EYES ON THE WATER

Tackling illegal fishing and human rights abuses through the use of onboard CCTV cameras

ENVIRONMENTAL JUSTICE FOUNDATION

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EJF is committed to combating illegal, unreported, and unregulated (IUU) fishing as well as associated human rights abuses in the fishing sector.

Our investigators, researchers, filmmakers and campaigners work with grassroots partners and environmental defenders across the globe.

Our work to secure environmental justice aims to protect our global climate, ocean, forests, wetlands, wildlife and defend the fundamental human right to a secure natural environment, recognising that all other rights are contingent on this.

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Acronyms

AI	Artificial intelligence
AIS	Automatic identification system
CCTV	Closed-circuit television
DoF	Department of Fisheries
DWF	Distant-water fishing
EM	Electronic monitoring
EU	European Union
FMC	Fisheries Monitoring Centre
GPS	Global positioning system
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
INTERPOL	International Criminal Police Organization
IUU	Illegal, unreported and unregulated fishing
MCS	Monitoring, control and surveillance
PSMA	Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing
RFMO	Regional fisheries management organisations
USAID	United States Agency for International Development
VMS	Vessel monitoring system
WARFP	West Africa Regional Fisheries Program
WCPFC	Western and Central Pacific Fisheries Commission

Trawler operating in the Gulf of Thailand.

1. Introduction

Illegal, unreported and unregulated (IUU) and unsustainable fishing places immense pressure on the world's oceans, decimating marine ecosystems, threatening global food security and jeopardising the livelihoods of more than 15 million people.[1] These destructive practices go hand in hand with human rights violations and labour abuses - investigations reveal that vessels involved in IUU fishing routinely subject crew to severe abuse and conditions of modern slavery.[2] A major challenge in effectively tackling these issues is that much of this harmful activity occurs in the middle of the ocean, where it is easier to avoid detection. A critical first step in combating this is establishing 'eyes on the water' - enabling the monitoring, detection and enforcement of compliance with fisheries regulations to ensure that global supply chains are free from IUU fishing and human rights abuses.

Increasingly, vessel-based closed-circuit television (CCTV) cameras - a key component of electronic monitoring (EM) systems that often also include global positioning system (GPS) boxes and gear sensors - are being championed as effective tools to tackle unsustainable and illegal fishing, as well as associated human rights abuses, especially in remote high-seas fisheries where oversight is limited.[3] This report examines how the installation and monitoring of CCTV cameras can enhance transparency and aid in combating IUU fishing and human rights abuses at the required pace and scale. The opening section outlines the limitations of traditional monitoring, control and surveillance (MCS) tools, highlights the advantages and limitations of using CCTV cameras on board fishing vessels and reviews the existing commitment landscape to CCTV use across flag states, regional fisheries management organisations (RFMOs) and industry actors. The report then presents five case studies from China, the European Union (EU), Ghana, Taiwan and Thailand, demonstrating how CCTV has proven effective, been considered beneficial, or could potentially play a crucial role in addressing IUU fishing and associated human rights abuses, while simultaneously acknowledging the limitations and pitfalls of the technology.

The findings of this report show that the adoption of fleet-wide CCTV, as a key tool within broader MCS systems, has massive potential to enhance transparency, tackle IUU fishing, and address human rights abuses at sea. Adopting CCTV offers major fishing flag states a way to support timely, credible, and verifiable at-sea monitoring of vessel compliance with fisheries laws and regulations, as well as labour and human rights standards on board. Furthermore, CCTV can also play a critical role in helping states implement key provisions of the Global Charter for Fisheries Transparency[4] - a practical, low- or no-cost framework for combatting IUU fishing and associated human rights abuses through increased transparency.

2. Background

2.1 Limits of traditional tools for tackling IUU fishing and human rights abuses at sea

Detecting instances of non-compliance with fisheries laws and regulations is a critical first step in addressing harmful activity at sea. Effective oversight of fishing activity - including knowledge of who is involved, when it occurs, what is being caught and how - has traditionally relied on a range of tools including dockside compliance checks, aerial and patrol vessel surveillance, remote tracking via vessel monitoring systems (VMS) and Automatic Identification Systems (AIS), onboard human observers and reviewing fisher-reported data such as logbooks.[5] Of these, only onboard observers - trained specialists who collect data on catches, bycatch and at-sea vessel operations such as gear use and trans-shipment - provide independent, on-the-water compliance monitoring throughout an entire voyage, though their effectiveness is constrained by several key limitations:[6]

- **Limited coverage:** Although many RFMOs have mandated observer coverage for specific gear types, large segments of fishing activity remain unmonitored - either because no minimum coverage is required, or existing requirements are low.[7] The South Pacific Regional Fisheries Management Organisation, for example, has only recently set targets to introduce 5% observer coverage for squid jigging vessels by 2027, increasing to just 10% by 2029.[8] The scope of Tuna RFMOs' commitments varies, particularly in relation to gear type. For example, purse seiners in the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), and the Western and Central Pacific Fisheries Commission (WCPFC) face 100% observer coverage requirements, whereas longliners are generally covered by only 5%, and other gear types have no coverage requirements.[9] These already limited levels of coverage are also highly vulnerable to external shocks, as demonstrated during the COVID-19 pandemic, when at-sea observer deployments were widely suspended.[10]

- **Risks to observer safety:** Serious concerns exist regarding observer safety. Isolated at sea, observers are vulnerable to intimidation, threats and harm.[11] Over the last decade, at least 14 observers have been reported missing or have died in suspicious circumstances.[12] These incidents are rarely resolved and fail to result in trials to hold those responsible to account.[13]

- **Compromised reporting:** Within this context, observers have reported that fear for their safety, or low pay, has led them to accept bribes and refrain from reporting incidents of IUU fishing that they have witnessed on board.[14] Additionally, with such a small proportion of trips being observed, there is a risk of vessels simply modifying their behaviour during monitored trips.[15]

2.2 Blind spots in monitoring crew abuse

The abuse of crew at sea is well documented. For example, a recent EJF investigation found that crew from 63% of interviewed Chinese squid vessels operating in the Southwest Atlantic reported incidents of physical violence or deaths on board.[16] While recent years have seen some legislative and policy progress on tackling human rights abuses,[17] effective enforcement hinges on the capacity to monitor and report on onboard conditions.

There are significant limitations in the ability of current monitoring methods to produce robust, verifiable data. While onboard observers may be well-positioned to report on crew abuse, they are often not mandated or trained to identify and/or report on issues related to living and working conditions or crew welfare.[18] Testimony and evidence shared by fishers themselves can play a critical role in exposing abuse; however, port authorities are often ill-equipped or unwilling to undertake thorough, victim-based investigations.[19]

On a larger scale, vessel location data has been used to identify high-risk vessel behaviour - such as extended trip duration[20] and limited time between setting and hauling events[21] - as proxies for overwork and potential abuse. While such approaches may be helpful indicators of forced labour and can inform risk assessments undertaken by stakeholders such as port authorities, civil society groups, or seafood buyers, they cannot capture in detail what occurs on board and may offer limited evidential value.

2.3 CCTV as a tool to combat illegality and abuse at sea

Onboard CCTV involves installing and monitoring cameras throughout a vessel, normally to oversee fishing activities, gather scientific data and ensure compliance with fishing regulations. CCTV often forms the core component of a broader EM system, which typically also includes video storage units, gear sensors and GPS tracking.[22] Equally important are the onshore components of the EM system, which involve the secure transmission of data and its review by analysts.

Since the first pilot of EM more than 20 years ago, it has been implemented in over 100 fisheries, both in trials and as part of full fisheries monitoring programmes.[23] During this time, video footage has proven effective in monitoring bycatch, discards and trans-shipment activities.[24] More recent progress has expanded EM's scope, extending its use beyond fisheries compliance to include monitoring labour conditions. For instance, a 2024 pilot on Taiwanese-flagged tuna longliners demonstrated EM's effectiveness in tracking labour abuse indicators, such as accidents, injuries, the use of safety equipment, work hours and trip length.[25]

The existing use of CCTV technology has demonstrated its value in driving transparency, monitoring compliance and enabling enforcement, while also highlighting key challenges, limitations and risks. Both sets of considerations are outlined below.

2.4 Advantages of CCTV monitoring

Detailed data: CCTV provides a detailed record of fishing operations and crew activities, enabling accurate monitoring and oversight. Artificial intelligence (AI) tools, when trained on expert-annotated imagery datasets, are increasingly capable of optimising the review of this data. For example, they can automate species identification and estimate fish size, supporting bycatch monitoring.[26] In the coming years, AI could help automate the detection of individual fishers on deck - enabling identification of, for instance, cases of excessive working hours - although this application is still in the early stages of development.[27]

A trawler operating in Senegalese waters.

Cost-effective way to increase coverage: As best practice increasingly recognises the need for 100% observer coverage (human or electronic),[28] CCTV offers a more affordable way to meet this target than expanding human observer coverage.[29] Furthermore, a recent report found that scaling up CCTV data review from 20% (the recommended minimum review rate, according to several studies, including IATTC scientific advisors[30]) to 100% would increase costs by only 35%, highlighting that once EM systems are installed, expanding coverage becomes a relatively low-cost step toward more comprehensively monitoring potential IUU fishing.[31] Additionally, advances in AI are expected to reduce analysis time significantly,[32] potentially lowering review costs, which currently account for up to 60% of program expenses.[33] CCTV also provides the added advantage of round-the-clock eyes on deck. Unlike a human observer, who needs to sleep, only monitors a single location at a time and might not be available for every fishing trip, cameras can run 24/7 and record multiple points on a vessel simultaneously.

Independent and verifiable: CCTV data can be replayed and verified by multiple expert analysts,[34] unlike human observer accounts, which can be more easily disputed because they can be difficult to corroborate.[35] This makes CCTV footage a powerful tool for law enforcement[36] and resolving disputes. For instance, it can provide evidence to help resolve cases where fishers allege excessive working hours, but the captain's records claim otherwise.[37] CCTV footage has also played a role in investigations into deaths at sea. In the still unresolved death of Eritara Aati Kaierua - a Kiribati fisheries observer who died at sea under suspicious circumstances in 2020[38] - footage was requested by Kiribati authorities and shared with the International Criminal Police Organization (INTERPOL) to support their investigation.[39] In 2024, campaigners publicly released footage from the vessel to maintain pressure and renew calls for accountability.[40]

Potential for timely monitoring to enable effective enforcement: Advancements in satellite transmission, 5G networks and AI are making near-real-time transmission of video data increasingly viable.[41] As only a fraction of footage captured by CCTV is relevant to the detection of potential IUU fishing and associated human rights abuses, and full video transmission is prohibitively expensive, integrating AI into onboard EM systems would enable the detection of key events whilst cutting costs. Onshore experts could then review this targeted data before vessels return to port, enabling timely action by port inspectors, regulators and remediation services.[42]

Strengthening traceability: CCTV can be a key tool for verifying traceability. Recording and capturing trans-shipment activities provides independently verifiable information to track seafood from bait to plate. As more market states implement traceability systems - including catch documentation schemes - to block IUU-linked seafood from entering their supply chains, CCTV, alongside traditional MCS tools, can help industry and flag states demonstrate compliance with these requirements.[43]

2.5 Challenges, limitations and risks of CCTV monitoring

Protecting privacy and confidentiality: A key challenge in using CCTV is ensuring policies address personal privacy, data protection and encryption, manage the collection, storage and sharing of data, and comply with related laws that vary between jurisdictions.[44] CCTV raises privacy concerns for fishers.[45] Unlike environmental monitoring, which can restrict cameras to areas used for fishing, to minimise capturing individuals, monitoring labour conditions is more complex, as observing human activity is essential.[46] AI systems on board that blur faces to protect privacy offer a solution;[47] however, anonymisation also prevents the identification of perpetrators and victims when needed.[48] Careful consideration is required to minimise unnecessary data collection while still enabling monitoring that protects workers' rights and safety.

Encouragingly, growing evidence shows that with proper consultation, consent and first-hand experience, fishers' trust increases and they acknowledge the benefits of CCTV as a tool for safety, accountability and protection.[49] This underscores the importance of meaningfully involving fishers in decisions about how information is used, with EM complementing - not replacing - active participation and ongoing dialogue with fisheries workers.[50]

Technical and practical limitations of CCTV: Since CCTV captures visual data, it simply cannot collect certain types of information, such as biological samples needed for bycatch verification.[51] Camera placement also presents key challenges; finding positions that provide a complete, unobstructed view of fishing activities is difficult, especially given the variation in vessel layouts. Consequently, blind spots are common, though they can be minimised by using multiple cameras and careful positioning. At-sea conditions, such as nighttime fishing, rough

weather and sea motion, can lead to blurry or poor-quality footage. Effective use also depends on crew cooperation, as cameras need regular maintenance. Without crew buy-in, there is a risk of neglect, sabotage or obstruction, such as deliberately blocking the field of view.[52] Additionally, if CCTV is not tamper-resistant or tamper-evident (meaning that if tampering occurs, it can be detected), there is a risk that video evidence of offences could be deleted.[53]

Data alone is not enough: To better address IUU fishing and associated human rights abuses, CCTV data must be used in conjunction with complementary tools. In particular, pairing CCTV with secure onboard Wi-Fi is both affordable and essential - yet, although many vessels already have Wi-Fi installed, few provide access to migrant crew; doing so would enable fishers to exercise their right to freedom of association, report abuses in real time and access grievance mechanisms.[54]

CCTV must also be coupled with effective systems to process, share and act upon relevant intelligence collected.[55] When evidence of non-compliance is detected, enforcement can only follow if data-sharing agreements, consistent standards and interoperability exist across systems and jurisdictions.[56] Flag states and vessel owners may have a vested interest in withholding CCTV data from fishing vessels, as its release could carry reputational, financial or political costs. As such, clearly defined processes for requesting and sharing intelligence are integral to the rollout of any EM initiative.

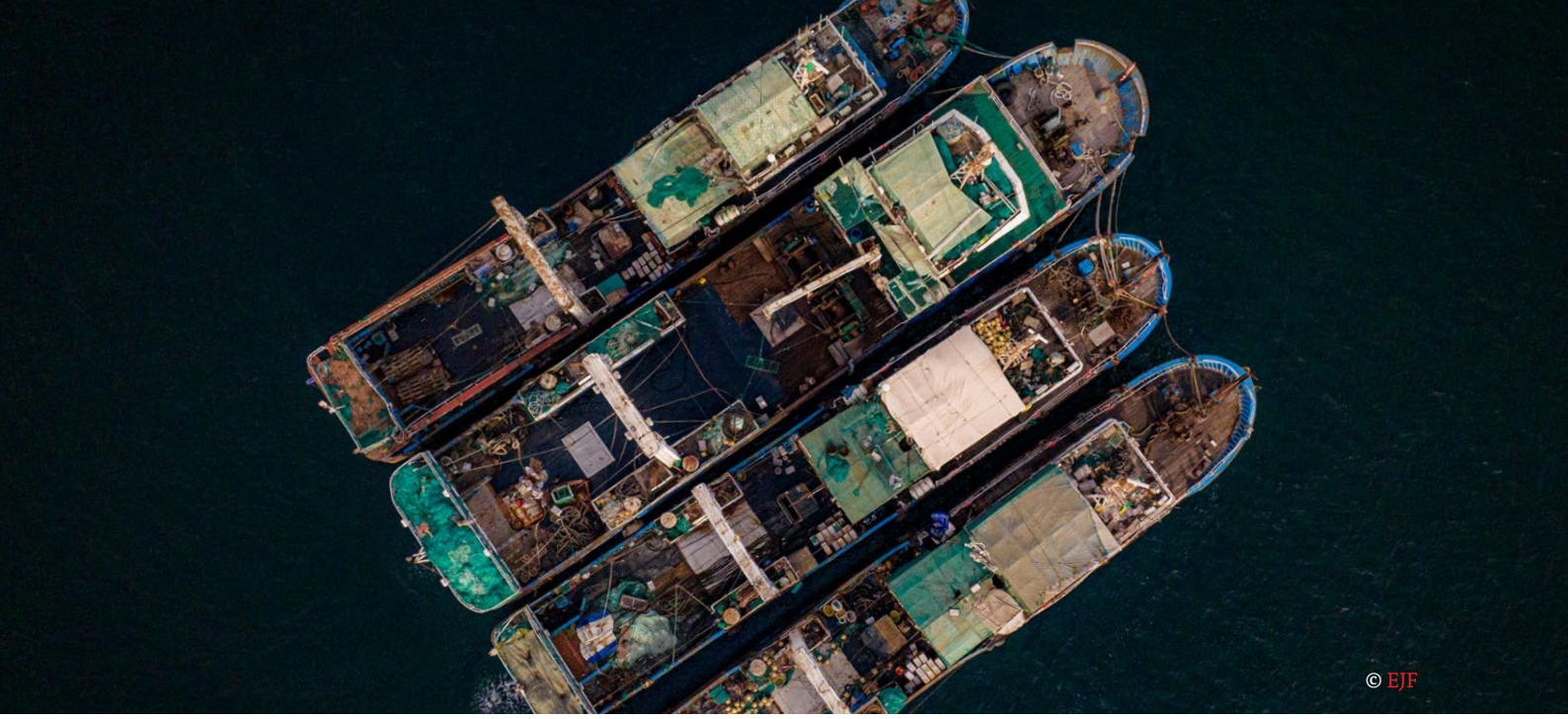
CCTV is most effective when integrated into a broader suite of complementary measures. When used alongside human observers - rather than replacing them - and complemented by tools like onboard Wi-Fi, which allow crew to report abuses, CCTV supports efforts to combat IUU fishing and protect fishers from abuse.

Concerns around the upfront costs: Upfront CCTV installation costs risk being a continued sticking point in the rollout of CCTV, particularly for fishing vessel owners and operators who often bear the cost. While costs vary by fishery, vessel type and installation complexity - making cross-programme cost comparisons difficult - IATTC estimates for the Eastern Pacific longline fishery place EM hardware and installation costs at US$13,390 per vessel,[57] the Scottish government estimates for large demersal vessels range from US$10,864 - US$11,886.[58]

While EM is a cost-effective alternative to increasing human observer coverage, in fisheries with limited existing coverage, it introduces a new cost burden, particularly for smaller operators.[59] Programme design plays a critical role here and must address who will bear the costs. Where feasible, technical and financial support from governments and/or other fisheries stakeholders (such as the processing or retail sector and NGOs) - ideally targeted at those most in need - can help to mitigate these costs. Government and other stakeholders have contributed to the rollout of EM in several fisheries, including in Denmark,[60] Ghana,[61] New Zealand[62] and the United States of America (USA).[63] At the same time, these costs are expected to fall as roll-out grows and technology advances.

Better communicating the benefits is also key. Amid calls for increased observer coverage, CCTV and EM offer a more cost-effective option than human observers. EM also supports improved operational analytics, including gathering information on unwanted bycatch hotspots, and better understanding when and where to fish to ensure maximum return on efforts.[64] Increasingly, vessel operators may also find themselves excluded from lucrative supply chains in which buyers and/or eco-labels demand the presence of EM to verify that vessels are operating sustainably, legally and ethically - creating potential economic gains and price premiums for early adopters.[65]

More broadly, CCTV and EM systems need to be reframed within some sections of the fishing industry from a burdensome additional source of scrutiny to a pivotal tool in improving the sustainability and ultimately, the profitability, of the marine ecosystems they rely on. Central to this reframing is the meaningful engagement of fishers throughout the design, planning and implementation phases[66] - ensuring that such systems do not disproportionately affect smaller fishing operations or those in the fishing industry that strive to operate legally and sustainably. Likewise, amplifying the experiences of early adopters (see **section 2.6**) will help make a 'business case' for EM.



Aerial view of Chinese trawlers.

2.6 Commitment landscape

The practical demonstration of CCTV as an effective and scalable tool has been instrumental in catalysing a growing number of commitments to expand independent at-sea monitoring using EM. In 2023, the EU adopted mandatory EM for a substantial portion of its fleet (see **Case Study 2**).[67] The new fisheries control rules will apply from January 2028 and are principally focused on monitoring compliance with discard rules.[68] Nonetheless, there is scope for Member States to use CCTV to check compliance with other aspects of the EU's Common Fisheries Policy. At the international level, tuna RFMOs have made progress by adopting minimum standards for EM,[69] although this has not yet been matched with adequate commitments to increase observer coverage. In notable exceptions, such as RFMO fleets with 100% observer coverage commitments - namely, purse seiners operating in the IATTC, ICCAT and WCPFC[70] - EM plays a central role, with the EU, for instance, reporting in 2025 that all its purse seine vessels are equipped with EM.[71]

Elsewhere, the USA also continues to implement EM across a number of its fisheries and fleets - with 14 programs currently in place, including the monitoring of industrial bycatch of bluefin tuna in its Atlantic pelagic longline fishery and for maximised retention compliance checks in its Northeast groundfish fishery.[72] The United Kingdom (UK) plans to expand EM across priority fisheries over the next five years, beginning with a first phase that engages early adopters - starting with the FRANK BONEFAAS, the largest vessel in the UK's pelagic trawl fleet.[73] In Scotland, EM requirements came into force for scallop fishing vessels in 2024[74] and are set to be applied to pelagic vessels in Scottish waters from March 2026.[75]

An increasing number of flag and coastal states - including Belize and the Federated States of Micronesia - as well as major industry players such as Carrefour, Thai Union and Walmart have set targets to achieve 100% on-the-water monitoring (via EM or human observers) across all industrial tuna fishing vessels within their supply chains or jurisdictions by 2027.[76] Thai Union reports that to date, 97% of the tuna it sources is covered by on-the-water monitoring.[77] Two Spanish tuna purse seiner organisations (Asociación Nacional de Armadores de Buques Atuneros Congeladores (ANABAC) and The Organización de Productores Asociados de Grandes Atuneros Congeladores (OPAGAC), committed to 100% observer coverage (human and EM) in 2012[78] - both serving as early adopters and advocates of EM.[79]

In parallel, individual vessels have voluntarily joined transparency tools like the Vessels in Other Sustainability Initiatives list,[80] where they publicly report on their practices - including their use of EM - and agree to third-party audits of their reporting. This reflects a growing recognition that onboard EM provides downstream companies and their consumers with greater confidence that they are buying seafood which is IUU fishing and abuse-free.

Certification organisations like the Marine Stewardship Council are also recognising EM as a key traceability tool. Their latest guidance states that 100% independently verified EM is sufficient for trans-shipment monitoring[81] and that fisheries with full independent observation, including EM, are considered to meet best-practice standards.[82]

3. CASE STUDIES

The following five case studies demonstrate both the strengths and limitations of CCTV technology, as observed in different jurisdictions and in addressing different compliance challenges. **Case study 1** explores the effectiveness of Taiwan's CCTV rollout in addressing shark finning and the deliberate capture of vulnerable marine wildlife. **Case study 2** examines the potential EU-wide rollout of CCTV to monitor large vessels - including bottom trawlers and distant-water fishing (DWF) vessels - at high risk of illegal and unreported discarding of catch. **Case Study 3** overviews the deployment of CCTV on Thai vessels in order to monitor trans-shipments. **Case Study 4** looks at CCTV as a tool to protect fisheries observers in Ghana, while **Case Study 5** draws on examples from China's DWF fleet to highlight the risk of CCTV being used to surveil and ultimately punish crew.

CASE STUDY 1: Taiwan - CCTV technologies to address shark finning and the deliberate capture of vulnerable marine wildlife

Taiwan is a major fishing nation, with a DWF fleet of approximately 940 vessels, placing it among the world's largest.[83] In 2015, the EU issued a 'yellow card'[84] warning of possible trade sanctions to Taiwan in response to the fleet's reported involvement in IUU fishing activities, including shark finning.[85] The yellow card was lifted in 2019 after Taiwan made progress on tackling IUU fishing, including implementing the Port State Measures Agreement (PSMA), reviewing its monitoring and control tools and increasing supply chain traceability.[86] In 2025, Taiwan demonstrated increased commitment to fisheries transparency by endorsing the Global Charter for Fisheries Transparency.[87] Despite these measures, the deliberate capture and killing of vulnerable species and the finning of sharks on board Taiwanese vessels is still frequently documented by civil society groups.[88] A 2024 at-sea investigation by Greenpeace identified four Taiwanese longliners fishing for sharks during a seasonal shark fishing ban,[89] and in the same year, Canadian authorities documented a Taiwanese vessel in the Northwest Pacific Ocean capturing and killing dolphins to use as bait.[90]

Fisher holds shark landed on vessel.

In recent years, Taiwan has committed to installing CCTV across its entire DWF fleet to monitor human rights concerns,[91] reporting that, as of July 2025, CCTV have been rolled out across 94% of active vessels.[92] Subsidies of NT$130,000 to NT$150,000 (US$4,056 to US$4,680) per vessel are provided by the Taiwanese government to cover[93] the upfront costs of purchasing and installing CCTV.[94] In 2024, the Taiwanese Fisheries Agency provided subsidies to 396 vessels, totalling NT$50,119,088 (over US$1.56 million).[95]

While there is limited data thus far as to the impacts of CCTV on labour conditions on Taiwanese vessels, and the Taiwanese authorities have yet to clarify how they will access footage currently owned by vessel operators,[96] investigations by EJF have found that installing CCTV on Taiwanese vessels is potentially deterring the illegal capture and killing of vulnerable marine wildlife. These findings suggest that CCTV could be a key tool for authorities - not only in deterring practices such as shark finning, but also, if footage is actively monitored, in identifying violations and enabling enforcement action.

In interviews with crew who have worked on board Taiwanese DWF vessels, EJF found instances where fishers reported that the presence of CCTV deterred shark finning and the capture of vulnerable marine wildlife. One fisher, from a Taiwanese longliner operating in the Atlantic Ocean, told EJF investigators that the presence of CCTV contributed to the immediate release of an accidentally captured false killer whale.

"We caught a false killer whale, but it wasn't allowed to be raised [...] we directly cut the branch line and threw it away whether it was alive or dead [...] the captain was afraid of the police. There was also CCTV".

Another fisher from the same vessel reported that shark finning occurred on only one trip, when the CCTV was broken, stopping once it was repaired - underscoring the need to ensure systems remain operational throughout the duration of trips.

Two additional fishers from another vessel in the fleet stated that the installation of CCTV has stopped shark finning on board. When asked what species they caught other than tuna, one responded:

"We caught marlin, but for sharks, it is prohibited, because there is CCTV on the vessel now. We could not catch sharks anymore".

"We also got swordfish. The shark was cut. There are laws and CCTV now. If we got a shark, it would be cut".

A fisher from a separate Taiwanese longliner operating in the Pacific, which engaged in seasonal (legal) shark fishing, reported that approximately 10% of the shark catch was illegally finned under the captain's instruction. When asked how this occurred with CCTV on board, the fisher stated that finning and the disposal of bodies took place in an area of the vessel not covered by cameras - emphasising the importance of full-deck camera coverage.

"Sometimes we took it [the body], sometimes we threw it away. It was not every day we took the fins and threw away the bodies [...] sometimes the general crew were stubborn. They [the general crew] wanted to take the bodies as well, not only the fins. Because the faster we fill the cargo, we would go back home sooner. But the captain would tell us to throw it away"

"The CCTV was facing the door. We processed beside that door. We also threw the body away beside that door".

Taiwan's ambitious deployment of CCTV across most of its distant-water fleet is a significant step towards much-needed transparency in one of the world's major fishing fleets. It provides a real-world example that the technology is applicable at scale and how CCTV can stop cruel practices such as shark finning and the capture of other vulnerable marine wildlife. Conversely, the cases reveal potential loopholes: coverage must be consistent, cameras well-maintained and all deck areas kept in view. Most importantly, a clear and robust process is needed to ensure that the competent authority, prosecutor's office, independent third parties and directly related stakeholders (such as crew members) have timely access to the footage when required. Short of this, the risk remains that unscrupulous actors will exploit 'dark spots' and continue harmful and illegal practices out of the sight of regulators.

CASE STUDY 2: EU - CCTV to lead the global fight against hidden overfishing?

The EU fishing fleet is globally significiant, numbering 68,863 vessels and catching 3.2 million tonnes as of 2024.[97] It targets species subject to international quotas, including overfished populations, such as North Atlantic mackerel,[98] and unintentionally captures threatened species, including Baltic Sea and Kattegat cod, as bycatch - with actual amounts caught often unknown due to unreported and illegal discarding.[99]

To ensure quotas are respected and to restore overfished populations, EU authorities must ensure EU vessels report catches accurately. Yet misreporting and unrecorded discards remain widespread.[100] At sea, EU vessels are known to throw back large amounts of unwanted fish that are mostly dead.[101] Despite the EU's discard ban being introduced in 2015, discard rates have "not changed" since then,[102] with an estimated 23% of total catches dumped,[103] reaching as high as 40% in some cases.[104] Vessel masters face strong incentives to discard catch, including highgrading - illegal and unreported dumping of lower-value (target) species to make room for higher-value catch - and avoiding situations where a trip must be cut short due to running out of (bycatch) quota for certain species. Certain vessel types are particularly associated with discarding, with larger vessels (above 24 metres) accounting for 37% of recorded discards and 92% coming from demersal (bottom-contacting) trawlers, regardless of their length or gear configurations.[105] Many bottom trawlers reportedly have equipment "configured to discard 100% of catch by default," while EU pelagic vessels are known to use equipment, such as pumps, that facilitates large volumes of discarding.[106]

Bottom trawling in the Bay of Biscay.

Although EM, including CCTV, is already used, for example, to monitor activities on deck on certain EU DWF vessels,[107] authorities need access to the footage to detect and tackle illegal discards and ensure compliance with the EU's discard ban. In 2022, footage of a large "carpet" of dead fish floating in the Bay of Biscay sparked public outrage and a French government and European Commission enquiry.[108] The spill was traced to the MARGIRIS, a Lithuanian-flagged pelagic freezer trawler. While the vessel owners and Lithuania (initially) characterised the spill as an unusual isolated incident, not indicative of future risk,[109] the Commission stressed that pelagic freezer trawlers are "inherently very high risk,"[110] citing the extensive body of evidence, including involvement in several large-volume discarding incidents and "the carrying on board of illegal equipment" that enables it.[111] It noted the vessel had CCTV that could have verified the circumstances and details of the discarding event.[112] However, Lithuania did not review the footage and stated it would only consider using EM, including CCTV, for compliance purposes on board "once EU legislation has been established".[113] Subsequently, the Commission asked EU Member States to "review the risk level of pelagic freezer trawlers further to this incident", given that they are obliged to ensure control and enforcement of all activities governed by the EU Common Fisheries Policy, including the discard ban.[114]

Within EU waters, CCTV monitoring of illegal and undocumented discarding remains limited, with Denmark a notable exception. In 2022, in response to the steep decline in cod populations and recognising that "electronic monitoring has lower operating costs than [human] observers,"[115] Denmark introduced CCTV on 73 trawlers to monitor sorting areas.[116]

The Danish Agricultural and Fisheries Agency reported that in phase 1 of the rollout - a voluntary stage involving 12 vessels - the purchase and installation of the EM camera system incurred upfront costs of US$17,056 per vessel.[117] In the wider rollout, installation took three working days, but "no potential days at sea were lost due to installation of EM at all," mitigating any loss of revenue for vessel operators.[118] The Agency also covered maintenance costs for all 73 vessels, which totalled US$40,481 between 2022 and 2024.[119]

The rollout proved highly effective. The trawlers were part of Denmark's Norway lobster (Nephrops) fishery, where small cod, caught by fine-meshed nets, have been at risk of being illegally discarded without documentation, allowing fishers to exceed bycatch quotas and distorting stock mortality data. The cameras enabled inspectors to verify whether fishers kept small cod for landing, as required by the EU's discard ban, and were therefore found to be effective in discouraging illegal throwbacks.[120]

However, in January 2025, the scheme became voluntary.[121] Although 50 vessels reportedly continue to participate[122] - incentivised by the promise of fewer inspections during the last haul[123] and higher bycatch quotas[124] - it is unclear how many still share data for control purposes.

In late 2023, the EU revised the EU's fisheries control system,[125] mandating EM, including CCTV, from 10 January 2028 on all EU vessels of 18 metres or longer deemed 'high risk' for non-compliance with the landing obligation,[126] making the EU the first major fishing bloc to mandate EM across a significant portion of its fleet. Although 'high risk' vessels are yet to be defined, monitoring large bottom trawlers and DWF vessels with EM could improve compliance with the landing obligation and provide accurate data on the untold amounts of marine life that are thrown overboard without a trace. This information could inform the management of fish populations caught by EU vessels and allow the EU to more credibly lead by example, encouraging non-EU states to require EM for monitoring, which could help restore overfished or threatened species through better fisheries management.

However, the ongoing evaluation of the Common Fisheries Policy, including its discard ban, risks delaying implementation and allowing third countries to outpace the EU in rolling out CCTV and EM. To end the EU's contribution to hidden overfishing and ensure accurate catch reporting, Member States can and should act decisively to roll out EM, including CCTV, starting with identifying the most discard-prone vessels, including bottom trawlers and those equipped to facilitate discarding.

CASE STUDY 3: Thailand - CCTV to monitor trans-shipments

Thailand has conducted significant reform in its fisheries sector over the past decade in response to global scrutiny over IUU fishing and associated human rights abuses.[127] Central to these reforms was the strengthening of Thailand's MCS framework, including deploying technologies such as EM systems (including CCTV) to enhance transparency and compliance in the fishing industry. After receiving a 'yellow card' warning from the EU in 2015, Thailand revamped its MCS systems under the Fisheries Act B.E. 2558 (2015) and subsequent amendments, setting a legal foundation for a more accountable and transparent fisheries governance regime.[128] Furthermore, in 2025, Thailand joined a growing global movement for fisheries transparency by announcing that its national fisheries governance is in line with the Global Charter for Fisheries Transparency at the 'Our Ocean' conference.

In 2019, the Thai government mandated the installation of CCTV systems with integrated sensors on specific classes of vessels. These include commercial DWF vessels and refrigerated transport vessels (reefers) operating in Thai waters or calling at designated ports under the PSMA. In line with reform efforts, CCTV systems have been installed on six large-scale reefers and on Thailand's DWF fleet, which consisted of two vessels as of May 2025.

Installation and certification of CCTV systems has been carried out exclusively by service providers approved by Thailand's Department of Fisheries (DoF), maintaining uniform standards and functionality. These systems are designed to continuously record activities on board and synchronise video footage with GPS and VMS data, allowing the DoF's Fisheries Monitoring Centre (FMC) to conduct both real-time surveillance and retrospective inspections. The footage captures a range of key events, including trans-shipments, fish handling practices, gear deployments and retrievals and the treatment of crew members.

Trans-shipment at sea - the at-sea transfer of catch from one vessel to another, often reefers - creates opportunities for illegal operators to exploit gaps in oversight. When illicit catch is transferred, it can easily be mixed with legally caught seafood, allowing undeclared or IUU-caught fish to enter the market undetected.[129] CCTV allows authorities to monitor whether unauthorised or unreported transfers take place between vessels, record transfers that do take place with a high degree of precision, capture essential information about at-sea interactions between vessels and estimate quantities and species transferred. This improves traceability across the supply chain, providing an auditable record that supports

Thira Rodchevid, Fishery Biologist for Port State Measures Implementation, Fishing and Fleets Management Division from the Thai Department of Fisheries, speaking at a side-event at the Our Ocean conference in Busan, South Korea, in 2025. Credit: Oceana / Franz Mahr

Trans-shipment of high-value tuna.

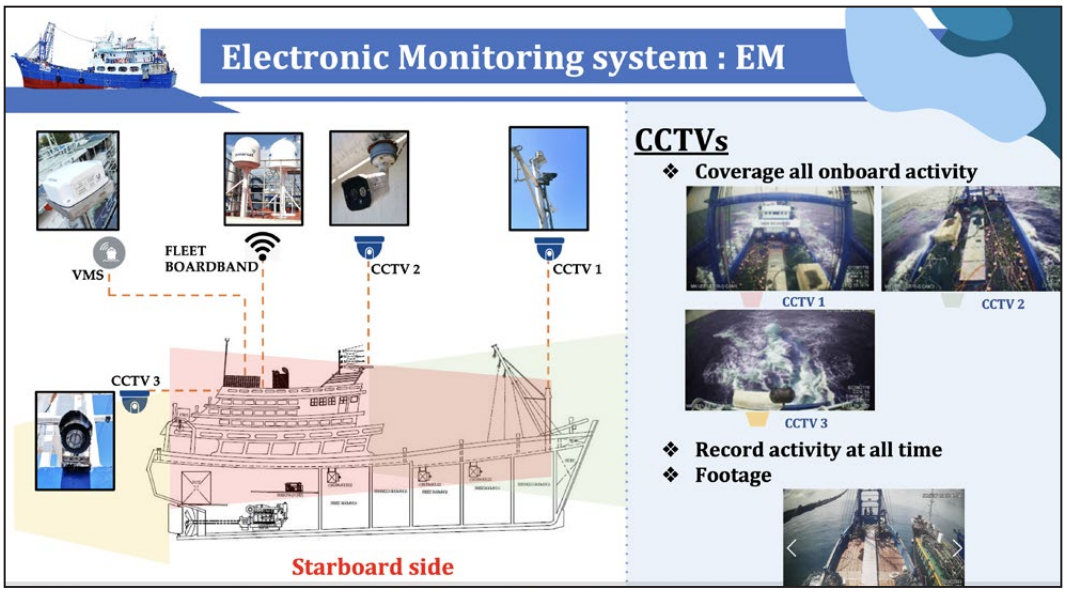
compliance verification, enforcement actions and preventing illegal catch from entering domestic and international markets.

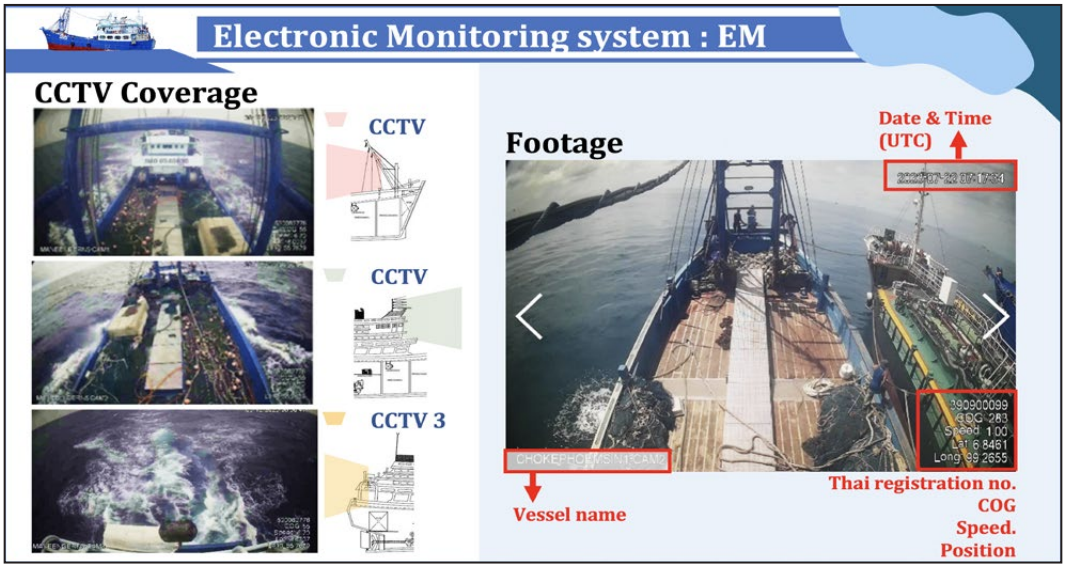
CCTV can also be used to monitor unauthorised crew transfers during trans-shipments, provided camera placement allows for observing crewing movements during at-sea vessel encounters. Once a vessel returns to port, operators must submit CCTV footage for inspection. This footage is reviewed by FMC officials, who assess compliance by cross-referencing it with the vessel's VMS, fishing logbooks and other operational data. If violations are detected - such as undeclared trans-shipments, irregular crew operations, or unauthorised fishing practices - enforcement actions are taken accordingly. In cases of non-compliance, penalties may include formal warnings, administrative sanctions, or legal prosecution. All reviewed data and outcomes are archived and stored securely, forming an evidence base for future inspections and audits.

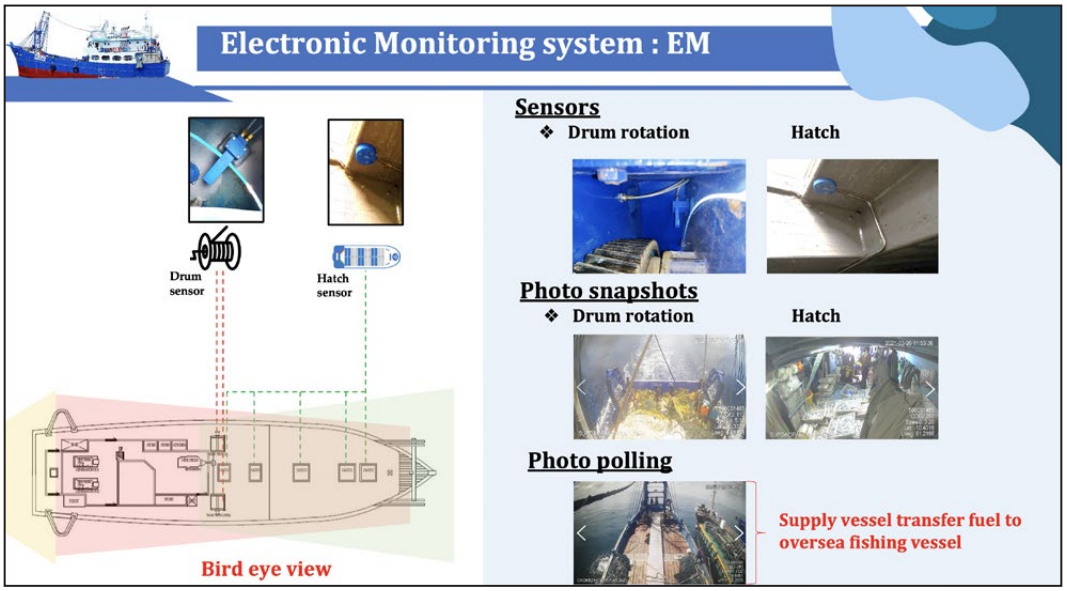
Despite significant progress, several challenges persist in the full operationalisation of CCTV and EM technologies in Thailand.

Technical issues such as poor video quality, unreliable connectivity in remote maritime areas and sensor calibration failures continue to hinder consistent data capture. In addition, the sheer volume of video footage generated creates a data overload for FMC staff, who often lack the human and technological capacity to thoroughly review all available materials.[130] Legal and ethical considerations also pose challenges, particularly around data privacy, the legality of constant surveillance and the protection of workers' rights.[131]

Economic constraints further complicate programme expansion, especially for small and medium-sized vessel owners who may struggle with the high initial installation and maintenance costs associated with CCTV and EM equipment. The initial installation cost for a system integrating multiple sensors and automated detection algorithms can cost upwards of Thai฿1 million (around US$30,000), excluding ongoing maintenance and data management expenses. Although the DoF recognises that automated detection algorithms could help address existing monitoring gaps, the relatively small number of vessels that would benefit makes large-scale investment economically challenging, and the growing influence of the commercial fishing sector has further reinforced a cautious stance on regulatory reform. This underscores the need for targeted government support programs. In addition, some pilots[132] have tested automated detection algorithms capable of flagging suspicious behaviours, such as non-declared trans-shipments or prolonged operations without visible crew activity - potential indicators of forced labour or human trafficking. These capabilities aim to reduce dependency on manual footage review, which is both time-consuming and resource-intensive.







Flowchart of integration of CCTV & EM systems by the Thai DoF's FMC. Source: Presentation of Thira Rodchevid, Fishery Biologist for Port State Measures Implementation, Fishing and Fleets Management Division from the Thai DoF at a side-event at the Our Ocean conference in Busan, South Korea in 2025.

CASE STUDY 4: Ghana - CCTV to increase observers' security

Since 2018, the government of Ghana has appointed fisheries observers on board all Ghanaian-flagged industrial trawlers to collect data on fishing activities and report on illegal practices occurring at sea. The observer programme was originally established under the West Africa Regional Fisheries Program (WARFP) with salaries paid by the World Bank.[133] Following the end of the WARFP in Ghana in 2019, full observer coverage of the fleet has been maintained.

Despite the presence of observers, illegal fishing remains pervasive in Ghana's industrial trawl fleet. Trawlers routinely use illegally modified nets, resulting in large volumes of bycatch of small pelagic fish, which are sold to coastal communities.[134] Observers who attempt to document or prevent illegal activities have reported facing intimidation and threats, such as demands made by the captain or crew manager to see the observer's report, phones being seized to delete photographic evidence, observers being pushed and threatened with a knife or a metal bar, and threats to be 'dropped' at sea.[135] Observers are also offered bribes to refrain from reporting infractions.[136]

The challenges faced by observers on board Ghana's industrial fleet came into sharp focus in recent years with the disappearance at sea of two observers, Emmanuel Essien and Samuel Abayateye, reported missing since July 2019 and October 2023, respectively.[137] According to their families, shortly before disappearing, both men had reported or been trying to report incidents they had witnessed on board vessels.[138] In Emmanuel Essien's case, the police investigation found "no sign of violence or anything incriminating"[139] and was inconclusive.[140] In December 2023, a decapitated and mutilated body found washed ashore was identified as Samuel Abayateye by his family,[141] but the authorities have yet to release the results of DNA testing.[142] Both cases remain unsolved. Meanwhile, persistent intimidation and threats are fueling a climate of fear among observers. One former observer who quit his job after hearing about Essien's disappearance told journalists he had to perform his duties covertly:

> ***"I have to hide when I am taking pictures, because if they see me, they might hit me".***[143]

In March 2023, the Ghanaian government committed to deploying a range of EM solutions on board industrial vessels, including CCTV, aiming to achieve full coverage of the trawl fleet by 2025,[144] with financial support from the United States Agency for International Development (USAID).[145] A first pilot project was implemented in April 2023, with cameras installed on three vessels.[146] The trial was reportedly deemed a success, collecting sufficient evidence to monitor compliance.[147] The recent withdrawal of USAID funding from Ghana's fisheries sector has, however, seen the project placed on hold, although the Fisheries Minister Emelia Arthur has expressed her support for the initiative pending additional funding becoming available.[148]

While the deployment of EM solutions aims primarily at combating illegal fishing and improving transparency, it would also provide much-needed safeguards for observers. Real-time recording and transmission of on-board activity would deter attempts to intimidate, threaten and bribe observers (which constitute offences under Ghanaian law[149]), while also providing corroborating evidence of infractions, usefully complementing observers' reports. One Ghanaian observer indicated that CCTV monitoring would minimise the need for observers to put themselves at risk to record video evidence with their smartphones.[150] Conversely, the presence of observers can limit the risk of undue interference with on-board video equipment.

Reasons abound for why installing CCTV across all vessels would support the work of onboard fisheries observers. While not a silver bullet for addressing threats to observers or ensuring the robustness of their work, CCTV, when part of a comprehensive, well-equipped package of MCS measures and embedded in a sufficiently strong legal framework and regulatory environment, can augment human observer capacity. Ghana has taken positive steps, backing the Global Charter for Fisheries Transparency,[151] and passing the new Fisheries and Aquaculture Act, 2025 (ACT 1146), despite lobbying from the industrial trawl sector.[152] The bill, among other positive measures, introduces tougher penalties for IUU fishing.[153] However, as evidenced by the withdrawal of USAID funding, funding must be sustainable and a reliance on external parties such as aid organisations, as opposed to raising funds through increased licence fees or making CCTV a mandatory stipulation for the granting of licences, can hinder progress towards its rollout.

CASE STUDY 5: China - CCTV, a double-edged sword in the fight against human rights abuses on board the Chinese distant-water fleet

In 2024, leading human rights NGOs, including Amnesty International and Human Rights Watch, said of the Chinese government that it "will not acknowledge abuses, will not undertake any effort to secure accountability, and will not be persuaded to undertake any policy or legislative action to comply with China's international human rights obligations".[154] This disregard for human rights also plagues its vast DWF industry, which government figures place at 2,551 vessels[155] - though this is likely an underestimate.[156]

The size of China's fleet, when considered alongside the pervasive nature of the abuses on board and the failure of the Chinese government to effectively acknowledge, identify and eliminate them, renders thousands of crew working on board vulnerable to being victims of forced labour. CCTV has the potential to be a powerful tool for collecting data on certain labour conditions, particularly on large fleets like China's, where human observer coverage is impractical due to the number of vessels to be monitored. However, this case study shows that in the wrong hands, CCTV can further repress vulnerable crew - subjecting them to surveillance and punishment for perceived infractions on board.

Many of the abuses that CCTV is well-equipped to identify, such as incidents of physical violence and long working hours, are widespread on China's fleet. In EJF's interview database, which spans nearly a decade from 2016, almost half (46%) of the migrant fishers who have worked on Chinese vessels experienced or witnessed physical violence on board, compared to 20% on Taiwanese vessels and 14% on South Korean vessels.[157] Furthermore, over two-thirds of the fishers who have worked on Chinese vessels were regularly subjected to excessive overtime at work.[158]

"The work didn't give us any break at all! During my time on board for 22 months, I could only have normal rest - without doing any work - twice [...] because the weather was stormy".

Indonesian worker on a Chinese tuna vessel operating in the Indian Ocean

"When we worked, the vice captain was physically abusive because we made a mistake, despite us being new to the vessel. The vice captain was (acting) inhumanely, he often physically abused us. The captain was the same - (he would physically abuse us) when we made a mistake. One time, when my fellow crewmate was hauling and the fishing line broke. (Upon seeing that) the captain immediately went downstairs and beat my friend".

Indonesian worker on a Chinese tuna vessel operating in the Pacific Ocean

China's government has repeatedly outlined its ambitions for adopting CCTV technology on board DWF vessels, as outlined in its 13th and 14th Five-Year Plans and the White Paper on DWF, published in 2017, 2022 and 2023, respectively. Currently, only the regulation governing high seas trans-shipments specifies when EM may be used, permitting carriers to use EM as an alternative to human observers when they are unable to accommodate one.[159] However, the ultimate stated goal is to incorporate EM into a holistic and digitised regulatory system involving data on vessel position, electronic logbooks, trans-shipment information and product traceability.[160] According to the Chinese government, around 100 Chinese tuna vessels are equipped with EM, equivalent to 20% of tuna vessels flagged to China.[161]

CCTV has significant potential to address human rights abuses, as well as many other compliance issues that are commonplace on China's fleet. However, there is often a climate of distrust of migrant workers, as well as instances of senior Chinese crew often resorting to punitive and violent enforcement of on-board rules. This means that CCTV on Chinese vessels may, paradoxically, pose risks to those working on board. For instance, on a Chinese squid vessel operating in the Southwest Atlantic Ocean, an Indonesian crew member told EJF investigators how he was physically assaulted by numerous Chinese crew after having been seen on CCTV taking potatoes from the freezer, which he claims was on account of the insufficient food he was provided:

"I was hungry. I pity to see my colleagues. I felt they were my relatives; we worked and struggled together for 20 months. We faced a situation where we had no food at all. We found fish but no oil. We found potatoes that could be boiled for backup".

"Three of them [Chinese crew] hit me simultaneously [...] I went upstairs and was directly faced with the CCTV [...] I thought this might be about the potatoes. But I wonder why a small thing like this became a problem because there were still five packages [of potatoes]".

The efficacy of CCTV in reducing the prevalence of human rights abuses in China's DWF fleet, particularly in light of a government that refuses to acknowledge them, is, thus, contingent on the extent to which it is made available to external partners and experts - including those from coastal states where the vessels operate and RFMOs. This would enable broader objective monitoring of labour conditions, as well as the ability to review incidents of alleged physical violence when alerted to them by the crew, NGOs, or other concerned parties. It should be noted that China holds significant political and economic power and influence in many coastal states - where Chinese access to fisheries often goes hand-in-hand with huge investment in infrastructure - potentially creating unfavourable conditions for sustainable, legal and ethical fisheries.[162] This, alongside a lack of capacity to thoroughly investigate abuses associated with China's fleet from some coastal states, means that external support and scrutiny would be required from a broader set of stakeholders, such as industry and market states.

Furthermore, as detailed in this case study, CCTV may in fact lead to unwanted surveillance of vulnerable individuals by senior crew, which could ultimately lead to further human rights abuses such as physical or verbal abuse. As such, CCTV should be rolled out alongside readily accessible Wi-Fi for crew,[163] to allow for the real-time reporting of abuses to competent authorities, as well as the bolstering of capacity amongst port states to better equip them to detect, report and ultimately prosecute the perpetrators of human rights abuses on board fishing vessels.

Fisher reports experiences to EJF.

4. Recommendations

CCTV is not a panacea to end illegality and abuse in the fishing industry. However, when deployed widely as part of a broader EM system, subjected to close scrutiny and external verification, and used alongside additional safeguards such as human observers and accessible onboard Wi-Fi, it can be a major step towards more legal, ethical and sustainable fisheries. Recognising this, we call on policymakers in major fishing flag states to do the following:

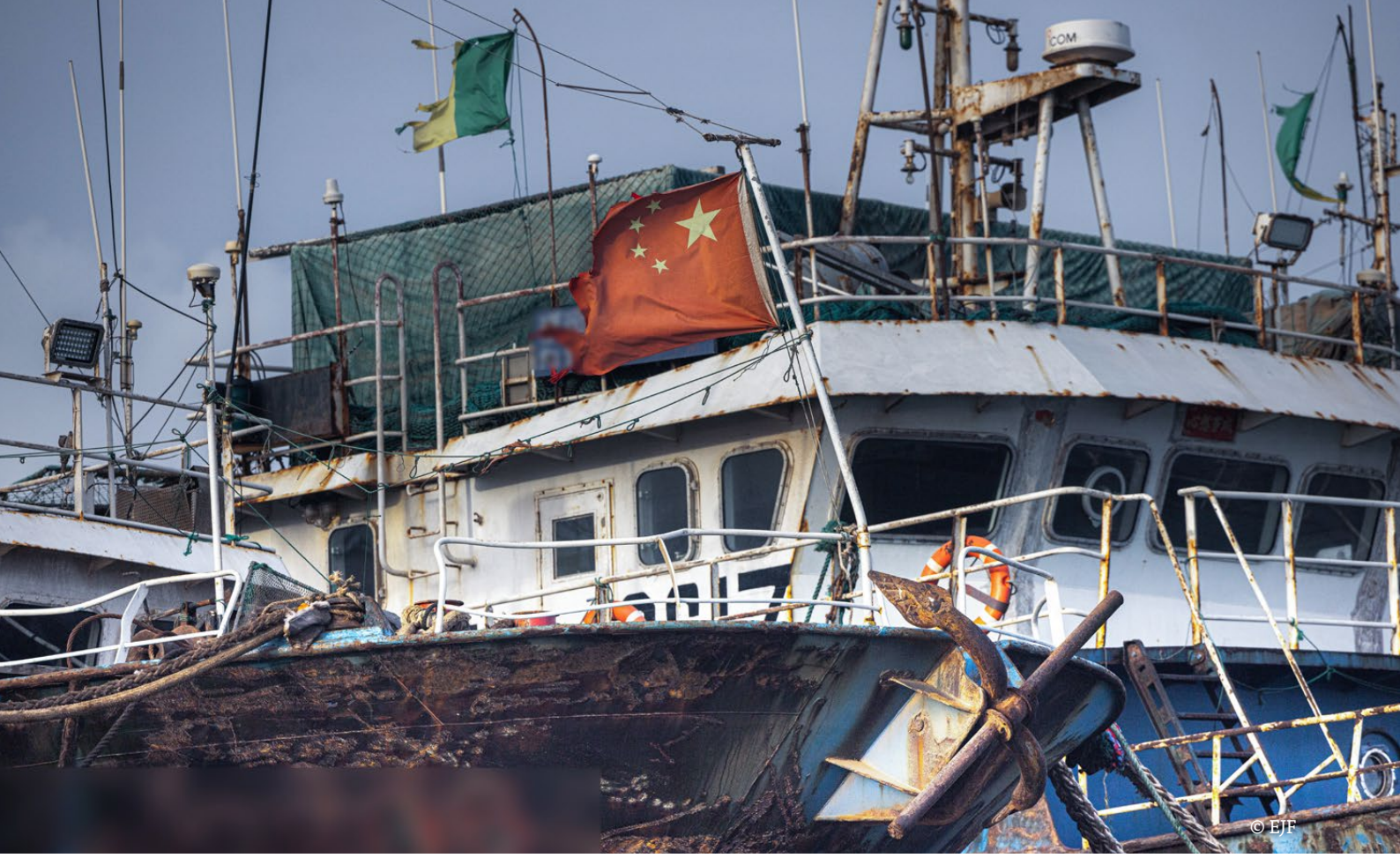
1. Endorse and implement CCTV as a tool for fisheries transparency:

- Lead on fisheries transparency by implementing CCTV systems that enable timely, credible and verifiable at-sea monitoring of vessel compliance with all applicable fisheries laws and regulations.
- Set time-bound targets to achieve 100% observer coverage - via EM and/or human observers - for industrial fishing fleets, with clear interim milestones to track progress towards full implementation. Given the often complex regulatory environments they exist in, distant-water vessels operating in high-risk fisheries should be seen as a priority.

2. Expand the use of CCTV to monitor human and labour rights standards onboard vessels:

- Consider CCTV as a key tool to meet the objectives of international human and labour rights standards, including the ILO Fundamental Principles and Rights at Work, ILO Work in Fishing Convention, 2007 (C188) and the 2012 Cape Town Agreement.
- Close the gap on labour rights monitoring by supporting or conducting trials of CCTV on board vessels.
- Prioritise privacy by advancing standards that ensure the ethical collection, use and management of personally identifiable information.
- Ensure CCTV is advanced in tandem with robust mechanisms for workers and observers to report abuse and submit grievances, with accessible Wi-Fi on board fishing vessels as an essential component, so that CCTV complements direct engagement.

Aerial view of trawler fishing in the Mediterranean.



Vessels docked in port.

3. Improve cross-border collaboration to strengthen compliance, oversight, and enforcement:

- Engage governments, market actors, civil society and fisheries workers - including observers - in consultations to ensure buy-in, harmonise standards and facilitate interoperability across systems.
- Adopt data protection and sharing protocols that specify who can access CCTV data, set clear conditions for its use, and ensure the data is securely stored and encrypted to prevent misuse.
- Invest in capacity building to ensure that CCTV data can be effectively analysed and used. This should include training experts to review footage and advancing AI tools to optimise analysis.
- Join multi-stakeholder initiatives to facilitate the exchange of intelligence and information that enables effective enforcement.
- Implement robust and dissuasive penalties and sanctions across jurisdictions to prevent individuals and companies from profiting from IUU fishing, and associated human rights and labour abuses.

4. Endorse and implement the Global Charter for Fisheries Transparency:

All states, industry actors and stakeholders should demonstrate a broader commitment to sustainable fishing by endorsing the **Global Charter for Fisheries Transparency**[164] and promoting CCTV as a key tool for the global implementation of Principles 6 (ensuring trans-shipments are fully monitored) and 7 (enabling traceability from boat to plate).

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