ANCHORING ACCOUNTABILITY: ENHANCING TRANSPARENCY IN MARITIME TRADE

JITHESH PRAKASH

UNITED ARAB EMIRATES

2025

ANCHORING ACCOUNTABILITY: ENHANCING TRANSPARENCY IN MARITIME TRADE

JITHESH PRAKASH

UNITED ARAB EMIRATES

INTRODUCTION

OVERVIEW OF DARK FLEETS IN GLOBAL MARITIME TRADE

Global maritime trade stands as one of the most critical arteries of the modern economy, responsible for the movement of approximately 80–90% of all goods traded across the globe (UNCTAD), 2024). From oil and gas to electronics, clothing, and agricultural products, ships transport the vast majority of commodities that sustain daily life and international commerce. Yet, behind the seemingly well-regulated facade of container ports and shipping routes, a shadow network has emerged, one that exploits the loopholes of maritime law, geopolitical tensions, and lax oversight mechanisms to operate in the margins of legality. These are the so-called dark fleets: vessels that purposefully evade detection and accountability by operating under concealed ownership, falsified documentation, and deceptive routing techniques.

Dark fleets are not entirely new to the maritime industry, but their prevalence and sophistication have surged in the wake of rising global sanctions, increased geopolitical tensions, and a broader digital transformation of the shipping industry. The term "dark fleet" refers to a network of vessels, predominantly oil tankers and bulk carriers, operating outside the normal maritime transparency framework. They frequently disable their Automatic Identification Systems (AIS), engage in ship-to-ship (STS) transfers in poorly monitored waters, and falsify cargo documentation to hide the origin or destination of their goods. These strategies are not merely technical infractions, but they are deliberate acts of obfuscation, designed to evade international sanctions, environmental regulations, and financial compliance protocols.

At the heart of the dark fleet problem is the international community's inconsistent maritime enforcement, which enables such vessels to function across national boundaries with relative impunity. These vessels are often registered under so-called "flags of convenience," a legal mechanism that allows shipowners to register their vessels in countries with lenient maritime laws. (Julien Bouissou, 2024). Additionally, the true ownership of these ships is frequently hidden behind layers of opaque corporate structures, including shell companies headquartered in secrecy jurisdictions. As a result, holding shipowners accountable for environmental disasters, sanction breaches, or illegal cargo becomes nearly impossible. ((OECD), 2023)

Over the past decade, dark fleets have proven themselves to be resilient and adaptive actors in the maritime ecosystem. As regulators and tracking technologies evolve, so too do the evasion tactics employed by these vessels. While sanctions against countries like Iran, Venezuela, North Korea, and Russia have led to a surge in the use of dark fleets to transport restricted commodities such as crude oil, they have also exposed deep vulnerabilities in the international regulatory architecture (Council, 2023).

In 2022 alone, the dark fleet responsible for carrying Russian crude oil saw explosive growth in the aftermath of the Ukraine conflict and Western-imposed sanctions. As traditional shipping routes and clients became inaccessible due to embargoes and price caps, Russia, like Venezuela and Iran before it, turned to an alternative logistics infrastructure that enabled the continuation

of exports through sanction-evading tactics, particularly in collaboration with third-party countries.

Yet the consequences of these fleets are not limited to geopolitical subversion. They represent a clear and present danger to global financial institutions, environmental safety, and maritime security. Many of the ships involved are over 20 to 25+ years old, poorly maintained, and often lack valid Protection & Indemnity (P&I) insurance. ((IMO), Global Maritime Security: Threats and Challenges, 2022). This not only increases the likelihood of vessel failure and catastrophic spills but also leaves coastal nations and marine ecosystems vulnerable to irreparable harm, with no recourse for damages.

SIGNIFICANCE OF THE ISSUE

The growing influence of dark fleets marks a serious challenge to global governance across multiple domains. While the maritime industry traditionally operates under complex but structured systems governed by organisations like the International Maritime Organisation (IMO), the emergence of dark fleets undermines the legitimacy and efficacy of these institutions. The significance of dark fleet operations can be understood across four interconnected spheres:

a. Sanctions Enforcement: Dark fleets directly undermine the power of economic sanctions, which are a key tool used by nations to exert diplomatic pressure on rogue states, deter military aggression, and enforce international law. By providing a clandestine channel for transporting sanctioned goods, particularly oil from Russia, Iran, and Venezuela, these fleets render sanctions less effective and deprive sanctioning states of leverage.

According to multiple independent tracking firms and maritime intelligence providers, between 1.5 and 2 million barrels of crude oil per day are transported globally using dark fleet tankers (Soldatkin, 2024). This volume, if monetized at conservative estimates of $70 per barrel, represents over $100 billion annually in sanction-bypassing oil trade. The scale of this economic leakage poses a grave threat to international financial systems and the credibility of multilateral enforcement mechanisms. ((CREA), 2024)

b. Maritime Security and Sovereignty: Many dark fleet vessels operate in sensitive maritime corridors, such as the Strait of Hormuz, the South China Sea, and the Eastern Mediterranean, where overlapping territorial claims already make naval governance challenging. These unmonitored vessels can serve as platforms for smuggling, arms trafficking, and even terrorist logistics. Their presence compromises national security and hampers regional stability, especially in areas where maritime borders remain contested or poorly enforced. (IMO), Maritime Security and Piracy Reports 2023, 2024

c. Environmental Risks and Safety Hazards: The environmental impact of dark fleets is disproportionately high. Because these vessels often bypass safety inspections and are not covered by standard insurance policies, they pose a significant risk in terms of oil spills, onboard fires, and maritime accidents. In 2022, a vessel suspected of carrying

sanctioned Venezuelan oil ran aground near Gibraltar, spilling crude into the sea and costing over $100 million in cleanup and compensation. Such incidents are expected to rise as dark fleet vessels grow older, and maintenance remains neglected. (Pedrozo, 2025)

Moreover, these vessels often dispose of waste illegally, conduct ballast water discharges in ecologically sensitive zones, and bypass routine emission control area (ECA) restrictions, further exacerbating marine pollution and contributing to global climate change. (Tannenbaum, 2024)

    d. Financial and Legal Risk to Stakeholders: For banks, insurance providers, and shipping brokers, dark fleet activities pose enormous reputational and legal risks. Financial institutions that unwittingly finance transactions involving dark fleet cargo can become subject to regulatory penalties, and insurance companies may face fraudulent claims involving vessels or cargoes that were misrepresented through forged Bills of Lading (BLs) or falsified vessel certifications.

Compliance teams at banks and maritime law firms report that they are overwhelmed by the growing sophistication of document forgery and frequently lack the tools or data to verify vessel histories in real time. The implications of this gap are far-reaching, especially in a world where global supply chains are increasingly scrutinised for compliance with Environmental, Social and Governance (ESG) standards. (Tannenbaum, 2024)

OBJECTIVES OF THE PAPER

The purpose of this paper is to provide a comprehensive, detailed exploration of the dark fleet phenomenon, identifying the full scope of the problem and presenting practical, enforceable strategies for its control. The key objectives are as follows:

    a. To analyse how dark fleet vessels operate, including their use of AIS manipulation, forged documents, ship-to-ship transfers, and multi-port routing to obscure cargo origins and vessel movements.
    b. To examine the structural vulnerabilities in the global maritime system that allow these fleets to thrive, particularly jurisdictional gaps, lack of enforcement coordination, and geopolitical ambiguity.
    c. To evaluate the economic, environmental, and security threats posed by these clandestine operations, drawing on case studies, international data, and expert reports.
    d. To propose robust detection and prevention strategies, leveraging technology, international cooperation, financial reform, and legal instruments that target the enablers of dark fleet activity.
    e. To advocate for increased transparency, accountability, and sustainability in maritime governance through regulatory reforms, blockchain implementation, vessel tracking innovations, and harmonised sanctions enforcement.

By addressing these aims, the paper seeks to arm policymakers, regulators, financial institutions, and maritime professionals with the tools and understanding required to disrupt the shadow networks that threaten the integrity of global maritime trade.

UNDERSTANDING DARK FLEETS

CHARACTERISTICS AND KEY FEATURES

The term "dark fleet" refers not merely to vessels that seek anonymity but to an entire class of maritime operations designed to operate in the shadows, shielded by opacity, deception, and legal ambiguity. These ships, often engaged in illegal or quasi-legal activity, are defined not by a single trait but by a complex matrix of behaviours and features that make them hard to trace and even harder to hold accountable.

At the heart of dark fleet operations lies concealed ownership. Most of these vessels are registered under opaque corporate structures, frequently involving shell companies based in secrecy jurisdictions such as Panama, Liberia, St Kitts, Nevis and the Marshall Islands. This lack of transparency is not a side effect but rather a deliberate strategy that allows bad actors to avoid scrutiny, accountability and regulatory obligations. In many cases, tracing the true ownership of a dark fleet vessel requires not only cross-border legal cooperation but also forensic-level financial investigation. (Intelligence, 2023)

In tandem with opaque registration practices, dark fleet vessels often operate with forged or manipulated documentation. Bills of Lading (BLs), a core legal instrument in international shipping, are frequently altered to disguise the nature or origin of cargo. In dark fleet operations, it is not uncommon for oil originating in sanctioned countries such as Iran or Russia to be labelled as coming from third-party nations like Malaysia, Oman or the UAE. These falsifications allow the cargo to pass through customs and inspection points with reduced risk of detection, especially in jurisdictions with weak maritime enforcement. (Triebert, 2023)

Adding to this ecosystem of deception is the manipulation of Automatic Identification Systems (AIS), a technology mandated by the International Maritime Organisation (IMO) to track vessels in real time. Dark fleet operators often engage in AIS spoofing, transmitting false location data to disguise the ship's true coordinates or simply turn off their transponders altogether while passing through sensitive regions. Disabling AIS is a flagrant violation of international maritime law, yet it remains a common tactic due to the difficulty of enforcement in vast international waters. (Androjna A. P., 2024)

Another essential strategy is the use of Ship-to-Ship (STS) transfers, wherein cargo is moved between vessels while at sea, typically in neutral waters. These transfers are often conducted under the cover of darkness or in remote locations to avoid detection by satellite imagery or naval patrols. Through STS operations, dark fleet vessels can effectively launder the origin of their cargo. For example, sanctioned crude oil might be transferred from a flagged vessel to one with no direct connection to a sanctioned country, thus creating a paper trail that appears legitimate. (Ballinger, 2024)

KEY MOTIVATIONS BEHIND DARK FLEET OPERATIONS

Understanding the motivations behind dark fleet operations requires a closer look at global economic incentives, geopolitical tensions, and structural gaps in the maritime trade system. While specific objectives vary, several key drivers consistently underpin their activities, including:

a. Evasion of International Sanctions

One of the primary drivers of dark fleet activity is the desire to evade international sanctions, especially those targeting the export of oil and gas from countries like Iran, Russia, Venezuela, and North Korea. Sanctions imposed by major economies, including the United States, the European Union, and the United Kingdom, are designed to exert economic pressure on governments accused of human rights violations, nuclear proliferation, or aggression against sovereign states. However, enforcing such sanctions on the high seas is immensely difficult, and dark fleet operators exploit this challenge to maintain revenue streams from banned exports. (U.S. Department of State, 2020)

Following Russia's invasion of Ukraine in 2022, a robust sanctions regime targeted its energy exports. In response, Russia increasingly relied on a shadow fleet composed of older, minimally insured vessels registered under opaque ownership structures and flags of convenience. These tankers employed AIS spoofing and ship-to-ship (STS) transfers to deliver crude oil to nations less stringent in sanction enforcement, such as India and China (Androjna A. P., 2024) (Lloyd's List Intelligence, 2023).

b. Illicit Cargo Movements: Arms, Drugs, and More

Dark fleets are not limited to smuggling hydrocarbons. They also play a pivotal role in the global black market for arms, narcotics, counterfeit goods, and endangered wildlife. The same techniques that allow oil shipments to evade scrutiny, falsified paperwork, disguised routes, and STS transfers are equally effective for transporting high-value illegal goods.

In conflict zones, such as the Horn of Africa or Southeast Asia, dark fleet vessels have been linked to arms trafficking for militias and insurgent groups. Similarly, the UN Office on Drugs and Crime (UNODC) has identified maritime smuggling routes used to ferry drugs between Latin America and West Africa. These operations are facilitated by a lack of oversight in international waters, making interdiction both logistically difficult and politically sensitive. (United Nations Office on Drugs and Crime, UNODC, 2024)

c. Economic Incentives and Competitive Advantage

Beyond illicit trade, some dark fleet operators are motivated by economic rationality; they simply wish to minimize costs and maximize profits. Complying with international safety, environmental, and labour standards imposes significant operational burdens on legitimate shipping companies. In contrast, dark fleet vessels often forgo insurance, delay maintenance, and use low-wage, poorly trained crews, allowing them to undercut competitors on price.

Thus, the motivations behind dark fleet operations are varied but interlinked: the evasion of sanctions, facilitation of illicit trade, and pursuit of economic gain form the triad that sustains this shadowy parallel shipping industry.

GROWTH AND CURRENT SCALE

The proliferation of dark fleets over the past decade has been nothing short of staggering, reflecting both increased demand and systemic gaps in maritime governance. Once a fringe activity conducted by a handful of rogue states or criminal organizations, dark fleet operations have grown into a sophisticated global enterprise with hundreds of ships, billions in trade volume, and an expanding network of facilitators.

According to TankerTrackers.com, the number of vessels classified as dark or shadow tankers increased from roughly 200 in 2021 to over 600 by early 2024, a growth of 300 percent in just three years. This rapid growth has been driven primarily by demand from sanctioned oil
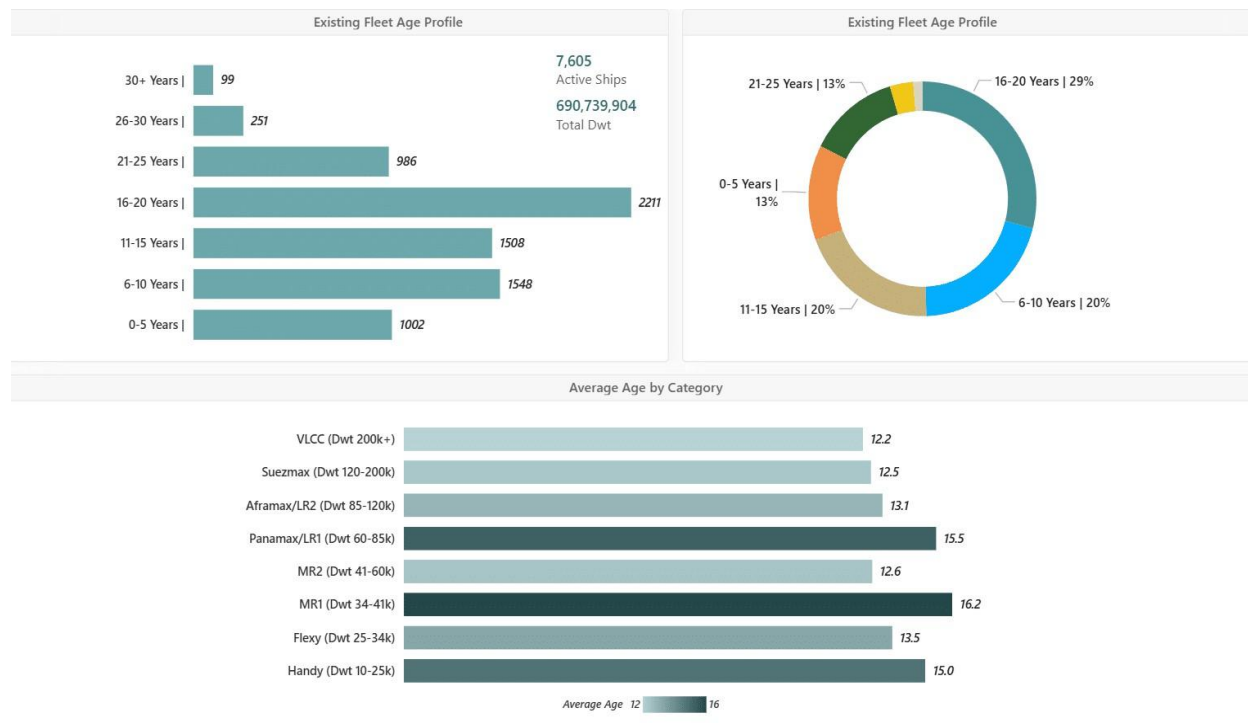

Figure 1 Global Fleet Age (Source Axis Data)

exporters seeking alternative supply routes. As Western countries tighten sanctions, sanctioned states and their allies have responded by acquiring or chartering older tankers to create what analysts have dubbed a "ghost fleet."

These vessels often operate well beyond their expected service life, with many exceeding 25–30 years in age. This is supported by data from AXIS Marine, which shows that more than 1,300 vessels in the global fleet are over 25 years old, including nearly 100 ships above 30 years.
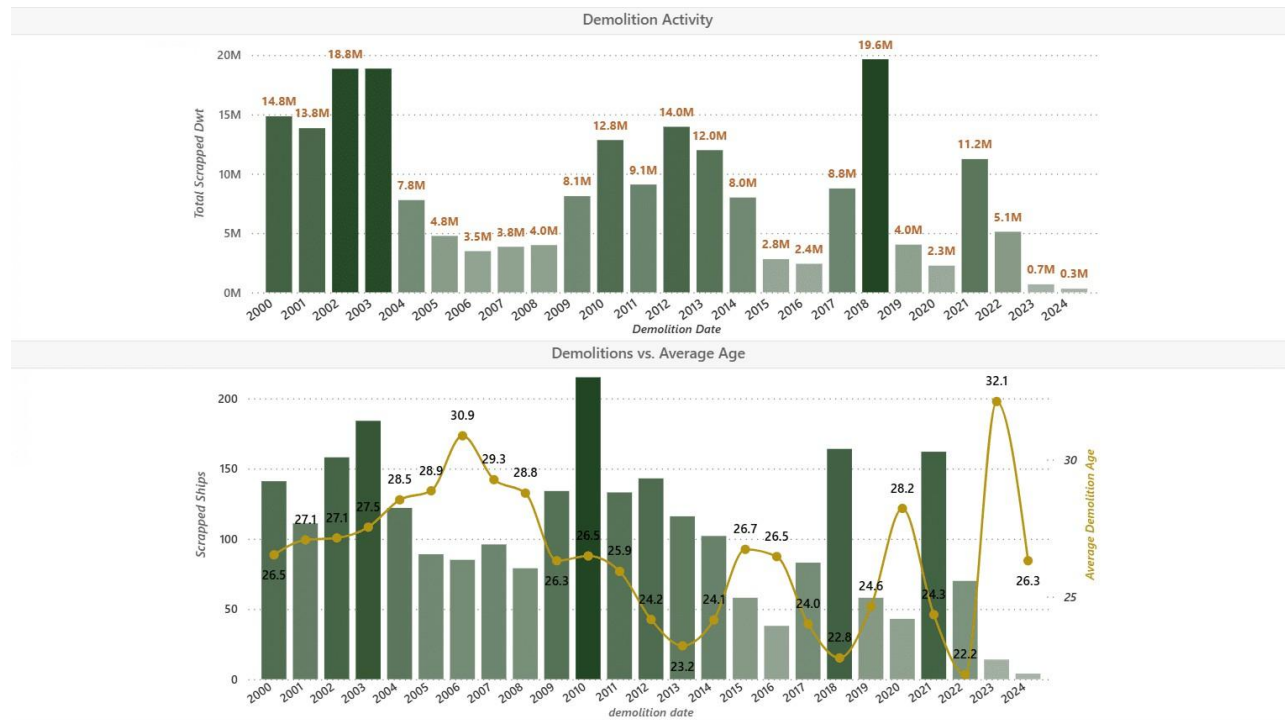

Figure 2 Demolition Activity (Source: Axis Data)

Older tankers are more readily available on the second-hand market, cheaper to acquire, and less likely to attract regulatory scrutiny when reflagged under obscure jurisdictions. Because these vessels often lack valid classification or Protection & Indemnity (P&I) insurance, they are considered unfit for regular commercial activity but remain perfectly suited for high-risk, high-reward ventures like sanction evasion.

In terms of impact, dark fleets now carry approximately 10% of global seaborne crude oil, according to data compiled by Bloomberg and maritime intelligence firms. This figure underscores not just the scale of the problem, but its normalization within global trade. When one in ten barrels of oil at sea is effectively "off the books," the implications for energy, financial institutions, and environmental safety become profound.

Dark fleet operations are no longer limited to tankers. The model has been replicated across other sectors, including dry bulk carriers and container ships. Analysts estimate that 5–10% of containerized trade globally may involve some form of illicit activity, whether through falsified

manifests, smuggling of contraband, or evasion of customs duties. In regions like West Africa and Southeast Asia, entire port clusters have become hubs for these shadow trades. (List, 2023)

Finally, the influence of dark fleets extends beyond the vessels themselves. A web of logistics firms, maritime lawyers, port agents, and financial intermediaries plays a critical role in enabling these operations. Many of these actors operate in grey zones, offering "compliance advisory services" that, in practice, amount to regulatory arbitrage. The result is a global maritime shadow economy that is increasingly difficult to dismantle.

OPERATIONAL TACTICS OF DARK FLEETS

Understanding the operational behaviour of dark fleets is essential to unravelling their full impact on global maritime trade. These clandestine operations are not random acts of evasion or opportunistic shortcuts; rather, they are highly organized, well-financed, and deliberately orchestrated systems of deceit. They combine technical subterfuge, bureaucratic manipulation, and legal ambiguity to function outside the realm of legitimate maritime oversight. This section offers an in-depth exploration of the primary tactics that dark fleets employ to remain undetected, obscure the true origins of cargo, and evade international scrutiny. These methods include the falsification of documentation, manipulation of Automatic Identification Systems (AIS), utilization of multi-port call strategies, and Ship to Ship (STS) transfers, all designed to distort the vessel's voyage history and mask the identity of owners and cargo.

MANIPULATION OF DOCUMENTATION

At the heart of dark fleet operations lies the manipulation and fabrication of critical shipping documents, particularly the Bill of Lading (BL). The BL is more than just a receipt for cargo; it is a legal document that serves as a title to the goods and a key reference for banks, insurers, customs authorities, and legal entities involved in maritime logistics. Its falsification has far-reaching consequences, enabling illicit cargo to enter legal supply chains and undermining global trade compliance mechanisms.

Operators within the dark fleet system are known to systematically switch BLs to misrepresent the origin, nature, or ownership of cargo. For example, crude oil loaded in a sanctioned country such as Iran or Venezuela may be rebranded on paper as originating from a neutral or third-party location like Oman or Malaysia. These altered documents are then used to deceive buyers, authorities, and financial intermediaries involved in the transaction. The alteration of BLs is often carried out in conjunction with false port records and tampered cargo manifests, effectively creating an entirely fictitious trade narrative.

The motivation for this deception is clear: a legitimate-looking BL allows the illicit cargo to pass through customs and gain entry into regulated markets. Furthermore, banks and insurers rely heavily on these documents when providing letters of credit or underwriting shipment risks. A

forged BL thus allows the dark fleet to secure financing and insurance under false pretences, further embedding illicit trade within the legitimate financial system.

FRAUDULENT VESSEL CERTIFICATION AND REGISTRY PRACTICES

Equally problematic is the widespread use of fraudulent or expired vessel certification. Every commercial ship is required to carry various safety and operational certificates issued by classification societies. These documents verify that the vessel meets international safety, maintenance, and operational standards. However, dark fleet operators often circumvent this system by either forging certificates or continuing to operate with expired or revoked documentation.

Many vessels operate under Flags of Convenience (FOCs), often in jurisdictions known for minimal regulatory oversight. These open registries often lack the capacity or will to enforce safety, labour, and environmental standards, allowing shipowners to obscure vessel histories and evade accountability. Through this form of regulatory arbitrage, non-compliant or sanctioned vessels can easily reflag with falsified documents and continue operating with impunity.

Adding to this challenge is the abuse of the IMO vessel numbering system, originally intended to ensure unique ship identification. Investigations show that bad actors exploit the system by transferring IMO numbers between ships or using forgeries to conceal a vessel's identity. This is frequently paired with FOC reflagging, making it difficult for authorities to trace vessel ownership and compliance records. (Bockmann, Abuse of IMO vessel-numbering scheme and falsely flagged ships continues, committee hears, 2023)

The combined manipulation of identity and flag status creates major loopholes in maritime governance. Without stronger international enforcement and advanced tracking systems, these practices will continue to threaten safety, environmental security, and transparency in global shipping.

The implications of fraudulent certification extend beyond regulatory evasion. Ships that are improperly maintained pose a significant threat to marine ecosystems and crew safety. These vessels are more prone to mechanical failure, collisions, and environmental disasters. Moreover, if an incident does occur, the absence of valid certification and insurance coverage means that affected parties, including coastal states and shipping partners, are left to absorb the financial and environmental fallout.

AUTOMATIC IDENTIFICATION SYSTEM (AIS) SPOOFING AND DISABLING

AIS technology, mandated under the International Maritime Organization's Safety of Life at Sea (SOLAS) convention, is designed to prevent maritime collisions and promote transparency in shipping operations. Vessels above a certain size are required to broadcast their location,

course, speed, and other identifying data through AIS, which can then be tracked by other ships,

ports, and satellite systems. However, in the murky waters of dark fleet operations, AIS is routinely manipulated to obscure a vessel's true movements.

There are three primary ways dark fleets manipulate AIS data:

a. Disabling AIS Transponders: In high-risk or high-surveillance zones, such as near sanctioned nations or in chokepoints like the Strait of Hormuz, vessels may deliberately turn off their AIS transponders to become "invisible" to tracking systems. This practice is commonly known as "going dark." While SOLAS requires continuous AIS broadcasting, enforcement of this rule is uneven, and many infractions go unnoticed.

b. Spoofing Location Data: More technologically sophisticated operators may engage in AIS spoofing, which involves sending false location coordinates or mimicking the identity of another vessel. This allows a sanctioned ship to appear as though it is operating in a completely different part of the world, misleading authorities and satellite monitors.

c. Identity Masking Through Vessel Cloning: In rare but growing cases, dark fleets have been found using the identity of a legitimate vessel, complete with cloned AIS signals and ship names to confuse regulators. In such scenarios, two ships may appear in the same region with identical identifiers, rendering tracking systems ineffective.
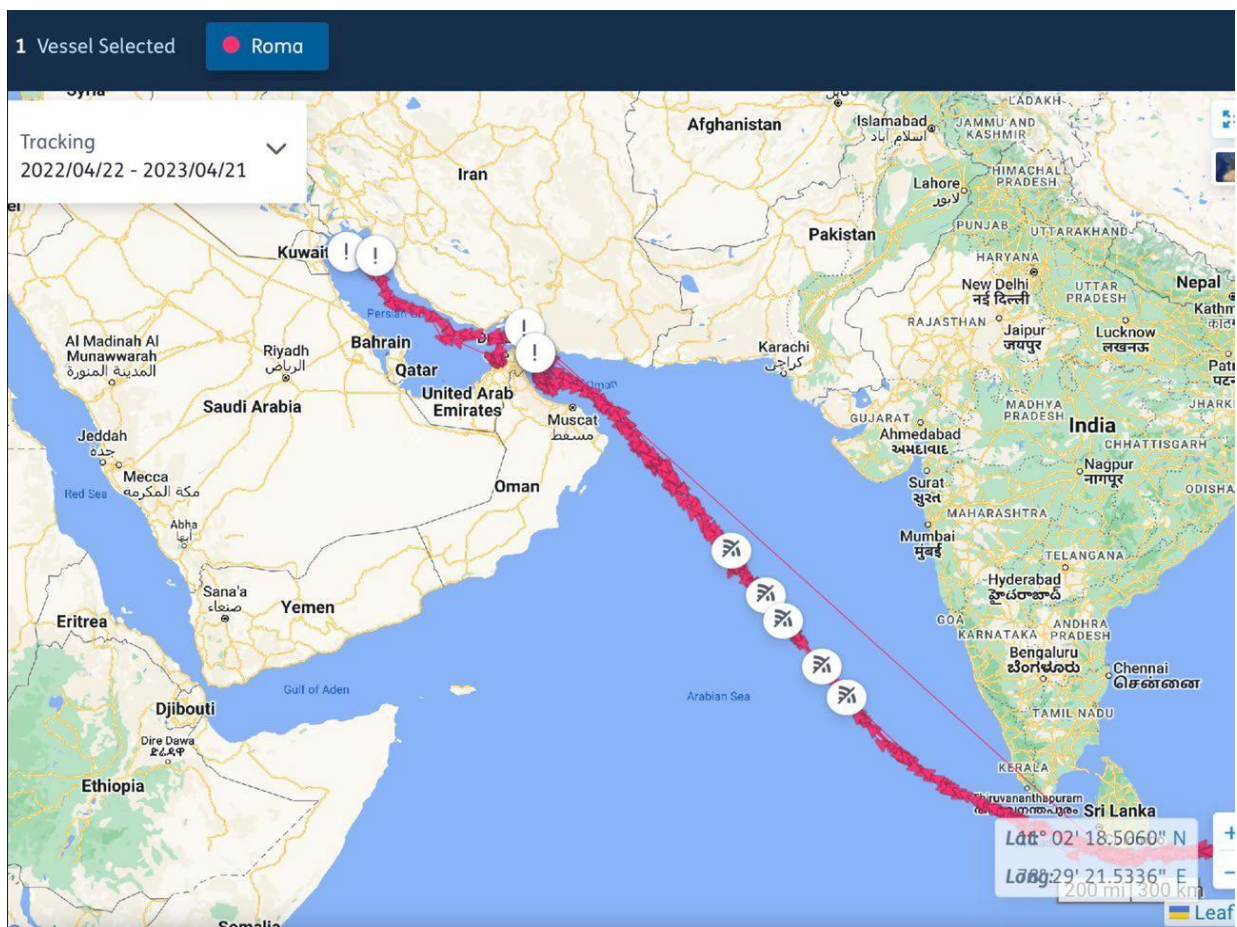

Figure 3 AIS Manipulation

The Roma, a 23-year-old VLCC, is suspected of deceptive operations, falsely claiming a Comoros flag and classification with Overseas Marine Certification Services, despite lacking valid registration, class, and insurance. The IMO database highlights these discrepancies, and a Panama-based classification society confirmed in April 2023 that it does not class the vessel. Registered under Koro Shipping Services Inc. in the Marshall Islands, Roma is listed in IMO GSIS, Lloyd's List Intelligence, and Equasis, but its Sharjah, UAE address is untraceable, and its ISM manager remains unknown.

AIS data reveals multiple transmission gaps, with the last recorded discharge at Dongjiakou, China, four months ago. While such vessels typically remain offshore to evade inspections, Roma was tracked at Manila anchorage from March 5–8, 2023, likely for a crew change. Lloyd's List contacted the Philippine authorities regarding a possible inspection but received no response. (Bockmann, Shifty Shades of Grey: the different risk profiles of the dark fleet explained, 2023)

These deceptive tactics render maritime surveillance tools less effective, making it extraordinarily difficult for enforcement agencies to monitor cargo routes or determine a ship's true point of origin. They also create significant safety risks for other vessels in crowded sea lanes, as untracked ships become collision hazards.

Multi-Port Call Strategies to Conceal Cargo Origins

Another intricate tactic employed by dark fleets is the use of multi-port call strategies. Instead of traveling directly from the loading port to the final destination, these vessels may stop at several intermediate ports, often in countries with minimal scrutiny where documentation is altered, cargo is partially ofloaded and mixed, or simply to create confusion about the ship's voyage history.

For instance, a sanctioned crude oil cargo originating from Iran might be first shipped to a port in Pakistan, where part of the cargo is ofloaded and rebranded. From there, the vessel may continue to any one of the oil-producing Gulf countries, where it undergoes another round of document adjustments before finally proceeding to its end-market in Southeast Asia or even Europe. By the time the cargo reaches its final port, its origin has been so thoroughly obscured that it appears indistinguishable from legitimate shipments.

These multi-port strategies serve several purposes. First, they disrupt the "chain of custody" in trade documentation, making it difficult for authorities or auditors to trace the cargo's original source. Second, they provide opportunities to launder the cargo's identity through STS transfers or the blending of different oil grades. Third, they allow for the manipulation of customs records and tax filings in ways that enable further financial fraud.

SHIP-TO-SHIP (STS) TRANSFERS IN INTERNATIONAL WATERS

Perhaps the most clandestine of all tactics is the Ship-to-Ship (STS) transfer. This practice involves the transfer of cargo between two vessels at sea, often in remote and loosely regulated international waters. While STS transfers are not inherently illegal and are frequently used for

logistical reasons in legitimate trade, they become problematic when used by dark fleets to launder the identity and origin of illicit cargo.
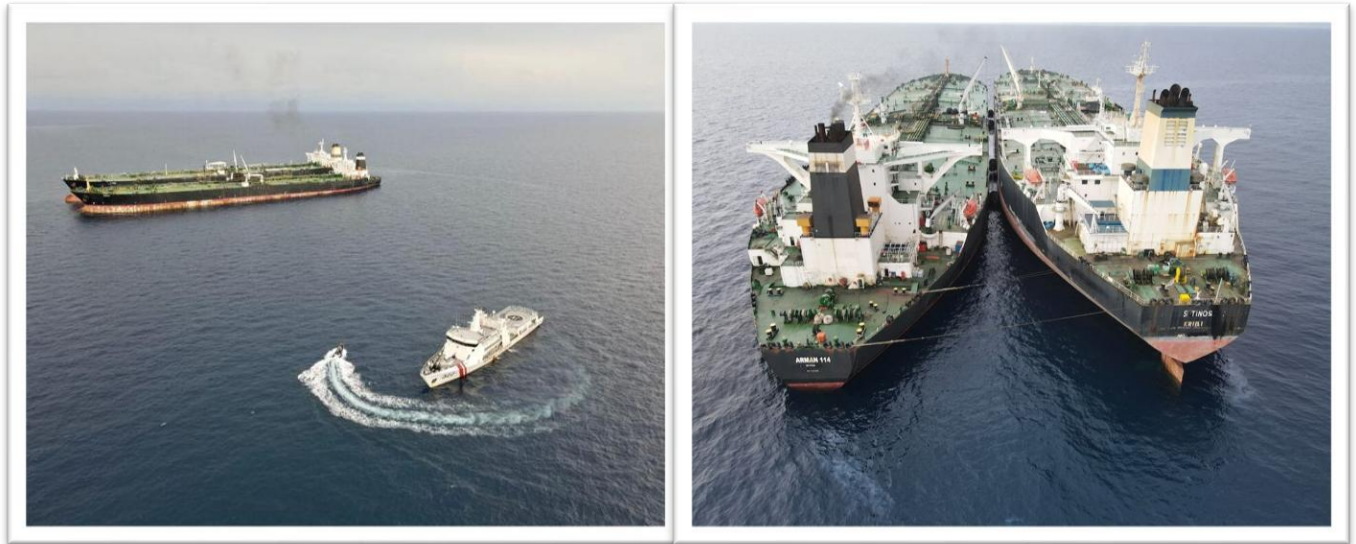

Figure 4 Indonesia seizes Iranian-flagged tanker suspected of illegal oil transfer

Indonesian authorities seized the Iranian-flagged super tanker MT Arman 114 in the North Natuna Sea for allegedly conducting an illegal ship-to-ship transfer of crude oil with the Cameroon-flagged MT Stinos. The vessel, carrying over 272,000 metric tons of light crude oil worth approximately $304 million, was found spoofing its AIS location to appear in the Red Sea while operating in Indonesian waters. Officials also accused the tanker of dumping oil into the ocean, violating environmental laws. The crew, including its Egyptian captain and 28 personnel, was detained, and authorities vowed stricter maritime patrols to prevent future violations. (Nangoy, 2023)

STS transfers allow dark fleet operators to mix sanctioned oil with legally sourced crude, creating a "gray market" product that is harder to trace. These exchanges often occur in known STS hotspots such as the Gulf of Oman, the South China Sea, the Eastern Mediterranean, and the mid-Atlantic. Because these areas are beyond the jurisdiction of any single nation, enforcement becomes a complex geopolitical challenge.

In addition to laundering cargo identity, STS transfers are often used to consolidate shipments from multiple small tankers into a larger vessel that is better equipped to deliver to major markets. This bulk consolidation further obscures the provenance of the cargo, especially when paired with falsified documentation and spoofed AIS signals.

Moreover, the absence of port infrastructure and emergency response teams in these remote areas increases the risk of oil spills and maritime accidents. Unlike regulated port facilities, open-sea STS transfers lack safeguards, oversight, and environmental contingency planning, making them a ticking ecological time bomb.
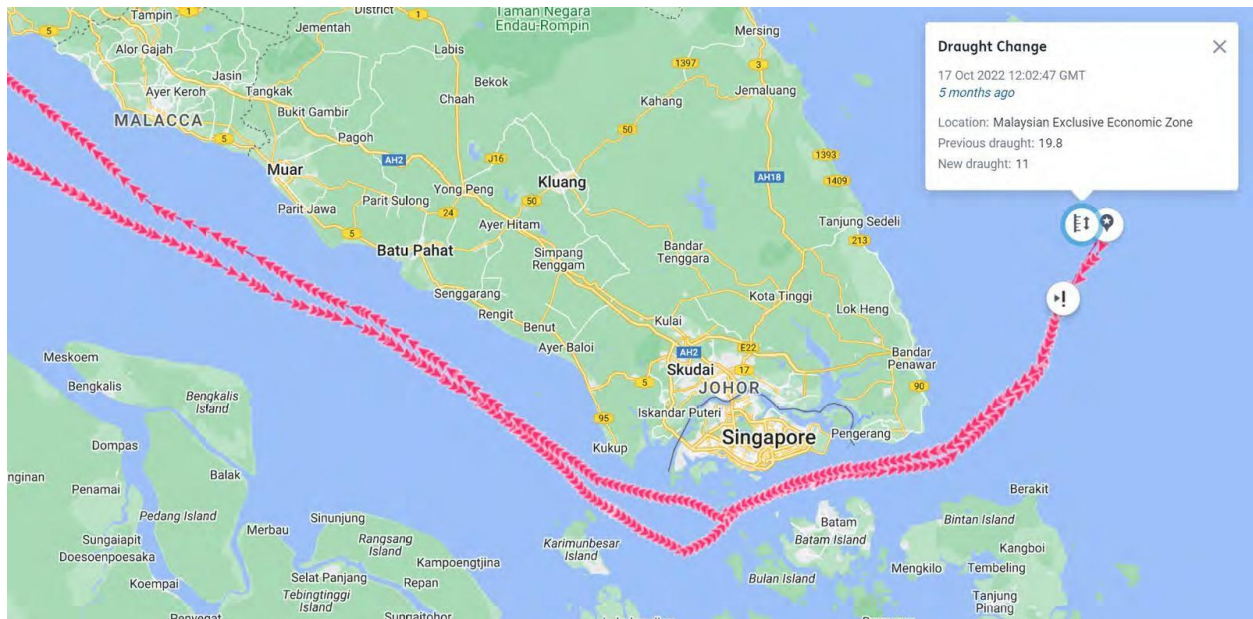
Figure 5: Route of crude tanker Hero II

The crude oil tanker Hero II travels from the Gulf of Oman, largely with its AIS turned off. It briefly appears during its transit through the Singapore Strait, then goes dark again. When it reappears, a draught change is logged before it heads back in the direction it came from. (Jungman, 2023)

THE IMPACT OF DARK FLEETS AND REGULATORY CHALLENGES

THE IMPACT OF DARK FLEETS

The activities of dark fleets that conceal their identity, ownership, and operations extend far beyond regulatory evasion. Their covert practices have far-reaching implications, destabilizing not only economic systems but also environmental safeguards, financial institutions, and national security frameworks. This section examines the multidimensional impacts of dark fleets across four critical domains.

ECONOMIC AND GEOPOLITICAL IMPLICATIONS

Dark fleets undermine the integrity of international sanctions regimes by covertly transporting restricted commodities, particularly oil and gas from sanctioned states such as Russia, Iran, Venezuela, and North Korea. These operations weaken the effectiveness of sanctions imposed by the United Nations (UN) or the European Union (EU) and other multilateral bodies and the United States of America (US), allowing targeted regimes to sustain revenue streams that fund military programs, domestic repression, or geopolitical provocations.

16

Beyond sanctions evasion, the unregulated inflow of such commodities distorts global markets. Illicit oil sales obscure true supply levels, complicating price forecasts and undermining legitimate exporters who must operate transparently. The resulting volatility affects not only energy markets but also national economies dependent on predictable pricing structures.

Geopolitically, nations are entangled in dark fleet logistics, whether through ship registries, port access, indirect trade risk, or diplomatic backlash. For instance, Southeast Asian states that engage with sanctioned oil may face tensions between economic needs and international obligations, straining their foreign policy positioning and exposing them to secondary sanctions or political pressure.

ENVIRONMENTAL AND SAFETY HAZARDS

Dark fleet vessels are frequently older ships with poor maintenance records, operating outside recognized safety and environmental frameworks. These conditions significantly elevate the risk of maritime accidents, particularly oil spills, which can devastate marine ecosystems and coastal communities. Such risks are amplified manifold because dark vessels often operate in remote or ecologically sensitive regions, including the Arctic and Southeast Asian waters.

Figure 6: The Pablo Explosion

The explosion of the Gabon-registered oil tanker Pablo off Malaysia's coast highlights the dangers of shadow fleet operations, which involve aging, poorly maintained vessels transporting sanctioned oil under unclear ownership and without insurance. While 25 of 28 crew members were rescued, three remain missing, and cleanup efforts face obstacles due to the vessel's opaque registration. Reports indicate oil pollution near Indonesia, with no responsible party identified. The incident underscores growing concerns over fraudulent ship registrations, illicit oil trading, and maritime safety risks, calling for stronger global regulatory enforcement. (Mandra, 2023) (Krishnamoorthy, 2023)

Ship-to-ship (STS) transfers, a common method used by dark fleets to avoid detection, are often conducted without regulatory oversight. These transfers increase the likelihood of spills and complicate efforts to monitor vessel activity, especially when they occur in international waters.
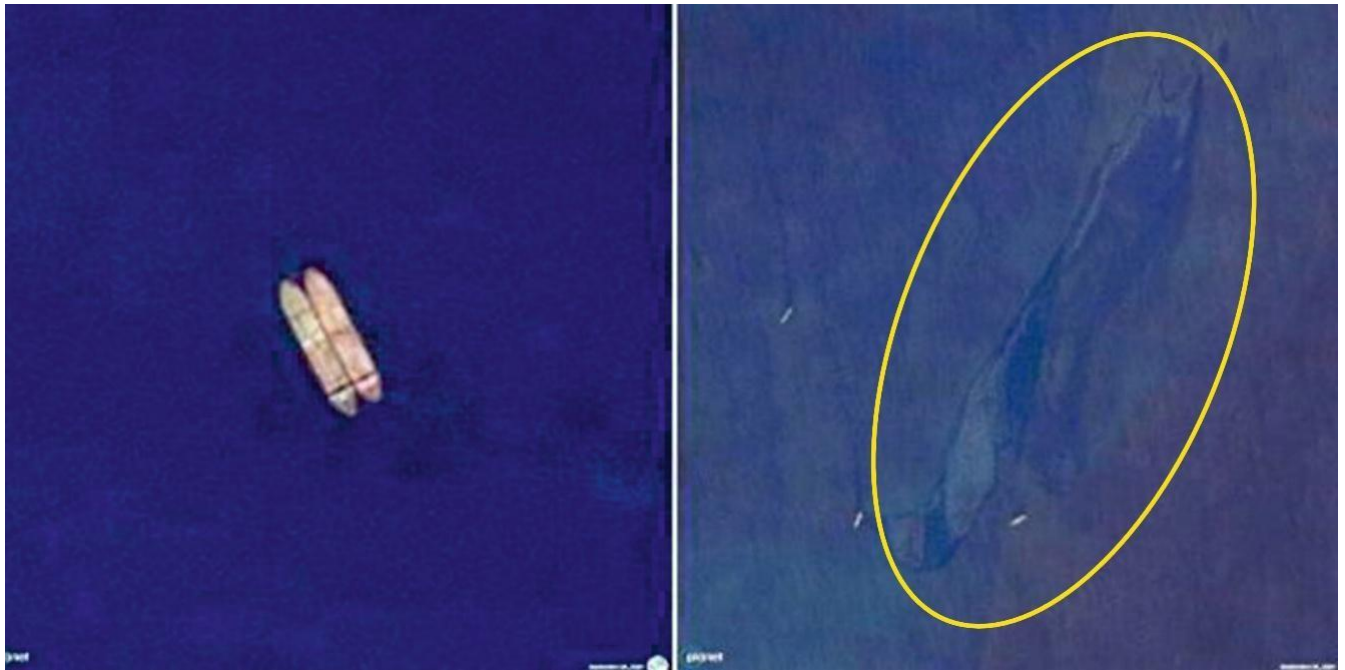

Figure 7 Dark fleet tankers 'spill 5,400 barrels

Two dark fleet tankers avoided nearby ports and conducted a ship-to-ship (STS) transfer at the intersection of Kuwait, Iraq, and Iran, an area known for unregulated maritime activities. The next morning, satellite imagery revealed an oil spill equivalent to approximately 5,400 barrels, yet no official reports were filed. These incidents occur frequently and unnoticed, leading to significant environmental damage and cleanup costs borne by coastal nations. The lack of oversight and accountability in such operations continues to pose a growing threat to marine ecosystems and regional stability. (Dixon, 2023)

Human safety is also compromised. Crews aboard these vessels frequently endure hazardous working conditions, in violation of the Maritime Labour Convention (MLC). Many lack adequate safety equipment, proper certification, or even legal employment status. In some cases, crew members are victims of forced labour or trafficking, an ongoing concern that merges human rights violations with maritime risk.

Figure 8 Smooth Sea 22 Explosion

The explosion of the Thai-flagged oil tanker Smooth Sea 22 on January 17th, which killed two crew members and left five missing, exposed a fraudulent ship-identity scheme. Though registered as a 2018-built vessel, investigations revealed it was actually built in 1986, previously sailing as Hai Zhou 168 and Smooth Sea 28. This deception links to North Korean sanctions evasion, a tactic observed in at least 11 vessels, according to C4ADS. The fraudulent IMO registration raises concerns over the validity of its $30 million insurance claim, highlighting broader risks in maritime security, compliance, and enforcement. (Smooth Sea 22 was not the ship it claimed to be, 2023)

FINANCIAL IMPACT AND ILLICIT FINANCING

The financial dimension of dark fleet operations is closely tied to transnational crime. Payments for illicit shipments often pass through complex webs of shell companies, offshore accounts, and opaque financial instruments. These practices facilitate large-scale money laundering, enabling criminal and state actors to integrate illicit funds into the legitimate financial system.

Such activities undermine global anti-money laundering (AML) efforts, erode trust in financial institutions, and enable sanctioned actors to maintain economic influence. Regulatory arbitrage and the use of legal grey zones make it difficult for enforcement agencies to trace the origin or destination of illicit funds.

The impact also extends to fair trade. By avoiding taxes, duties, and compliance costs, dark fleets can undercut legitimate operators, offering goods at artificially low prices. This not only distorts competition but also shifts the financial burden of cleanup, insurance, and enforcement onto compliant actors and public institutions, creating a structural disadvantage for law-abiding participants in global trade.

NATIONAL SECURITY RISK

Perhaps most alarmingly, dark fleets serve as conduits for the transport of arms, narcotics, and dual-use technologies that can be weaponized or diverted for illicit purposes. Their ability to evade detection makes them effective channels for supporting insurgent groups, militias, and even terrorist organizations. The resulting proliferation of weapons and controlled materials fuels conflict, undermines peacekeeping efforts, and destabilizes already fragile regions.

Because dark fleet operations often occur in legal and geographic grey zones such as international waters or ports with weak oversight, they represent persistent blind spots in maritime governance. This limits the ability of states to exert control over their borders and trade flows, posing long-term risks to national and regional security.

Figure 9 F Record Seizures of Drugs and Weapons in the Arabian Sea and Gulf of Oman

In 2021, U.S. and international forces under CMF, U.S. Naval Forces Central Command, and U.S. 5th Fleet seized over $193 million in illegal drugs and 8,700 illicit weapons during maritime interdictions in the Gulf of Oman and Arabian Sea. Increased patrols led to 50+ vessel boardings, 14 drug seizures, and multiple large-scale arms interceptions, including AK-47s, anti-tank missiles, and sniper rifles. The multinational coalition continues efforts to combat smuggling, disrupt criminal networks, and enhance regional maritime security. (Executive, 2022)

REGULATORY AND ENFORCEMENT CHALLENGES

One of the core challenges in regulating dark fleets is their strategic use of legal loopholes and technical subversion. Many vessels operate under flags of convenience or other flags where maritime oversight is weak, and compliance requirements are minimal. This allows ship owners to bypass national laws, lower costs, and obscure responsibility. Further complicating enforcement is the widespread use of shell companies and front organizations, often based in secrecy jurisdictions. These structures mask the true ownership of vessels, making it exceedingly difficult for authorities to trace operators or impose sanctions.

In addition to legal evasions, dark fleet vessels routinely manipulate or disable their Automatic Identification System (AIS), a key tool used by authorities to track maritime traffic. By broadcasting false coordinates (spoofing) or switching off AIS entirely, they can mask their movements and operate undetected in remote or loosely governed waters. These combined tactics, legal obfuscation, and technological evasion create a high degree of operational anonymity, severely hampering international efforts to monitor and control illicit maritime activity.

GAPS IN INTERNATIONAL COOPERATION AND COORDINATION

Another major challenge in combating dark fleets is the lack of cohesive international cooperation. The global nature of the shipping industry requires coordination among countries, international organizations, and regulatory bodies to enforce maritime laws effectively. However, fragmented legal frameworks, conflicting national interests, and the absence of a centralized enforcement mechanism create enforcement gaps that illicit operators exploit. While UNCLOS establishes fundamental maritime principles, it lacks strong enforcement tools, leaving shadow fleets largely unchecked. Some governments, driven by political concerns or economic incentives, hesitate to act, further weakening regulatory efforts.

Despite oversight from organizations like IMO, enforcement remains inconsistent due to sovereignty disputes and competing national priorities. Some states benefit indirectly from dark fleets, particularly through access to discounted commodities, reducing their motivation to intervene. Additionally, developing nations often lack the resources and technological infrastructure necessary for effective maritime monitoring, enabling illicit operations to thrive. In regions such as Southeast Asia, limited surveillance and enforcement capabilities allow shadow fleets to operate with minimal risk, highlighting the need for stronger international collaboration and regulatory measures.

FIVE STRATEGIES TO DETECT AND PREVENT DARK FLEET OPERATIONS

As dark fleet operations continue to grow in scale and complexity, global stakeholders must develop robust strategies to counter these illicit maritime networks. While enforcement efforts are often hindered by weak regulatory frameworks and jurisdictional loopholes, technological advancements and international cooperation provide promising solutions. This section outlines the key strategies that can be employed to detect and prevent dark fleet operations, ranging from enhanced vessel tracking systems to financial reforms and the implementation of artificial intelligence, blockchain technology.

STRENGTHENING VESSEL TRACKING AND INSPECTION MECHANISMS

a. AI-Powered Surveillance and Satellite Monitoring: One of the most promising developments in countering dark fleets is the application of artificial intelligence (AI) in vessel tracking. AI-powered surveillance systems can process vast amounts of data in real time, identifying irregular patterns in shipping activity and flagging suspicious behaviour for further investigation. While AIS data is frequently manipulated by dark fleet operators through methods such as spoofing and disabling the transponder, AI can analyse these irregularities and flag ships that exhibit abnormal behaviour. By leveraging machine learning algorithms, these systems can continuously refine their ability to detect vessels involved in illicit activities.

Satellite technology plays a crucial role in identifying dark fleet vessels that use AIS manipulation or engage in Ship-to-Ship (STS) transfers in unmonitored waters. In 2022, satellite imagery was used to track a network of shadow tankers moving sanctioned oil from Venezuela to Asia. By comparing satellite images with AIS data, authorities could identify discrepancies that indicated possible dark fleet activity. This combination of AI and satellite imagery allowed for the detection of illicit shipments that would have otherwise remained undetected.

b. Physical Inspections and Port Security

While technological advancements are essential, physical inspections at key ports and maritime hubs also remain a crucial part of the enforcement strategy. Enhanced port security measures, such as mandatory inspections of a ship's cargo and documentation, are vital in preventing dark fleet vessels from entering legitimate trade networks.

Countries that are major shipping hubs should implement stricter requirements for vessel certification, documentation, and crew qualifications. For instance, when a vessel enters a port, its Bills of Lading (BLs), cargo manifest, and vessel certificates should undergo thorough checks to verify the authenticity of the information. By ensuring that proper due diligence is conducted before allowing vessels to dock, ports can help block the entry of illicit goods and vessels associated with dark fleet operations.

Port State Control (PSC) authorities are responsible for conducting inspections to ensure that foreign ships comply with international safety standards. In 2021, the European Maritime Safety Agency (EMSA) led several high-profile port inspections aimed at detecting vessels operating under deceptive practices, such as falsifying BLs or using unregistered flags. By working in cooperation with international maritime organizations like the International Maritime Organization (IMO) and the International Maritime Bureau (IMB), port authorities can prevent illicit vessels from entering ports and conducting illegal transactions. (Agency, 2021)

FINANCIAL AND COMPLIANCE REFORMS

   a. Enhanced Due Diligence by Financial Institutions

Banks, insurers, and other financial institutions serve as critical gatekeepers in preventing dark fleet operations, ensuring financial transactions linked to illicit trade are swiftly flagged and blocked. Know Your Customer (KYC) protocols are essential in identifying the true owners and operators of vessels engaged in suspicious activities. These measures require financial institutions to collect comprehensive data on vessel owners, operators, and cargo traders, ensuring that transactions tied to sanctioned entities are intercepted before completion.

However, the effectiveness of this system is hindered by vetting software limitations, creating unintended challenges. Current compliance tools, while designed to detect risks, often operate on outdated data, leading to legitimate vessels engaged in OFAC-approved trade being wrongly flagged and rejected. This lack of real-time precision forces financial institutions to err on the side of caution, impeding lawful transactions and frustrating businesses that are compliant with regulations.

To address this critical flaw, financial institutions must transition toward adaptive vetting solutions that incorporate real-time updates, dynamic risk modelling, and AI-enhanced transaction tracking. By leveraging advanced analytics, compliance teams can differentiate sanctioned activity from permitted operations, ensuring legitimate transactions proceed without unnecessary intervention. This shift will strengthen oversight without stifling lawful trade, ultimately enhancing efficiency while curbing illicit maritime networks.

Iran's ability to circumvent sanctions relies heavily on the use of shadow companies, shell corporations, and offshore accounts. In 2020, several financial institutions were implicated in facilitating illicit transactions related to Iranian crude oil. By failing to rigorously apply KYC measures, these institutions allowed dark fleet operators to move vast quantities of sanctioned oil through the financial system. Stricter compliance measures would have helped identify and block these transactions earlier, preventing the flow of illicit oil to foreign markets.

Some banks now rationally check the authenticity of the Bills of Lading submitted to them as part of a documentary credit. This has acted as a deterrent for dark fleet operators.

   b. Anti-Money Laundering (AML) Measures and Transparency

In addition to KYC measures, Anti-Money Laundering (AML) regulations must be strengthened to prevent the illicit flow of funds that support dark fleet operations. Using complex money laundering schemes to finance the system of activities, practiced by the dark fleet operators, to hide the true ownership and origins of transactions.

To address this, the international community should push for greater financial transparency. Governments should impose stricter reporting requirements on companies involved in maritime trade, ensuring that financial institutions can track the origins of all transactions. Digital financial tools, including blockchain, can help enhance transparency and traceability by providing an immutable record of all transactions associated with dark fleet activities.

BLOCKCHAIN FOR TRANSPARENT SHIP OWNERSHIP AND CARGO TRACKING

a. Blockchain Technology: A Game Changer for Maritime Trade

Blockchain technology, often associated with cryptocurrency, holds enormous potential for transforming the way global maritime trade is monitored and regulated. By implementing blockchain-based systems, stakeholders can ensure greater transparency in ship ownership, cargo tracking, and the verification of Bills of Lading.

Blockchain's decentralized ledger system allows for the creation of a tamper-proof record of all transactions, providing a transparent history of a vessel's ownership and its cargo. This technology could help solve one of the most significant challenges in combating dark fleet operations: the lack of transparency in ship ownership.

In 2021, Singapore and Dubai began piloting blockchain-based systems to improve transparency in the shipping industry. The blockchain system used in Singapore's Port Authority, for instance, allowed stakeholders to track cargo shipments and verify vessel ownership in real time. This technology could play a pivotal role in detecting dark fleets, ensuring that ships engaged in illicit activities can be flagged and monitored at every stage of the transaction. (Singapore, 2021)

INTERNATIONAL COLLABORATION AND POLICY REFORM

A key challenge in combating dark fleets is the lack of consistent enforcement across countries. As different nations have different sanctions regimes, dark fleet operators can often find loopholes in certain jurisdictions. For example, while the European Union may enforce strict sanctions on Iranian oil exports, some major oil-consuming countries continue to purchase Iranian oil through intermediaries and shadow fleets.

To address this issue, international cooperation is essential. Organizations like the United Nations, the International Maritime Bureau (IMB), and the International Maritime Organization (IMO) must play a leading role in harmonizing sanctions enforcement across jurisdictions. By creating a global database of flagged vessels, authorities can ensure that all countries are on the same page when it comes to enforcing maritime sanctions.

CONCLUSION AND CALL TO ACTION

CONCLUSION

The rise of dark fleets poses a significant threat to the integrity of global maritime trade. Operating under concealed ownership, falsified documentation, and employing tactics such as AIS spoofing and ship-to-ship (STS) transfers, these vessels undermine international sanctions, maritime security, and environmental protection efforts. Despite growing awareness, enforcement remains fragmented due to jurisdictional loopholes, geopolitical complexities, and the exploitation of flags of convenience. Additionally, the manipulation of critical documentation like Bills of Lading (BLs) complicates detection and heightens the risk of financial fraud, exposing institutions, insurers, and regulators to reputational and legal consequences. However, advancements in vessel tracking technologies, the application of blockchain for cargo and ownership transparency, and stronger international coordination offer promising strategies to combat this threat.

To address the dark fleet phenomenon effectively, a unified regulatory response is essential. Governments and international bodies must collaborate to harmonize sanctions enforcement, enhance documentation transparency, and impose stringent penalties on those complicit in dark fleet operations. Financial institutions, insurers, and shipping brokers also have a critical role, with enhanced Know-Your-Customer (KYC) practices needed to disrupt illicit financial flows. Holding these stakeholders accountable ensures better screening of transactions linked to suspicious maritime activities. Investment in AI-powered surveillance, satellite monitoring, and real-time data analytics will strengthen global capacity to identify and respond to dark fleet operations, ultimately reinforcing the resilience of maritime trade against illicit actors.

FINAL CALL TO ACTION

The international community must take swift, decisive action to address the growing threat posed by dark fleets. This includes:

i.   Strengthening sanctions enforcement through coordinated global efforts.
ii. Utilizing advanced technologies to track, monitor, and analyse vessel movements, ensuring that dark fleet vessels are detected before they can evade regulations.
iii. Enhancing regulatory oversight, with a focus on transparency and accountability in both shipping and financial sectors.
iv. Encouraging multinational cooperation to close regulatory gaps and create a unified framework for addressing dark fleet operations.

Governments, international regulatory bodies, financial institutions, and the maritime industry must all recognize that dark fleets undermine the integrity of global trade and pose significant risks to national and international security. The fight against these illicit networks will require collective action, transparency, and commitment from all stakeholders.

By adopting these strategies and ensuring that enforcement remains robust and coordinated, we can reduce the impact of dark fleet operations and safeguard the future of global maritime trade. The time for action is now, before dark fleets continue to grow in scale and influence, threatening the stability of the global economy, international security, and environmental sustainability.

REFERENCES

1. (CREA), C. f. (2024). *Financing Putin's War: Shadow Fleet Exports of Russian Oil. CREA.*

2. (IMO), I. M. (2022). *Global Maritime Security: Threats and Challenges. IMO. Retrieved from https://www.imo.org/en/OurWork/MaritimeSecurity/Pages/Threats-and-Challenges.aspx*

3. (IMO), I. M. (2024). *Maritime Security and Piracy Reports 2023. International Maritime Organization (IMO).*

4. (OECD), O. f.-o. (2023). *Sanctions and the Global Shipping Industry: Impact of Russia's War in Ukraine. OECD. Retrieved from https://www.oecd.org/en/topics/economic-outlook.html*

5. (UNCTAD), U. N. (2024). *Review of Maritime Transport. United Nations Conference on Trade and Development (UNCTAD). Retrieved from https://unctad.org/webflyer/review-maritime-transport-2022*

6. Adland, R. C.-C. (2020). *Optimal Ship Speed and the Cubic Law Revisited: Empirical Evidence from an Oil Tanker Fleet. Transportation Research Part E: Logistics and Transportation Review. Retrieved from https://doi.org/10.1016/j.tre.2020.101972*

7. Agency, E. M. (2021). *EMSA Outlook 2021: Maritime Safety and Security Improvements. European Maritime Safety Agency. Retrieved from The EMSA Outlook 2021 document is a report published by the European Maritime Safety Agency (EMSA). It falls under the category of institutional reports, rather than an academic journal or news article.*

8. Androjna, A. P. (2024, January). *AIS Data Manipulation in the Illicit Global Oil Trade. Retrieved from https://www.mdpi.com/2077-1312/12/1/6*

9. Ballinger, O. (2024). *Automatic Detection of Dark Ship-To-Ship Transfers Using Deep Learning and Satellite Imagery. arXiv.*

10. Bockmann, M. W. (2023). *Abuse of IMO vessel-numbering scheme and falsely flagged ships continues, committee hears. Lloyd's List Intelligence. Retrieved from https://www.lloydslist.com/LL1144513/Abuse-of-IMO-vesselnumbering-scheme-and-falsely-flagged-ships-continues-committee-hears?utm*

11. Bockmann, M. W. (2023). *Shifty Shades of Grey: the different risk profiles of the dark fleet explained. Lloyds List Intelligence.*

12. Bockmann, M. W. (2024, November 18). *Spoofing tanker completes Russia cargo STS with sanctions-linked Suezmaxes. Retrieved from lloydslistintelligence.com: https://www.lloydslist.com/LL1151476/Spoofing-tanker-completes-Russia-cargo-STS-with-sanctions-linked-suezmaxes*

13. Bockmannci, M. W. (2024). *Evolving geopolitical risk, sanctions, the 'dark' fleet, and deceptive shipping practices. Lloyd's List Intelligence.*

14. Council, A. (2023). *Russia's growing dark fleet: Risks for the global maritime order. Atlantic Council. Retrieved from https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/russias-growing-dark-fleet-risks-for-the-global-maritime-order/*

15. Dixon, G. (2023, October 03). *Dark fleet tankers 'spill 5,400 barrels during Middle East oil transfer. Retrieved from TradeWinds is part of DN Media Group: https://www.tradewindsnews.com/tankers/dark-fleet-tankers-spill-5-400-barrels-during-middle-east-oil-transfer/2-1-1719478*

16. *Executive, T. M. (2022, January 18). Record Seizures of Drugs and Weapons in the Arabian Sea and Gulf of Oman. Retrieved from The Maritime Executive, LLC: https://maritime-executive.com/article/record-seizures-of-drugs-and-weapons-in-arabian-sea-and-gulf-of-oman*

17. *Intelligence, L. L. (2023). Shifty Shades of Grey: The Different Risk Profiles of the Dark Fleet Explained. Lloyd's List Intelligence. Retrieved from https://www.lloydslistintelligence.com/*

18. *International Maritime Organization. (2024). Maritime Security and Piracy Reports 2023. International Maritime Organization (IMO).*

19. *Julien Bouissou, A. M. (2024, October 30). Le Monde. Retrieved from Russia's ghost fleets, a strategic asset for selling sanctioned oil: https://www.lemonde.fr/en/les-decodeurs/article/2024/10/30/russia-s-ghost-fleets-a-strategic-asset-for-selling-sanctioned-oil_6731039_8.html*

20. *Jungman, C. (2023). Blacklisted Russian and Iranian ships: trading patterns and partners revealed. Seasearcher / Lloyd's List Intelligence.*

21. *Krishnamoorthy, J. Y. (2023, September 18). How a burnt-out, abandoned ship reveals the secrets of a shadow tanker network. Retrieved from The Guardian: https://www.theguardian.com/business/2023/sep/18/how-a-burnt-out-abandoned-ship-reveals-the-secrets-of-a-shadow-tanker-network#:~:text=The%20Pablo%20was%20part%20of,Pablo%20remains%20where%20it%20is.*

22. *List, L. (2023). Dark fleet: Out of mind, but not out of sight. LIyods List. Retrieved from https://www.lloydslist.com/LL1144570/Dark-fleet-Out-of-mind-but-not-out-of-sight*

23. *Lloyd's List Intelligence. (2023). Shifty Shades of Grey: The Different Risk Profiles of the Dark Fleet Explained. Lloyd's List Intelligence. Retrieved from https://www.lloydslistintelligence.com/thought-leadership/reports-and-whitepapers*

24. *Mandra, J. O. (2023, May 8). Devastating Pablo tanker explosion exposes dangers of growing shadow fleet. Retrieved from Offshore Energy Magazine: https://www.offshore-energy.biz/pablo-tanker-explosion-exposes-dangers-of-growing-shadow-fleet/*

25. *Nangoy, S. S. (2023, July 12). Reuters. Retrieved from Reuters: https://www.reuters.com/world/indonesia-seizes-iranian-flagged-tanker-suspected-illegal-transshipment-oil-2023-07-11/*

26. *OECD. (2021). MISUSE OF CONTAINERIZED MARITIME SHIPPING IN THE GLOBAL TRADE OF COUNTERFEITS. Retrieved from https://www.oecd.org/en/publications/misuse-of-containerized-maritime-shipping-in-the-global-trade-of-counterfeits_e39d8939-en.html*

27. *Pedrozo, P. P. (2025, April 27). Guest Post: Prof Pete Pedrozo on "Russia's Shadow Fleet". Retrieved May 4, 2025, from https://sites.duke.edu/lawfire/2025/04/27/guest-post-prof-pete-pedrozo-on-russias-shadow-fleet/*

28. *S&P Global Market Intelligence. (2023). Russia's Shadow Fleet – Understanding Its Size, Activity, and Relationships. S&P Global Market Intelligence. Retrieved from https://www.spglobal.com/marketintelligence*

29. *Singapore, M. A. (2021). Dltledgers' Tech Creates Digital Bill of Lading to Link Ports of Singapore and Rotterdam. Asia Biz Today. Retrieved from https://www.asiabiztoday.com/2021/05/03/dltledgers-tech-digital-bill-of-lading-singapore-rotterdam/*

30. *Smooth Sea 22 was not the ship it claimed to be. (2023, January 27). Retrieved from International Institute of Marine Surveying 2025.: https://www.iims.org.uk/smooth-sea-22-was-not-the-ship-it-claimed-to-be/*

31. *Soldatkin, V. (2024). Russia faces higher costs on sea-borne oil exports due to new US sanctions. REUTERS. Retrieved from https://www.reuters.com/business/energy/russia-faces-higher-costs-sea-borne-oil-exports-due-new-us-sanctions-2025-01-13/?utm_source*

32. *State, U. D. (2020). Sanctions Advisory for the Maritime Industry, Energy and Metals Sectors, and Related Communities. U.S. Department of State, U.S. Department of the Treasury, and U.S. Coast Guard. Retrieved from https://home.treasury.gov*

33. *State, U. D. (2020). Sanctions Advisory for the Maritime Industry, Energy and Metals Sectors, and Related Communities. U.S. Department of State, U.S. Department of the Treasury, and U.S. Coast Guard. Retrieved from https://home.treasury.gov*

34. *Tannenbaum, D. (2024, December 2). Toxic Tonnage: How the Dark Fleet puts the world at environmental & economic risk. Retrieved May 4, 2025, from https://www.doccredit.world/dark-fleet-environmental-and-economic-risks/*

35. *Triebert, C. M. (2023). Fake Signals and American Insurance: How a Dark Fleet Moves Russian Oil. The New York Times. Retrieved from https://www.nytimes.com/interactive/2023/04/10/world/europe/russia-oil-dark-fleet.html*

36. *U.S. Department of State. (2020). Sanctions Advisory for the Maritime Industry, Energy and Metals Sectors, and Related Communities. U.S. Department of State, U.S. Department of the Treasury, and U.S. Coast Guard. Retrieved from https://home.treasury.gov*

37. *United Nations Office on Drugs and Crime, UNODC. (2024). Transnational Organized Crime Threat Assessment. UNODC. Retrieved from https://www.unodc.org/unodc/data-and-analysis/TOC-threat-assessments.html*