transportation costs. By contrast, exports to China are supplied primarily through Russia's Far Eastern ports, making these shipments considerably more cost-effective. In addition, the price-cap mechanism has strengthened the bargaining position of major importers, enabling them to negotiate substantial discounts on Russian crude oil (Important Stories, 2024).

Another major concern relates to the technical condition of vessels comprising the *shadow fleet*. Most of these tankers are ageing ships that are not subject to regular technical inspections and frequently fail to comply with internationally recognised maritime safety standards. Many operate under so-called *flags of convenience*, meaning that they are registered in jurisdictions with relatively limited oversight of vessel safety, technical maintenance, and operational compliance.

According to maritime expert Craig Kennedy, the average age of tankers operating within Russia's *shadow fleet* is approximately eighteen years. Many of these vessels no longer meet contemporary international safety requirements. They are typically operated for prolonged periods with only minimal maintenance, resulting in progressive structural deterioration and an increasing number of technical defects. Advanced corrosion considerably complicates repair work and exposes maintenance personnel to hazardous substances. Furthermore, inadequate technical maintenance substantially increases the likelihood of serious maritime accidents. For example, damaged pipelines may cause high-pressure oil or fuel leaks, while defective fuel systems may ignite fires in the vicinity of flammable materials, thereby significantly increasing the risk of catastrophic onboard accidents (Korotkova, 2025).

The deteriorating technical condition of vessels operating within the *shadow fleet* poses a serious threat to both the health and safety of seafarers. Insufficient maintenance, extensive corrosion, and the continued use of obsolete equipment substantially increase the probability of mechanical failures that may result in severe maritime accidents. Damage to fuel and hydraulic systems creates a significant risk of uncontrolled releases of flammable or toxic substances. In extreme cases, technical failures may lead to explosions or fires at sea, where evacuation and rescue operations are inherently complex and often severely constrained.

An additional concern is that the activities of the *shadow fleet* undermine the enforcement of international maritime law and significantly complicate efforts by national and international authorities to identify and monitor illicit maritime shipments. Furthermore, vessels operating within this network may be involved in activities extending beyond sanctions evasion. For example, one vessel associated with the *shadow fleet* was suspected of deliberately damaging the Estlink-2 submarine power cable in the Gulf of Finland in late 2024. Consequently, European governments, armed forces, and intelligence agencies increasingly regard Russia's *shadow fleet* as a significant threat to regional and international security (Lebedeva, 2025).

The continued operation of the *shadow fleet* also undermines the credibility and effectiveness of international law. Its existence demonstrates that economic sanctions and

regulatory mechanisms designed to restrict illicit trade in strategic commodities can be circumvented through sophisticated commercial and logistical arrangements. Such practices weaken confidence in sanctions as an effective instrument of political and economic pressure. If states subject to international sanctions remain capable of conducting large-scale international trade through opaque ownership structures and concealed supply chains, the deterrent effect of sanctions is substantially reduced. In the longer term, this erosion of confidence in international regulatory mechanisms may contribute to increasing instability in international relations. It may also encourage states and commercial actors to disregard established legal norms, facilitate the expansion of illicit trade networks, and deepen political divisions among countries seeking to uphold international legal standards.

Environmental Disaster

Ageing and poorly maintained oil tankers used by Russia to circumvent Western sanctions on crude oil exports pose a significant threat to the marine environment. According to expert assessments, many of these vessels operate in poor technical condition and lack adequate insurance coverage, substantially increasing the likelihood of catastrophic oil spills, particularly under adverse navigational and weather conditions. According to the Finnish Border Guard, which monitors the activities of the *shadow fleet* in the Gulf of Finland, the number of such tankers has increased considerably since the beginning of Russia's full-scale invasion of Ukraine in 2022. It is estimated that between 70 and 80 Russian tankers transit the Baltic Sea each week, of which approximately 30–40 belong to the *shadow fleet*. Furthermore, an analysis conducted by the Kyiv School of Economics estimates that approximately 430 *shadow fleet* vessels operate worldwide, with many of their routes passing through the Danish Straits because of Russia's heavy reliance on Baltic export terminals (Voice of America, 2025).

On 15 December 2024, two oil tankers carrying a combined cargo of approximately 9,200 tonnes of fuel oil collided in the Kerch Strait. Each vessel was transporting more than 4,000 tonnes of petroleum products. As a result of the accident, a state of emergency was declared in several municipalities of the Temryuk District in Krasnodar Krai, including the resort city of Anapa. Oil pollution subsequently reached extensive sections of the coastline, where significant traces of petroleum contamination were recorded. In response to the incident, the Russian Government established a special operational task force headed by Deputy Prime Minister Vitaly Savelyev to coordinate emergency response and clean-up operations. Simultaneously, the Investigative Committee of the Russian Federation initiated criminal proceedings concerning alleged violations of maritime transport safety regulations that resulted in fatalities (BBC Russian Service, 2025).

The maritime accident, involving the sinking of vessels carrying approximately 9,200 tonnes of fuel oil, was subsequently described by the President of the Russian Federation, Vladimir Putin, as an "environmental disaster." During a public address delivered on 19 December 2024, he stated that approximately 40% of the transported fuel oil had leaked into the Black Sea following the sinking of the tankers. He also expressed the expectation that improving weather conditions after 21 December would facilitate more intensive clean-up operations.

On 20 December 2024, divers confirmed that fuel oil continued to leak from the wreck of the tanker *Volgoneft 212*. In response, preventive measures were implemented at the accident site, including the deployment of floating containment booms designed to limit the further spread of petroleum pollutants. During a single day of clean-up operations, approximately 10 tonnes of contaminated oil-water mixture were recovered, while an area of approximately 7,500 m² was treated using sorbent materials to reduce further environmental contamination (Radchuk, 2025).

Environmental Impacts

If similar maritime accidents occur more frequently, they may have a wide range of adverse environmental consequences for the Black Sea ecosystem. The principal impacts include the following:

Water and shoreline pollution

Oil spills result in long-term contamination of both marine waters and coastal zones. Fuel oil and other petroleum products typically remain on the water surface, forming extensive oil slicks that may spread over considerable distances under the influence of marine currents and weather conditions. Following the tanker accident off the coast of Anapa in December 2024, approximately 40 km of coastline became contaminated, causing significant damage to coastal ecosystems and adversely affecting water quality. Many petroleum-derived compounds, including polycyclic aromatic hydrocarbons (PAHs), possess highly toxic and carcinogenic properties, while their degradation in the marine environment may require many years (Davydova, 2025).

Mortality of marine organisms

Exposure to petroleum products poses a serious threat to marine biodiversity. Heavy fuel oil adheres to the bodies of marine organisms, impairing their mobility, thermoregulation, and respiratory functions. Seabirds, including cormorants, gulls, and swans, lose the waterproof properties of their feathers, making them vulnerable to hypothermia and death. Dolphins and other marine mammals are particularly susceptible to hydrocarbon poisoning caused by inhalation of toxic vapours and ingestion of contaminated seawater. In addition, volatile toxic compounds released from the water surface pose considerable risks to human health, contributing to respiratory diseases, skin disorders, and long-term chronic health conditions among populations residing in contaminated coastal areas (Baraniak, 2025; Yandex Neurum, 2024).

Long-term contamination of marine ecosystems

In addition to contaminating surface waters, petroleum products may gradually settle on the seabed, forming long-lasting toxic deposits. Oil binds to suspended particles and eventually accumulates in bottom sediments, where it may persist for decades. During this period, toxic compounds can enter marine food webs through bioaccumulation, affecting fish populations and other aquatic organisms. Such contamination may contribute to population declines in sensitive species and disrupt the ecological balance of the Black Sea ecosystem. According to expert assessments, fuel oil released during the December 2024 accident is likely to accumulate on the seabed of Anapa Bay, thereby exerting long-term adverse effects on the region's marine flora and fauna (Yandex Neurum, 2024).

Threats to protected natural areas

The Black Sea coastline includes numerous protected areas that play an essential role in conserving regional biodiversity. Among the most important is the Bolshoi Utrish Nature Reserve, which provides habitat for numerous rare and protected species of seabirds and coastal vegetation. In the event of major oil spills, toxic substances may infiltrate soils and groundwater within protected ecosystems, resulting in long-term environmental degradation. Furthermore, petroleum contamination may contribute to sustained declines in animal and plant populations, thereby threatening the ecological stability and conservation value of these protected areas (Bolshoi Utrish Nature Reserve, 2025).

Economic Consequences

Oil spills in the Black Sea may generate substantial economic losses for the coastal states. The principal economic consequences include the following:

Losses in the fisheries sector

Marine oil pollution has a significant adverse impact on marine ecosystems, leading to declining fish stocks and reduced populations of other aquatic organisms. Consequently, commercial fish catches decrease, fishermen's incomes decline, and certain fishing grounds may be temporarily or permanently closed because of environmental contamination (Fatima, 2025).

Losses in the tourism sector

Pollution of coastal waters and beaches substantially reduces the attractiveness of affected areas as tourist destinations. As a result, tourist arrivals decline, leading to significant revenue losses for local economies. These effects are particularly severe in coastal communities whose economic

development depends heavily on tourism and related service industries (Fatima, 2025).

Costs of environmental response and remediation

Responding to large-scale oil spills is an expensive and technically complex process because of numerous environmental, operational, and logistical challenges. Once released into the marine environment, oil spreads rapidly across the water surface, forming extensive slicks that are difficult to contain. Depending on weather conditions, sea currents, and wave dynamics, pollution may affect vast marine and coastal areas, requiring the deployment of specialised vessels, containment booms, skimmers, sorbents, and other emergency response equipment. Furthermore, shoreline clean-up operations are labour-intensive and often require long-term environmental monitoring and ecosystem restoration (Meduza, 2025; Fatima, 2025).

In January 2025, the Government of the Russian Federation allocated approximately RUB 1.5 billion from its reserve fund to finance the elimination of the environmental consequences of the fuel oil spill in the Kerch Strait (Dorofeeva & Kiseleva, 2025).

Declining property values

Environmental contamination of coastal areas may substantially reduce their investment attractiveness, resulting in declining real estate values. These effects are particularly pronounced in tourist destinations, where environmental quality represents one of the principal determinants of property prices and investment decisions.

Public health impacts

The evaporation of toxic petroleum compounds from contaminated seawater may contribute to respiratory diseases, dermatological disorders, and other adverse health effects among populations living in affected coastal regions. Consequently, oil pollution may increase public healthcare expenditures, reduce labour productivity, and encourage population outmigration from environmentally degraded areas.

The Fight against the *Shadow Fleet*

At present, no universally accepted mechanism has been developed to counter the activities of the Russian *shadow fleet* without raising complex issues under international law. Moreover, overly restrictive measures could contribute to a further escalation of tensions between Russia and Western states. According to expert assessments, one of the most effective approaches would be the introduction of mandatory insurance verification for oil tankers. Under such a mechanism, vessels unable to provide valid proof of insurance could be denied access to specific maritime zones or ports. Combined with sanctions imposed by the European Union and the United States, such measures could contribute to the establishment of a more effective international monitoring and enforcement system (Strelnikov & Resheto, 2025).

Experts further emphasise that the effectiveness of these measures ultimately depends on political commitment and coordinated international action. An illustrative example is the decision adopted by the International Maritime Organization (IMO) in 2023 to introduce stricter restrictions on the carriage of heavy fuel oil in Arctic waters. Extending comparable regulatory measures to other strategically important maritime regions could significantly strengthen international maritime safety and environmental protection (Strelnikov & Resheto, 2025).

In December 2024, the European Union adopted its fifteenth package of restrictive measures against the Russian Federation. As part of these sanctions, the list of vessels identified as belonging to the *shadow fleet*—and consequently prohibited from entering European ports or receiving specified maritime services—was expanded. As a result, the total number of sanctioned vessels increased from 52 to 79 (European Union, 2025). Subsequently, on 16 December 2024, during the Joint Expeditionary Force (JEF) Leaders' Summit held in Tallinn, the United Kingdom, Denmark, Sweden, Poland, Finland, and Estonia agreed to instruct their maritime authorities to request documentary evidence of valid insurance from vessels suspected of operating as part of the Russian *shadow fleet* while transiting the English Channel, the Danish Straits, and the Gulf of Finland.

Information collected during these inspections, including data concerning vessels that failed to respond to official requests, is intended to support coordinated international enforcement measures (Polivan & Gudev, 2025).

Despite these initiatives, no automatic enforcement mechanisms currently exist for vessels whose insurance documentation proves inadequate or which fail to provide the requested documentation. Furthermore, the Danish Defence Intelligence Service has warned that increasing pressure on the *shadow fleet* could encourage Russia to provide military escorts for oil tankers operating in the Baltic Sea, thereby increasing the risk of direct confrontation between Russian and NATO naval forces. Additional retaliatory measures may include intensified GPS interference and other forms of electronic warfare targeting maritime navigation systems (Polivan & Gudev, 2025).

Retired United States Navy Admiral James Stavridis has argued that the international community should establish a comprehensive database identifying all vessels operating as part of Russia's *shadow fleet*. In his view, artificial intelligence technologies applied to satellite imagery analysis could significantly improve vessel identification and monitoring capabilities. He further proposes the public disclosure of information concerning companies and jurisdictions facilitating sanctions evasion, followed by the introduction of secondary sanctions against states that permit their national flags to be used by *shadow fleet* vessels. Examples include flag states such as Barbados, whose ship registries have reportedly been used by vessels transporting Russian crude oil. According to Stavridis, additional penalties could be imposed either through the International Maritime Organization or directly by the United States, the United Kingdom, and the European Union. He also suggests that vessels repeatedly violating international sanctions could be detained in foreign ports until judicial proceedings are completed before national courts or an appropriate international tribunal (Usatenko, 2025).

A precedent for such action has already emerged. In December 2024, Finnish authorities detained the tanker *Eagle S* during an operation involving armed law enforcement personnel on suspicion of involvement in sabotage activities. The vessel, which was transporting approximately 100,000 barrels of crude oil from St Petersburg, was subsequently subjected to investigation. According to *Politico*, several European countries are currently conducting confidential negotiations concerning the possible large-scale detention of Russian oil tankers operating in the Baltic Sea. In parallel, European Union Member States are examining new legislative initiatives that would establish a legal basis for such actions. Among the options under consideration are the application of international environmental law and anti-piracy legislation. Should existing legal mechanisms prove insufficient, individual states may adopt national legislation authorising the detention of vessels suspected of violating international sanctions (Kulakova, 2025).

Discussion

The findings of this study indicate that Russia's *shadow fleet* serves a considerably broader purpose than merely facilitating the circumvention of international economic sanctions. In practice, it constitutes an integral component of the Russian Federation's broader strategy aimed at maintaining financial revenues derived from energy exports despite the restrictive measures imposed by the international community (Budris, 2025; Khokhlov, 2025).

The analysis demonstrates that, despite successive rounds of international sanctions, Russia has retained the capacity to export substantial volumes of crude oil to global markets. These findings suggest that the effectiveness of existing sanctions remains constrained unless they are supported by comprehensive monitoring, enforcement, and international coordination mechanisms designed to prevent sanctions evasion (Important Stories, 2024; Strelnikov & Resheto, 2025).

The study also highlights the significant environmental risks associated with the operation of the *shadow fleet*. The advanced age of many vessels, inadequate technical maintenance, and the absence of transparent monitoring and regulatory oversight substantially increase the likelihood of

maritime accidents and large-scale oil spills. Such incidents may result in long-term environmental degradation, particularly in the Black Sea, whose semi-enclosed ecosystem is especially vulnerable to petroleum pollution and requires extended periods for ecological recovery (Davydova, 2025; Voice of America, 2025).

Furthermore, the activities of the *shadow fleet* extend well beyond the economic dimension of sanctions circumvention and have important implications for maritime security and the protection of critical infrastructure. Recent incidents involving damage to underwater infrastructure in the Baltic Sea have reinforced concerns that vessels associated with the *shadow fleet* may also be used to support hybrid activities directed against strategically important maritime assets (Lebedeva, 2025; Polivan & Gudev, 2025).

Consequently, addressing the challenges posed by the *shadow fleet* requires a comprehensive and coordinated international approach that integrates economic, legal, political, environmental, and military instruments. Strengthening international cooperation, improving maritime surveillance, enhancing sanctions enforcement, and developing effective legal mechanisms remain essential prerequisites for reducing the security and environmental risks associated with the continued operation of Russia's *shadow fleet* (Strelnikov & Resheto, 2025; Usatenko, 2025).

Conclusion

Russia's *shadow fleet* represents a complex challenge that should not be underestimated. Insufficient efforts to counter its activities not only reduce the effectiveness of international sanctions but also increase the risk of maritime conflicts, undermine the credibility of the international sanctions regime, and contribute to the gradual destabilisation of the international security order. The absence of effective mechanisms for enforcing sanctions allows Russia to maintain significant revenues from energy exports, thereby limiting the overall effectiveness of economic restrictions as an instrument of political and economic pressure. In the longer term, this situation may encourage other sanctioned states to adopt similar mechanisms for circumventing international restrictions, thereby further weakening confidence in the effectiveness of the global sanctions regime.

Furthermore, the continued operation of the *shadow fleet* may contribute to escalating tensions along strategically important maritime routes, particularly in the Baltic and Black Sea regions. Should Russia decide to provide military protection for tankers operating within the *shadow fleet*, NATO Member States may be compelled to increase their naval presence in these regions, thereby raising the risk of maritime incidents, political provocations, and unintended military escalation. Such developments could also threaten critical maritime infrastructure, including submarine telecommunications cables and gas pipelines, which may become targets of sabotage or other hybrid activities.

In addition to its geopolitical and security implications, Russia's *shadow fleet* poses a serious environmental threat to both the Black Sea and the Baltic Sea. Many vessels comprising the fleet are ageing tankers operating outside internationally recognised monitoring systems and maritime safety standards, thereby increasing the likelihood of maritime accidents, including oil spills, mechanical failures, and shipwrecks. Moreover, because many of these vessels lack adequate insurance coverage or internationally recognised certification, responsibility for financing environmental remediation and compensation following a major pollution incident may remain legally uncertain, substantially increasing the environmental and economic consequences of such accidents.

Funding

This study received no specific financial support.

Competing interests

The authors declare that they have no competing interests.

Use of Artificial Intelligence

Artificial intelligence was used for language editing, translation, and technical verification of the manuscript.

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