RESEARCH PAPER

EU FISHERIES CONTROL COALITION

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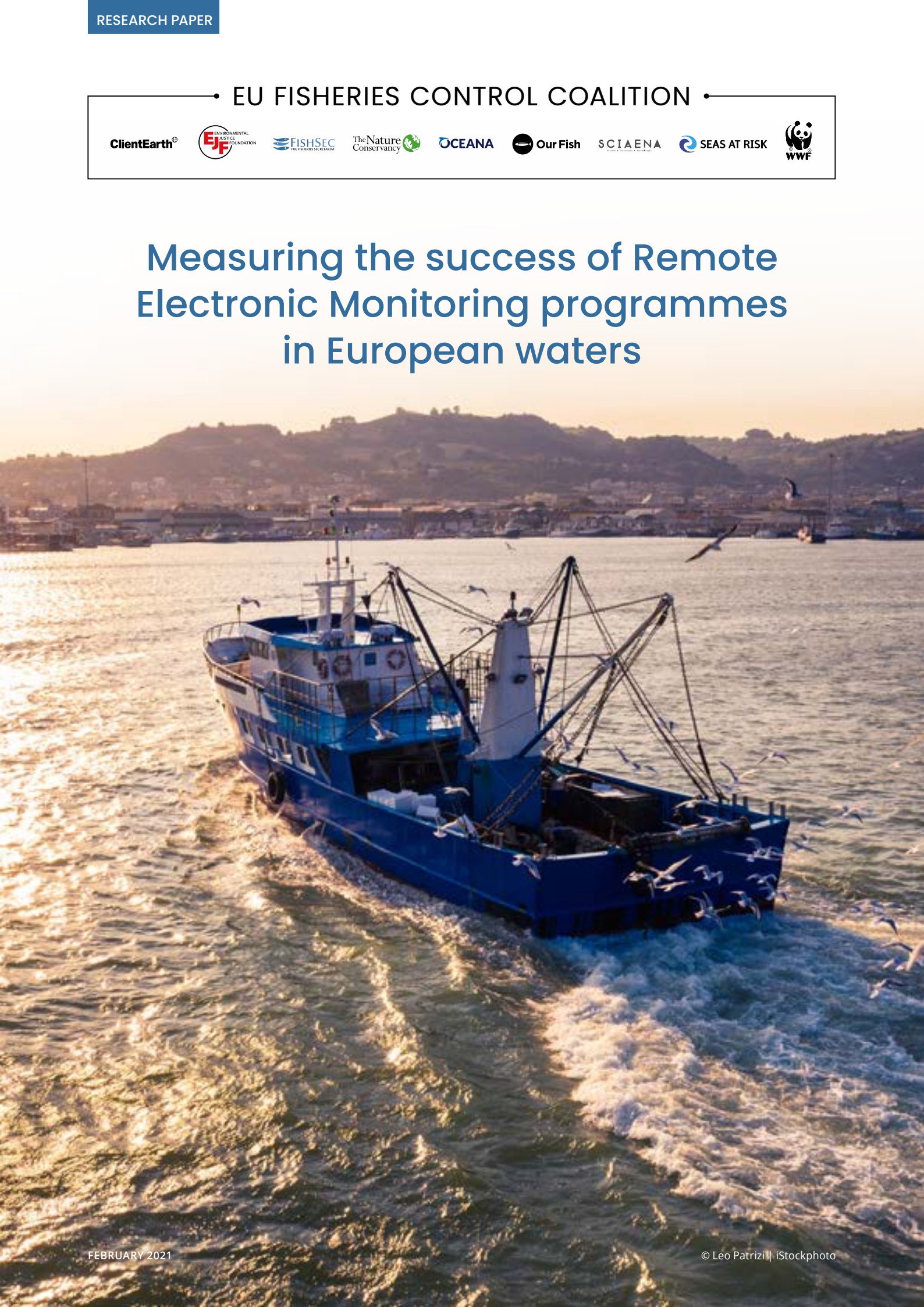
Measuring the success of Remote Electronic Monitoring programmes in European waters



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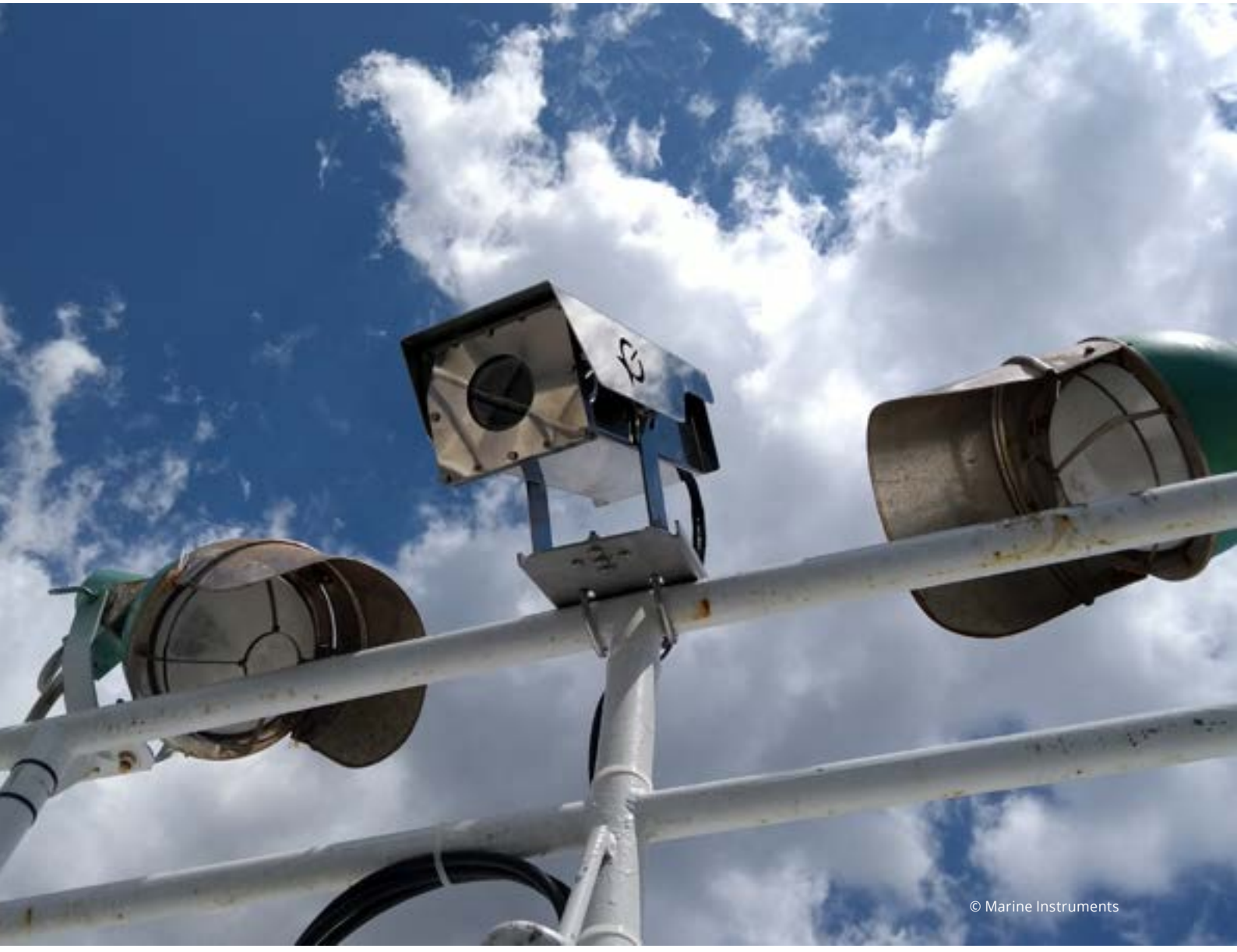

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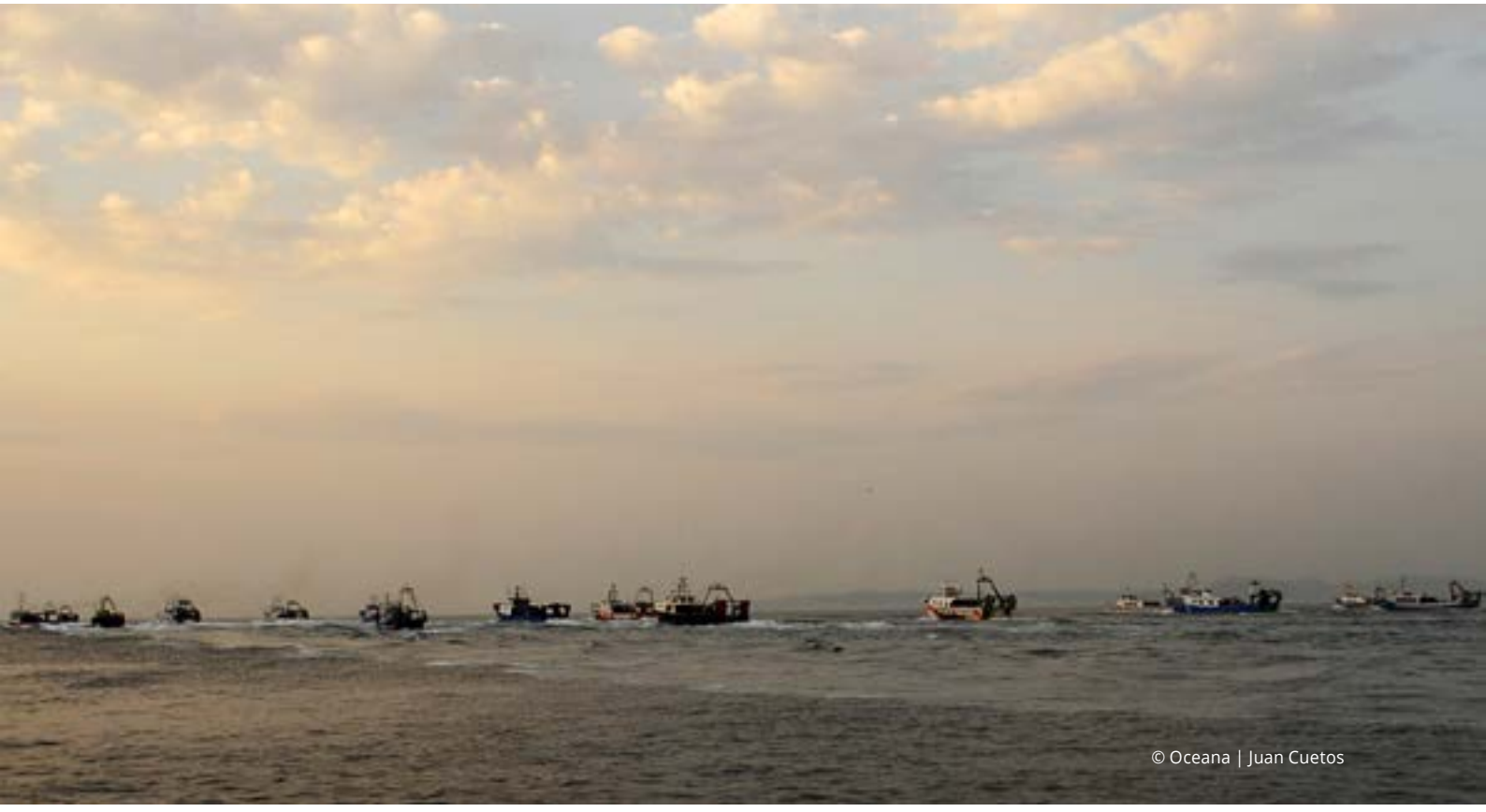
Executive Summary

Remote Electronic Monitoring (REM) programmes (including CCTV) have now been implemented in the European Union (EU) for about a decade. This paper shows that REM systems have been successfully used in various types of fisheries and vessels, as well as for diverse purposes. For instance, REM not only supports the implementation of the Landing Obligation, which requires the landing of all regulated commercial species that are caught so they may be counted against designated catch quotas[1], but also the effective monitoring of bycatch which supports better scientific assessments and management of fish stocks.

As REM technologies have continued to advance and mature, European REM programmes have offered numerous solutions and best practices to the technical and political challenges faced by EU fisheries as they strive to meet sustainability objectives. These challenges include widespread inaccurate reporting of fisheries data, failure to comply with the Landing Obligation as a result of a weak enforcement system, and shortcomings in traditional monitoring methods such as on-board observers.[2] **The tried and tested solutions offered by REM demonstrate the added value of this technology to support a fisheries management system that successfully promotes environmental sustainability, whilst furthering the economic viability of the fishing industry.**

REM (including CCTV) should now be introduced as a mandatory measure. In addition to enforcing the Landing Obligation, REM should be used to support fisheries management at large, as it would bring significant added value to the verification of catch data and the collection of accurate information on the bycatch of sensitive species. This would further improve compliance with the Landing Obligation and provide better data collection to support robust stock assessment, securing both the environmental sustainability and economic viability of EU fisheries.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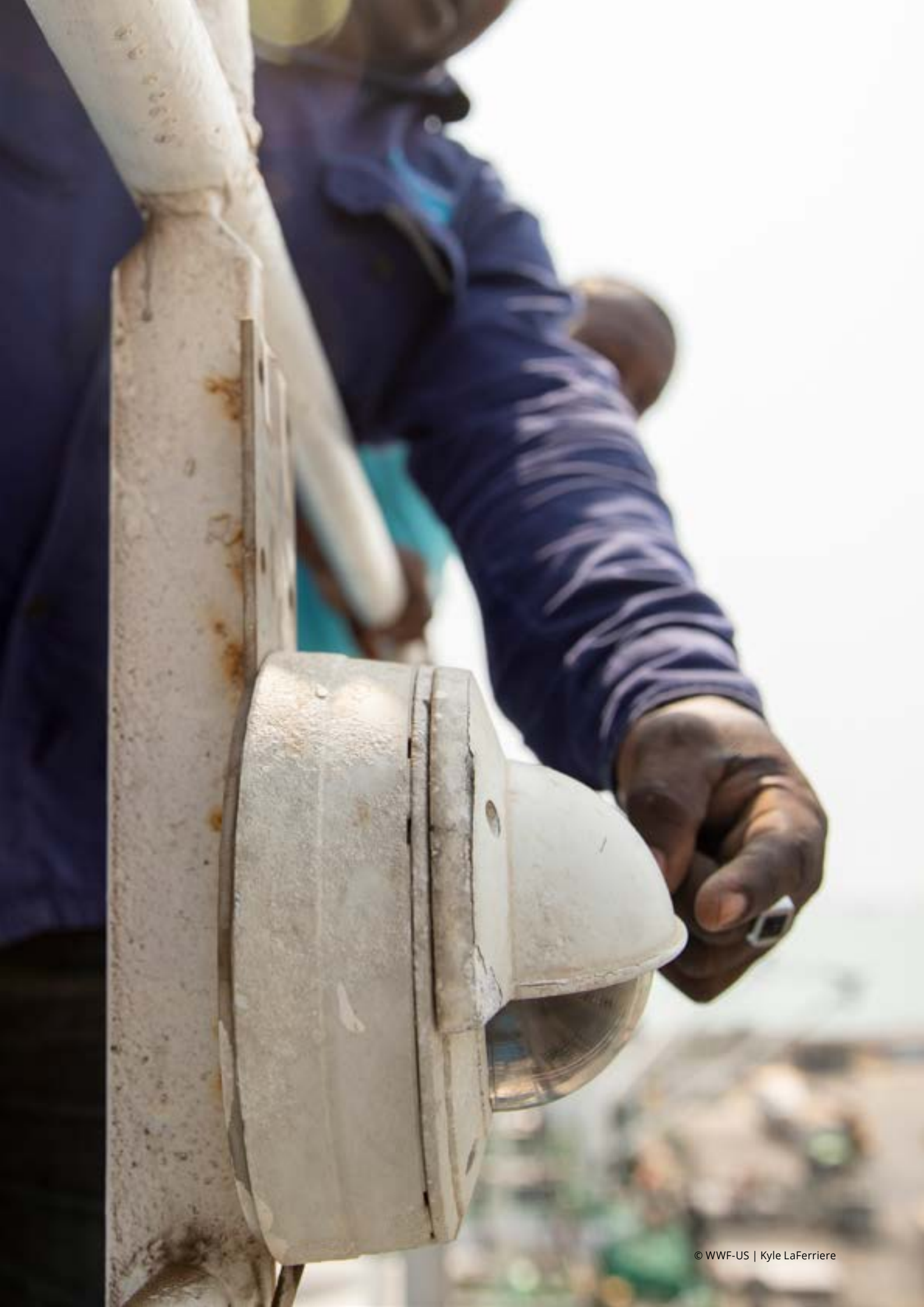


Background

Remote Electronic Monitoring (REM) technology consists of an integrated array of equipment that monitors fishing activities on vessels at sea, such as sensors (e.g. on nets or other gear) and Closed-Circuit Television (CCTV) cameras.[3] REM indicates the intensity of a vessel's activities, provides temporal and spatial data, as well as imagery of on-board fisheries work for direct review by observers on land.[4] The resulting information simultaneously supports cross-checking of fishing activity logbook data and confirms vessel compliance with regulations. This monitoring of fisheries activities not only discourages violations, but it gives legitimacy to self-reported data.[5]

For over 20 years, REM has been trialled across the globe as an efficient and cost-effective addition to traditional fisheries monitoring and control,[6] as it has the potential to support objectives for fully documented fisheries. In particular, REM systems have been implemented to address gaps in fisheries monitoring and compliance, as well as to increase seafood traceability along the supply chain. REM also supports better data collection for scientific purposes, such as for stock assessments.

Legal framework for REM in the EU

In 2009, Article 13 of the Control Regulation introduced REM, providing Member States with the opportunity to carry out pilot projects on traceability using new tools and technologies, including electronic monitoring devices.[7]

In 2013, Article 15.13 of the Common Fisheries Policy (CFP) mentioned that "for the purpose of monitoring compliance with the Landing Obligation, Member States shall ensure detailed and accurate documentation of all fishing trips and adequate capacity and means, such as [...] closed-circuit television (CCTV)".[8] Furthermore, Article 38 on control and enforcement invited the Commission and Member States to carry out pilot projects on new control technologies and systems for data management.[9]

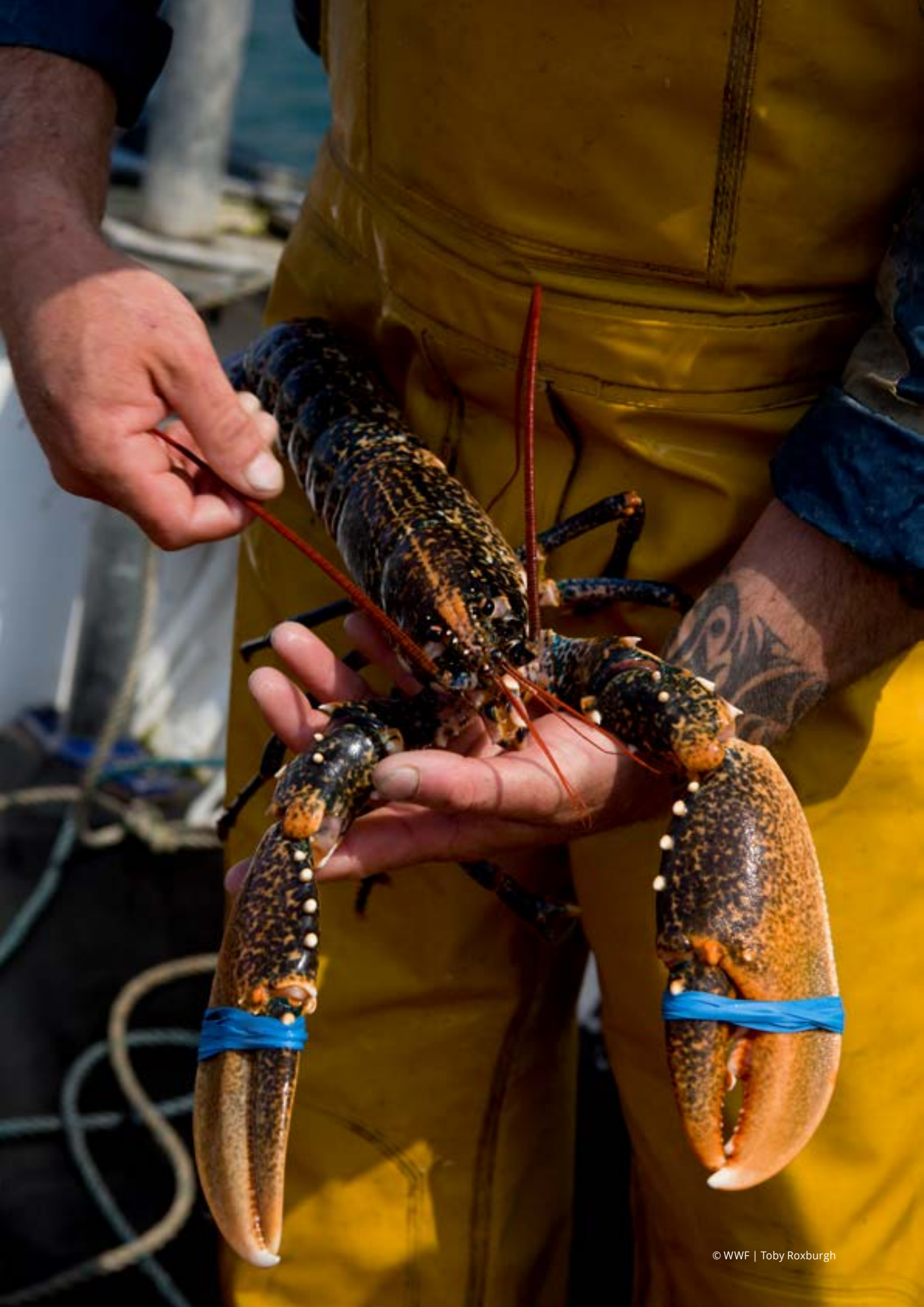
To date, REM remains a voluntary compliance tool. This contrasts with other technology-based monitoring tools such as Vessel Monitoring Systems (VMS), which are already compulsory for vessels over 12 meters in length under the Control Regulation.[10]

State of play in EU fisheries

The EU fisheries control system is not currently fulfilling the objectives of the CFP. Firstly, the European Fisheries Control Agency (EFCA) finds that a significant proportion of fisheries-dependent data is sub-optimal and vulnerable to widespread misreporting.[11] The current control system, lacking an effective method of logbook verification, is failing to obtain all the data sources needed to guarantee effective and sustainable management of fisheries activities.[12] The enforcement of the Landing Obligation, a measure designed to ensure that operators avoid unwanted or undersized catches, has also proven challenging, with widespread non-compliance by EU Member States.[13] In the same vein, Member States have failed to implement adequate conservation measures as laid down by Articles 6 and 7 of the CFP. Member States have also been unable to establish and enforce monitoring systems that triangulate the exact cause(s) of bycatch of legally protected or sensitive species, thereby violating the Technical Measures Regulation[14] as well as the Habitats Directive.[15, 16] Finally, traditional monitoring methods, especially of on-board fisheries observers, cannot provide 100% coverage of fisheries activities as observer programmes lack the scalability needed to ensure that fishers' behaviour delivers on the EU's overarching sustainability objectives.

In 2017, the European Commission formally conducted an evaluation of the Control Regulation and subsequently adopted a proposal to revise the Control Regulation in May 2018.[17] To better implement the CFP, the revision calls for the introduction of a new Article that will mandate a risk-based use of REM tools for effective control of the Landing Obligation in the form of continuously-recording CCTV systems that incorporate data storage.[18] In addition, Member States may require their fleets to use other Electronic Monitoring (EM) systems for the purpose of enforcing the Landing Obligation.

This paper serves as an overview of the various REM programmes implemented in EU waters (including the United Kingdom) to date. They demonstrate the added value and suitability of REM to fully deliver on the rules and objectives of the CFP. While these successes relate specifically to the Landing Obligation, trials and fully implemented programmes overseas have proven REM to be effective for supporting better data collection, thereby improving stock assessment and fisheries management at large, as well as addressing the bycatch of sensitive species.



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REM Programmes in Europe

The following table provides an overview of the various REM programmes implemented in EU fisheries (including the United Kingdom) so far. Programmes included in the table range from pilot trials to fully fledged, legally mandated schemes at national level as well as private, self-assigned REM requirements.

The table shows that many programmes have already been implemented in Europe covering various types of fisheries and vessel sizes, as well as diverse objectives such as supporting the Landing Obligation and monitoring of bycatch. Sufficient knowledge has been gathered at national and private levels to render the technology mature for a Europe-wide roll out.

At present, some European fleets are making REM an operating requirement, whilst some Member States are constructing regulated schemes which mandate REM in certain fisheries. This is creating increased disparity between EU fleets and fishers, which is detrimental to a level playing field in European fisheries. REM (including CCTV) should, therefore, be introduced as a mandatory measure. Establishing equal conditions for all European fisheries will protect shared resources and ensure a level playing field.

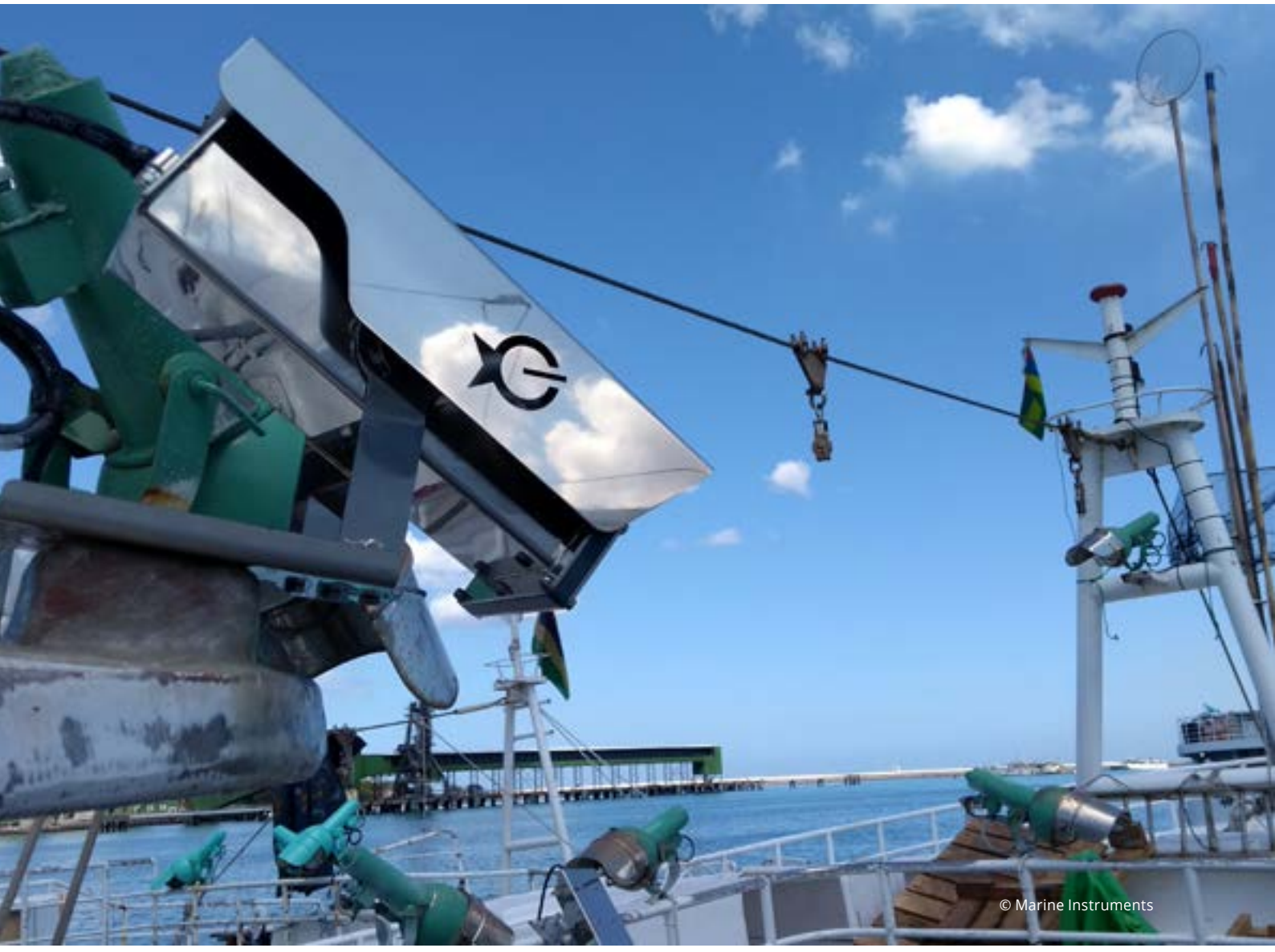


Table 1: Overview of European REM programmes

Country	Supervising body	Years of REM activity	Fishery type	Number of vessels involved	Size of vessels involved (metres)	Nature of REM programme	Objectives and targets
Denmark	Public (Danish Technical University – DTU –, Danish AgriFish Agency)	2008 – 2016	Trawl Seine Gill nets	6-27	11 – 39.95	Pilot trial	Test and develop REM as a documentation measure for the Landing Obligation Discuss the Landing Obligation in the face of new technologies Estimate discard rates Assess REM data transmission options Investigate the perception of REM by stakeholders
		2014 – 2015	Trawl Seine	14	12 – 31	Pilot trial	Compare the discard estimates of REM, fishers and on-board observers to evaluate the precision of REM Analyse the effect of free gear selection using REM as a documentation tool
		2010 – 2011	Gill nets	6	10 – 15	Pilot trial	Assess bycatch levels of harbour porpoise in gill nets using REM
		2010 – 2018	Gill nets	3	9.63-11.05	Pilot trial	Assess the ability of CCTV-supported REM technologies to provide precise information on incidental catches of seabirds in small-scale gillnet fisheries
		2020	Bottom-trawlers in Kattegat	In total, up to 100 vessels in Kattegat are expected to be involved: 15 vessels in 2020, 85 other vessels in 2021-2022		Fully fledged scheme	Document lobster fishing in the Kattegat, in particular the bycatch of cod and compliance with the Landing Obligation NB: The programme is the first in Europe to be legally mandated by a Member State
UK (Scotland)	Public (Defra, Marine Scotland)	2008 – present	Demersal trawl	6-27	–	Pilot trial	Test REM capabilities for scientific data collection Compare REM with other monitoring schemes such as on-board observers for Landing Obligation Experiment with REM automated video review technology development

Country	Supervising body	Years of REM activity	Fishery type	Number of vessels involved	Size of vessels involved (metres)	Nature of REM programme	Objectives and targets
UK (England)	Public (Defra, Cefras, Marine Management Organisation, Bangor University)	2010 – 2015	Longline Otter trawl Gill net	6-16	9.8 – 40	Pilot trial	Test the impact of the discard ban in mixed fisheries Develop REM as a verification method for discards Investigate the potential of using market-grading data for reference fleet monitoring
		2011 – 2015	Beam trawl	7-9	–	Pilot trials	Explore the effect of the Landing Obligation in mixed demersal beam trawl fisheries Investigate discard levels using self-reporting REM Develop trials of fully documented fisheries for demersal species
		2012	Demersal trawl	2	< 10	Pilot trial	Test the reliability of REM equipment and their adequacy to monitor and quantify catches
		2013 – 2014	Twin-rig otter trawl	1	20	Pilot trial	Test REM as a tool to fully documented fisheries and to verify skippers' records Test impacts of the discard ban in mixed demersal fisheries Explore options to secure the implementation of the Landing Obligation while maintaining profitable landings
		2014	Crustacean fisheries	4	–	Pilot trial	Evaluate the use of on-board camera systems to collect data
The Netherlands	Public (Dutch Ministry of Economic Affairs, Dutch National Federation of Fishermen's Organisations, Wageningen Marine Research) Private (The Redersvereniging voor de Zeevisserij and Archipelago Marine Research)	2011 – 2015	Demersal trawl and seine	12	20 – 42	Pilot trial	Evaluate the efficacy of REM as a control tool for mixed bottom trawl fisheries Explore the effects of the Landing Obligation
		2013 – 2017	Gill nets	12	5.46 – 14.54	Pilot trial	Assess rates of bycatch
		2014	Midwater trawl	1	125.53	Pilot trial	Develop REM as a tool to control compliance with the Landing Obligation compliance by freezer trawl vessels
		2015	Beam trawl	2	–	Pilot trial	Evaluate the efficacy of REM as control tool for the discard ban in sole fisheries
Germany	Public (German Federal Thünen Institute of Baltic Sea Fisheries)	2011 – 2016	Demersal trawl	2	30.28 – 37.05	Pilot trial	Evaluate and develop the reliability of information on discards by REM
		2011 – 2013	Gill nets	3	12 – 15	Pilot trial	Use REM to assess rates of bycatch of harbour porpoise and seabirds in gill nets fisheries

Country	Supervising body	Years of REM activity	Fishery type	Number of vessels involved	Size of vessels involved (metres)	Nature of REM programme	Objectives and targets
France	Mixed (Orthongel, IRD, OD, CTO, SFA)	2012	Purse Seine	1	81.85	Pilot trial	Evaluate REM as a support or alternative to on-board observer schemes in tropical tuna purse seine fisheries (Indian Ocean)
		2015 – 2016	Purse Seine	2	77 – 81.85	Pilot trial	Evaluate REM as a support or alternative to on-board observer schemes in tropical tuna purse seine fisheries (Atlantic and Indian Oceans)
		Scheduled for 2020				Pilot trial	An administration-led REM pilot project was due to start in the first semester of 2020, exploring the possibility of trialling camera and sensor installation on nets on four vessels
Spain	Mixed (ICCAT, PEVASA)	2012 – 2016	Purse Seine	5	75.6 – 76.75	Pilot trial	RE in tuna fisheries (Atlantic Ocean)
	Private (International Seafood Sustainability Foundation, Digital Observer Service, Satlink)	2015	Supply vessel	5	-	Pilot trial	REM in tuna fisheries (Indian Ocean)
	Private (ANABAC-OPAGAC)	2018	Purse Seine	27	-	Fully implemented Programme	Evaluate REM as a support or alternative to on-board observer schemes in tropical tuna purse seine fisheries (Indian Ocean)
	Private (ANABAC-OPAGAC)	2018	Purse Seine	22	-	Fully implemented Programme	Evaluate REM as a support or alternative to on-board observer schemes in tropical tuna purse seine fisheries (Atlantic Ocean)
Sweden	Public (Swedish Board of Fisheries, Swedish Agency for Marine and Water Management)	2008	Gill net	2	10.6 – 11.6	Pilot trial	Compare the efficacy of REM systems with on-board observer schemes regarding cetacean bycatch
		2020 (duration would be 1-3 years)				Pilot trial	Proposals from The Swedish Agency for Marine and Water Management for voluntary REM experiments focusing on the use of CCTV to guarantee compliance with the Landing Obligation. Proposals sent to the Ministry for consideration in January 2020, decision still pending
Regional: North Sea	Public (EFCA)	TBD	TBD	TBD	TBD		Operational plans expected in late 2020 will focus on non-compliance with the Landing Obligation

Main source: Van Helmond, et a (2020). *Electronic monitoring in fisheries: Lessons from global experiences and future opportunities.* Fish and Fisheries, 21(1), 162-189. https://doi.org/10.1111/faf.12425

Complementary sources: Plet-Hansen, PhD Thesis, *Fisheries data from electronic monitoring and traceability systems in the context of the EU landing obligation,* 2020; Ulrich *et al.*, *Discarding of cod in the Danish Fully Documented Fisheries trials, Journal of Marine Science,* 2015 ; WWF, *Remote Electronic Monitoring in the UK Fisheries Management,* 2017; WWF, *Electronic Monitoring in Fisheries Management,* 2015; Needle *et al.*, *Scottish science applications of Remote Electronic Monitoring,* Journal of Marine Science; Van Helmond, Chen, Poos, *How effective is electronic monitoring in mixed bottom-trawl fisheries?,* Journal of Marine Science, 2014; Glemarec, G., Kindt-Larsen, L., Scherffenberg Lundgaard, L., Larsen, F., *Assessing seabird bycatch in gillnet fisheries using electronic monitoring,* 2020, Biological Conservation; EU Fisheries Control Coalition intelligence

Taking stock: Proven benefits of REM to public and private fisheries stakeholders

Benefits for public authorities

The full implementation of the CFP's objectives, especially of the Landing Obligation, has proven challenging for EU fisheries monitoring and control authorities. These challenges include ensuring that catch data is reliable and sufficient, successfully meeting the costs associated with effective monitoring, control and surveillance, and guaranteeing a level playing field between diverse fisheries. The table below draws on several studies to present the outcomes and lessons learned from past and ongoing REM programmes in Europe to demonstrate the benefits of REM technologies in addressing these policy needs and, ultimately, shows how the EU can successfully contribute to the achievement of the objectives of the CFP.

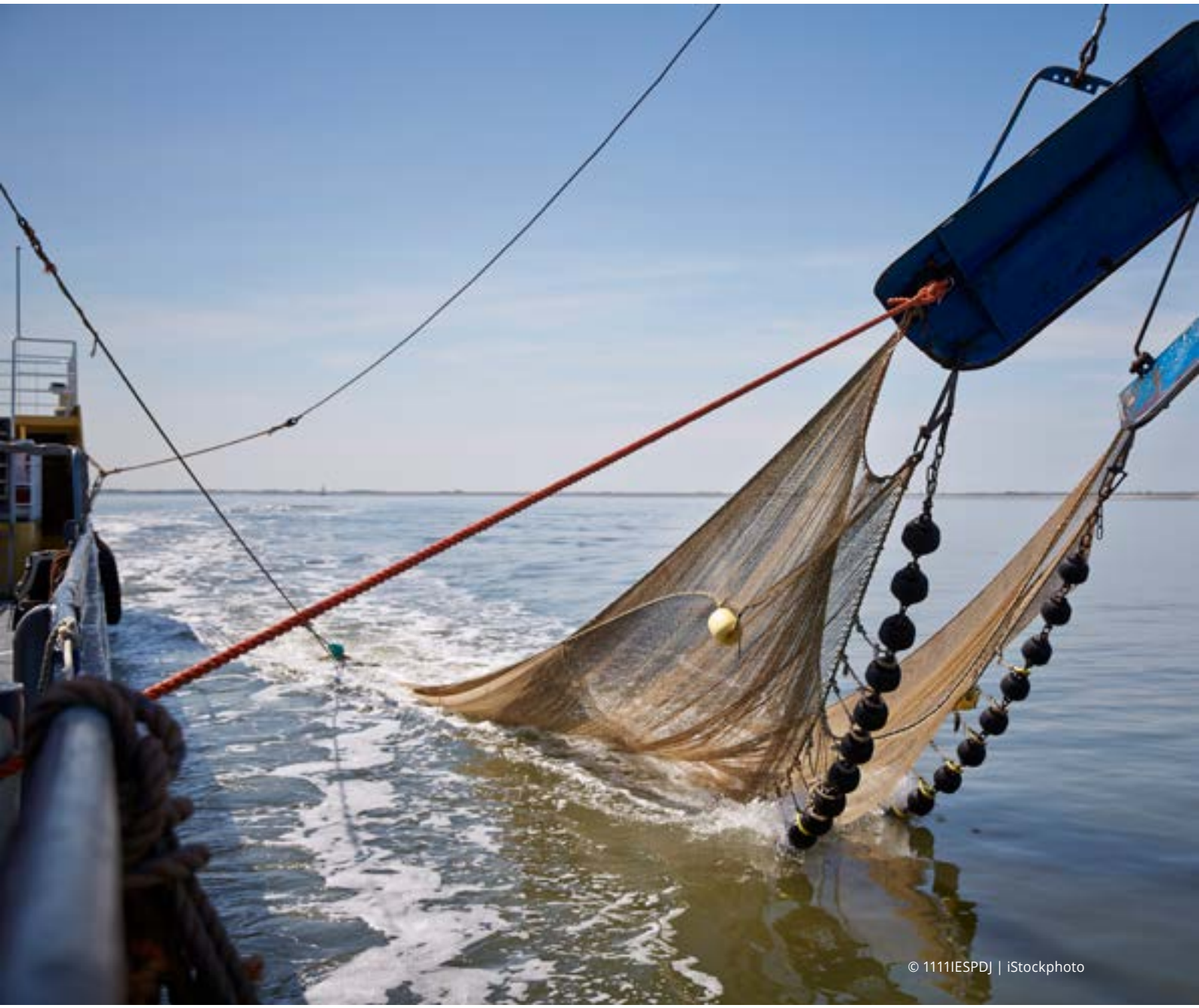


Table 2: Assessment of REM programmes in European fisheries

Objectives of the public fisheries authorities	Practical issues faced	Identified needs for success	Benefits of REM systems
Reinforce control and monitoring capabilities with a view to secure compliance with the Landing Obligation	A significant proportion of fisheries-dependent data is sub-optimal and vulnerable to widespread misreporting Full observation coverage by humans via means of aircraft, at-sea vessel patrols or on-board human observers is virtually impossible On-board human observers can be subjected to bribery or intimidation	Improve the reliability, comprehensiveness and quantity of the catch data collection	Truly random video auditing creates an incentive for fishers to report all catches accurately, supporting better compliance with the Landing Obligation. For instance, a 2017 study conducted in Denmark by DTU Aqua found that 63% of fisheries inspectors interviewed acknowledged a positive outcome in terms of full documentation and compliance with discard regulations REM systems offer the possibility to integrate visual (CCTV) data with positioning and effort data, thereby providing more comprehensive and accurate analyses REM systems are able to function 24/7, regardless of the conditions at sea REM systems can be installed on any type of vessel and do not rely on the vessel's capacity to host an on-board observer REM data can be independently audited REM systems cannot be subject to bribery or intimidation Reduced costs of REM compared with on-board observers increase vessel coverage for the same budget, delivering wider and truly random coverage
Ensure cost-effective monitoring efforts, including effective implementation of the Landing Obligation	Aircraft, vessel patrol and on-board observers are costly systems of fisheries observation	Improve the cost effectiveness of fisheries data collection and treatment	Cost-efficiency: despite higher initial set-up costs related to systems purchase and installation, REM is a significantly more cost-effective monitoring method in the long run when compared with on-board observers. For equivalent data coverage, a 2011 study led by L. Kindt-Larsen showed that REM systems could operate at up to a tenth of the cost of schemes for observers at sea Member States can use funds from the European Maritime and Fisheries Fund (EMFF) for REM deployment With technological progress and expansion of the REM market, REM system set up and operation costs are likely to continue decreasing. WWF found that the annual cost of REM systems – between 2015 and 2017 – dropped by 22% due to advancements in technology and greater efficiencies of analyst staff time. This is a pattern that is likely to continue as the REM market expands and more investment is placed into research & development

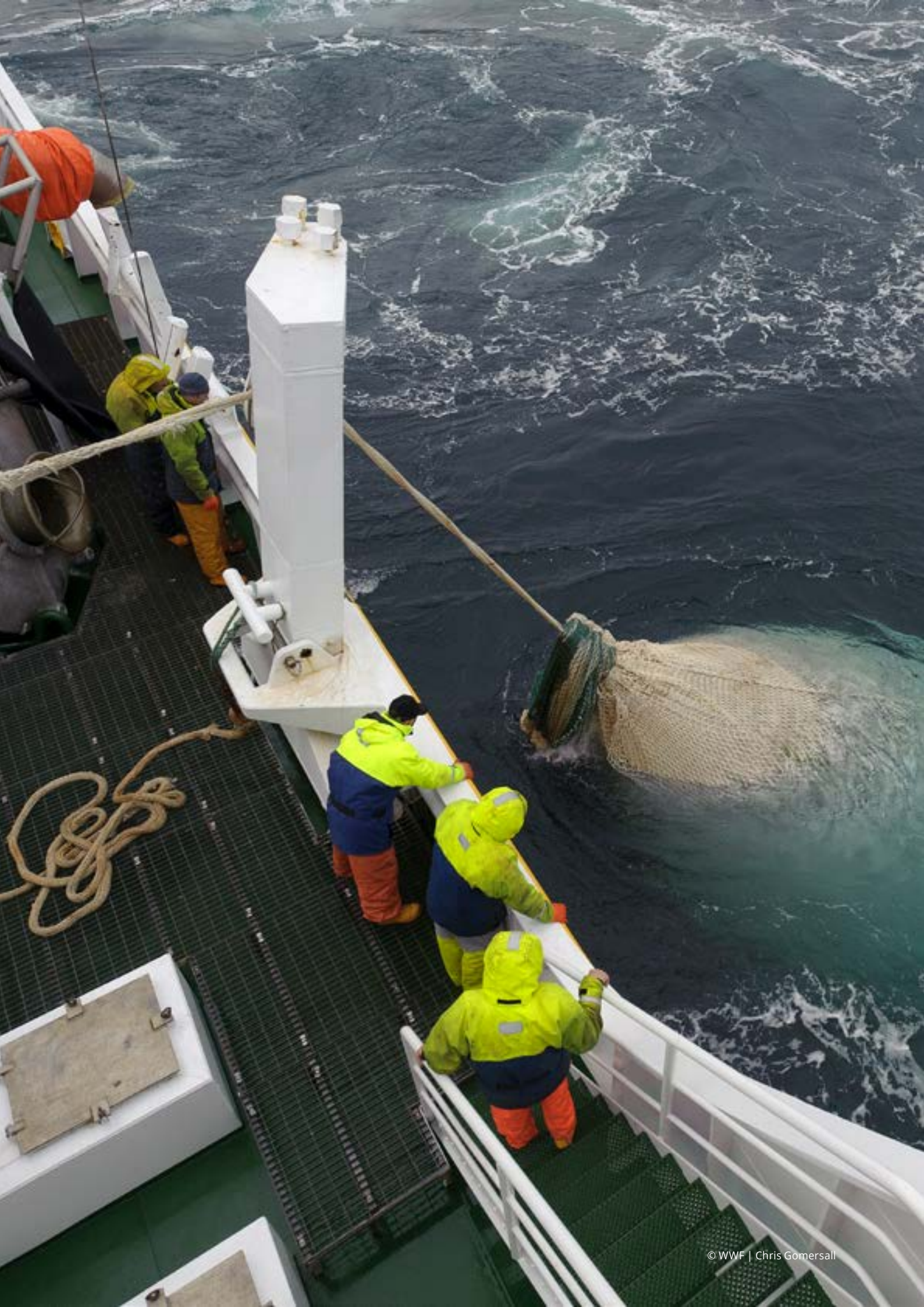
Objectives of the public fisheries authorities	Practical issues faced	Identified needs for success	Benefits of REM systems
Secure the equitable treatment of all European fisheries operators with regards to the Landing Obligation	As not all EU Member States have the same control and monitoring capabilities, some fishers may be less controlled and monitored in some countries; this leads to decreased costs or increased revenues for unmonitored non law abiding fishers when compared to their counterparts in other regions of Europe Some segments of fishing fleets can be more easily controlled and monitored than others. For instance, small fishing boats do not have the physical capacity to host on-board observers	Ensure a control and monitoring baseline for all European fishing vessels, no matter the size, type of fishery or operating location, with a view to guarantee a level playing field in the common European fisheries market	REM can be deployed in all segments of the European fishing fleet, delivering full observational coverage of fishing vessels and their activities across Europe. REM systems were successfully installed in vessels ranging from 5.5 to 125.5 meters length The continuous decrease of costs of REM technologies encourages their implementation by all EU Member States, regardless of financial capabilities

Sources: Needle *et al.*, *Scottish science applications of Remote Electronic Monitoring, Journal of Marine Science,* 2014; Van Helmond *et al.*, *Electronic monitoring in fisheries: Lessons from global experiences and future opportunities,* 2019; Plet-Hansen *et al.*, *Remote electronic monitoring and the Landing Obligation – some insights into fishers' and fishery inspectors' opinions,* 2017; European Fisheries Control Agency, *Annual Report for the Year 2018,* 2019, Marine Policy; The Guardian, *Fishing observers 'intimidated and bribed by EU crews',* 2012, https://www.theguardian.com/environment/2012/may/18/fishing-inspectors-intimidated-bribed-crews; United Kingdom House of Lords, *Fisheries: implementation and enforcement of the EU landing obligation,* 2019; (https://www.parliament.uk/documents/lords-committees/eu-energy-environment-subcommittee/Implementation-and-enforcement-of-the-eu-landing-obligation/Landingobligation.pdf); WWF, Remote Electronic Monitoring in UK Fisheries Management, 2017, https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf ; L.Kindt-Larsen, E. Kirkegaard, J. Dalskov, *Fully documented fishery: a tool to support a catch quota management system,* ICES Journal of Marine Science, 2011, https://academic.oup.com/icesjms/article/68/8/1606/749597

Benefits for industry

REM programmes in Europe have concretely demonstrated their added value for the fisheries industry. Further, first-hand feedback from fishers and researcher analyses of the results of REM trials have identified new prospective advantages of the technology. Some of these benefits are summarised below.

- REM could prove **financially profitable for fishers**, as more efficient fisheries management measures fostered by REM have ultimately led to **better financial performance** by the industry.[19] **Business analytics** can also use REM data to identify and avoid bycatch hotspots at sea, as well as to support profitable **certification schemes** and marketing strategies by improving traceability along the supply chain.[20]
- REM-experienced fishers have welcomed positive results in terms of **public goodwill**.[21] They acknowledge that using REM allows them to take advantage of their compliance with fisheries rules and legislation to market their sustainable best practices.[22]
- Fishers have reported that REM systems support **better stock assessments** and thus more sustainable fisheries management.[23]
- In remote fishing areas, REM systems **reduce the high costs and logistical constraints** of vessels to have on-board observers.[24]
- REM is an unparalleled tool for demonstrating compliance with fisheries rules when responding to inquiries from public authorities. The REM data is unbiased and can be independently verified.
- REM can support better labour and safety conditions onboard; for example, as a way to monitor extra working hours.
- The use of REM can **increase flexibility** in fisheries regulations thanks to improved accountability of fishery activities.[25]
- Deploying REM at a European scale would be an effective way to address national monitoring discrepancies as it would establish a control and monitoring baseline for all European fishing vessels regardless of size, type of fishery or operating location. This would **reinforce a level playing field** between all European fishers.
- In the face of an ongoing global health crisis, REM would reduce the need for on-board observers at sea and portside inspections, helping to protect crews, observers and inspectors, whilst ensuring the continuity of fisheries monitoring.



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Saving stocks: from REM technical and political challenges to best practices and policy solutions

Along the EU's course to secure both sustainable and profitable fisheries, REM is set to make significant contributions to both public and private stakeholders. Table 2 shows that, as the technology has matured over the last two decades, REM programmes in Europe have sometimes encountered technical or political challenges (Column 1), which have occasionally been used to oppose REM. Nonetheless, REM programme participants and researchers have successfully identified the causes of these challenges (Column 2) and have proposed relevant best practices and solutions to resolve them (Column 3). As a result, no technical or political challenges should prevent the wide-scale deployment of REM in Europe, especially as the technology continues to improve at a rapid pace.

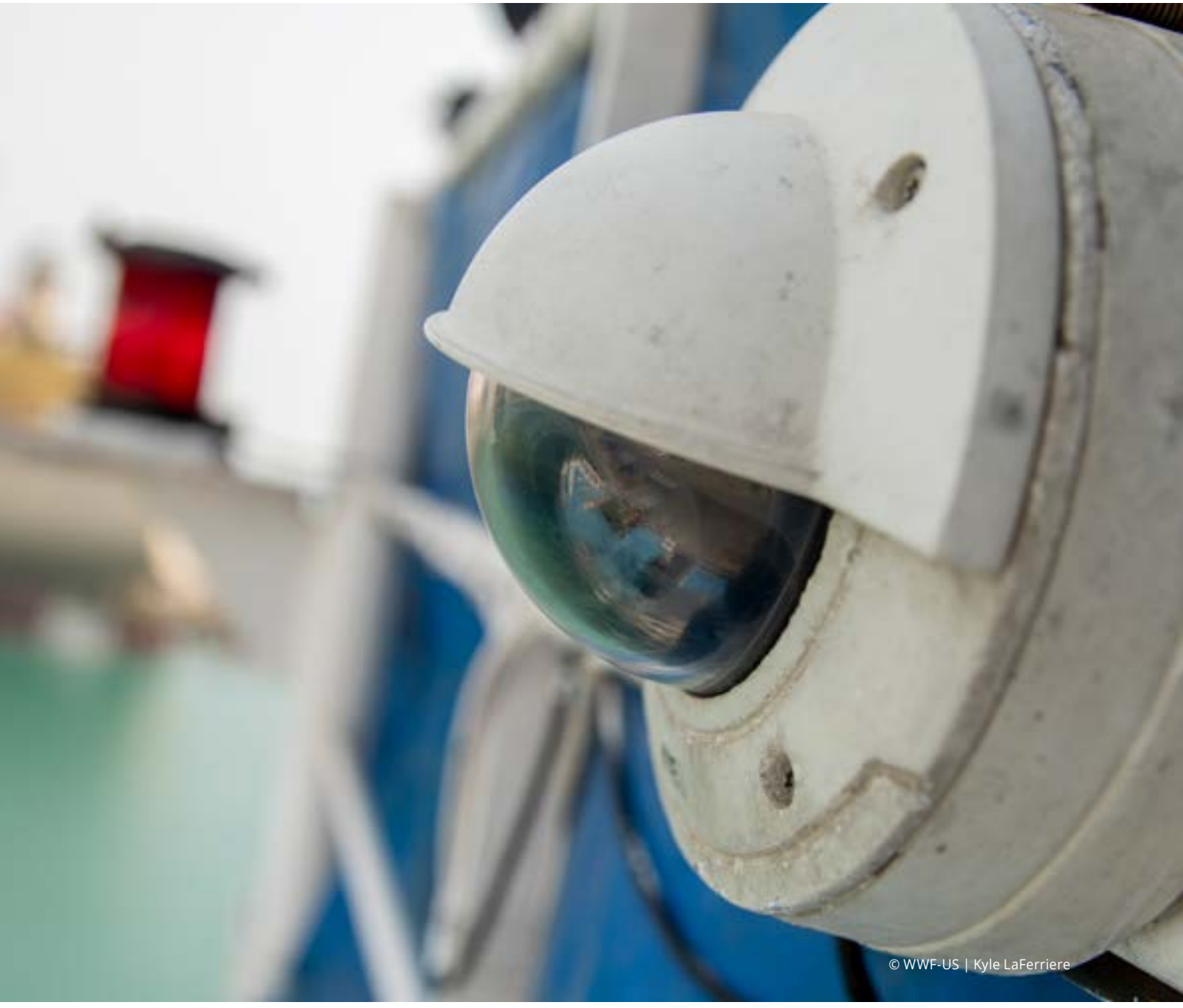
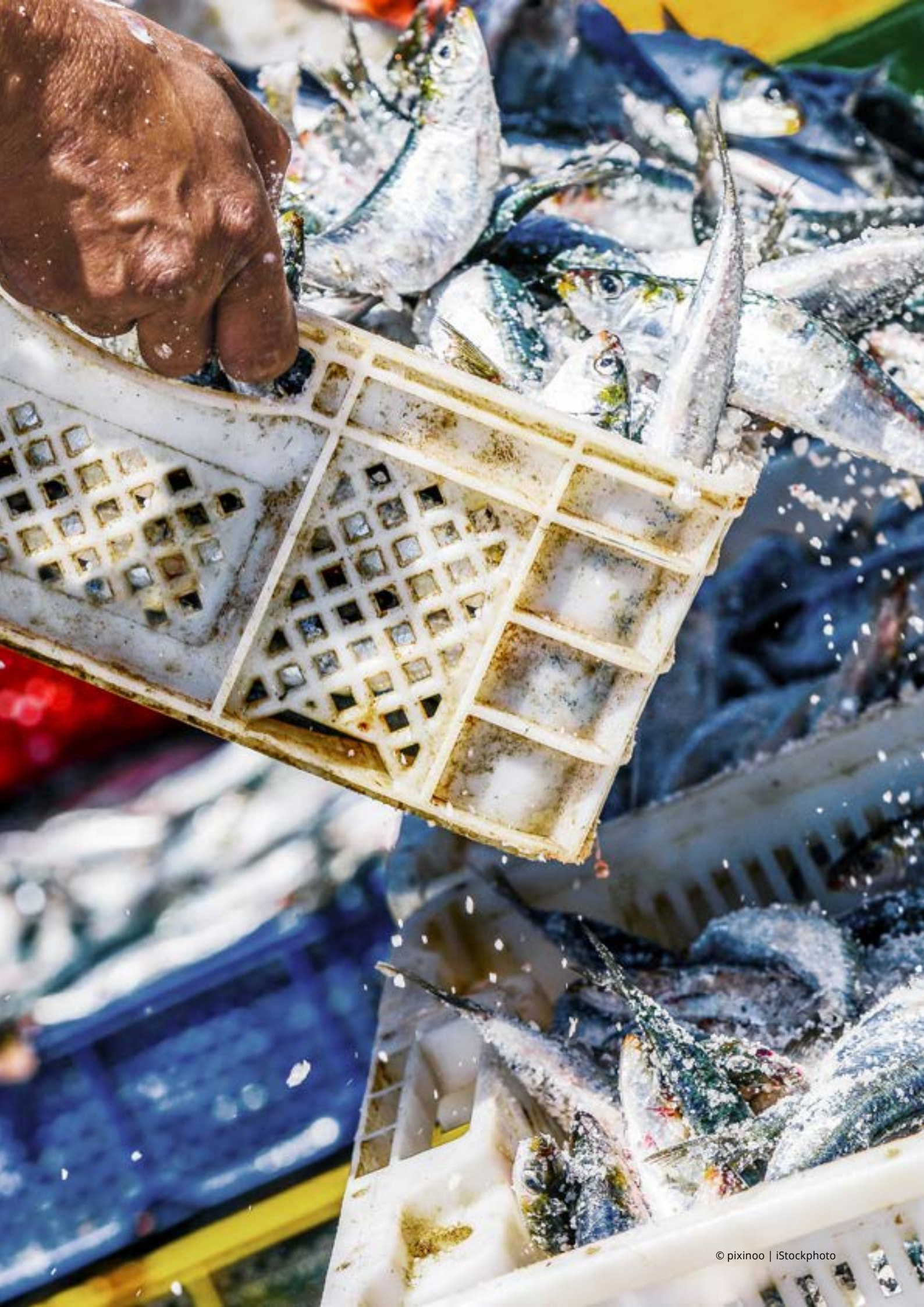


Table 3: Analysis of key REM technical and financial challenges, and their solutions

Issue (1)	Source of the issue (2)	Best practices and solutions (3)
Technical issues related to REM devices		
Data collection loss	Poor image quality or obstructed view: often, this was the result of water droplet formation on camera lenses due to working environments exposed to water, poor weather conditions and dirty manual work; sometimes, vessel crew may intentionally or unintentionally block the camera's view Systems failure such as non-functional drum rotation sensors	More emphasis should be put on the importance of camera maintenance such as regular checks and cleaning of lenses Technical solutions such as treating cameras with rain repellent products have yielded positive results Automated warning systems triggered when image quality is too low would also help with maintaining camera equipment Studies suggest that crew may become acquainted with the presence of cameras, together with increased experience in proper handling, optimisation and maintenance of EM equipment
Data storage and transmission failure	Corrupted or lost data: insufficient data storage, namely due to poor or incorrect hard drive exchange management, damage to hard drives during transport and loss of hard drives	Wireless data transmission via Wi-Fi networks or 4G has solved hard drive technical issues, in addition to being much cheaper. Higher performing data compression software also contributes to systems that are more effective Increased experience in proper handling of EM equipment and optimised maintenance of EM equipment
Technical issues related to the specificities of fishing boats		
REM device installation	Reduced size or even absence of sorting areas on small vessels raises the question of the appropriate location for a camera	On small vessels with open decks, custom mounting infrastructure was successful in resolving camera location issues
Safe REM device power supply	On small vessels, limited battery storage while engines were disengaged	Autonomous, battery operated and solar powered systems have been developed in REM trials outside of Europe
Technical issues related to the type of fisheries		
Effectiveness of REM in mixed fisheries	Difficulty to distinguish small quantities of a given fish within large volumes of mixed fisheries bycatch, especially when similar looking species are targeted	Improved protocols to secure image quality (see above for solutions to data collection loss) and to allow for the recording of individual fish on trawler conveyor belts would facilitate fish recognition; new technologies have been trialled to to reduce the reviewers' workload, including with automated video analysis Advancement in resolution and sensitivity of digital cameras will improve image quality collection Automated image analysis algorithms, together with other developments in artificial intelligence machine learning will make fish identification faster and more accurate
Effectiveness of REM in large volume fisheries	Identification of small individuals of a given species by video devices in large catch volumes would not be as efficient as for large specimens Large quantities of fish caught by vessels such as trawlers complicates the monitoring of all fish taken on board by direct video analysis	

Issue (1)	Source of the issue (2)	Best practices and solutions (3)
Political challenges: From ethical opposition to electronic monitoring		
Privacy concerns	Opposition to what is seen as intrusive devices Concern of possible misuse of data	Numerous safeguards are available to guarantee data privacy (e.g. encryption, rights of review, Freedom of Information exemptions, irreversible pixelation), whilst it is also important to dispel the perception that CCTV equates to full-time personal surveillance As automatic recognition software improves, the need for human involvement in the video review process is likely to diminish, along with concerns over potential manipulation Fishers who participated in REM trials are much more positive about the technology, showing that privacy concerns are often based on misconceptions related to a lack of information Fishers' involvement and participation from the very beginning of REM implementation has delivered very positive results in terms of acceptance
Financial challenges: Costs and access to funding		
High initial setup costs	Costs of REM devices Operating costs	Whilst REM programmes are initially more expensive than on-board observers, they become more economical after just one year and increasingly cheaper over time REM technologies are increasingly efficient, which reduces their user cost. In some trials, the cost related to data storage was significantly reduced from several thousand Euros per year for manually exchanged hard drives to about a 100 Euros per year on vessels transmitting their data via Wi-Fi or 4G networks It is fair to assume that as the technology becomes more commonplace, the REM market will mature and prices will drop

Sources: Van Helmond *et al.*, *How effective is electronic monitoring in mixed bottom-trawl fisheries?*; van Helmond, A. T. M., Chen, C., & Poos, J. J., *Using electronic monitoring to record catches of sole (Solea solea) in a bottom trawl fishery*; Van Helmond *et al.*, *Electronic monitoring in fisheries: Lessons from global experiences and future opportunities*; Bartholomew *et al.*, *Remote electronic monitoring as a potential alternative to on-board observers in small-scale fisheries*; Mortenson *et al.*, *Effectiveness of fully documented fisheries to estimate discards in a participatory research scheme*; Plet-Hansen *et al.*, *Remote electronic monitoring and the landing obligation – some insights into fishers' and fishery Helmond opinions, Marine Policy*; Bergsson, H., & Plet-Hansen, K. S. (2016). *Final report on development and usage of electronic monitoring systems as a measure to monitor compliance with the landing obligation* – 2015 (p. 42); Ballesteros, M.; Chapela, R.; Santiago, J. L.; Norte-Navarro, M.; Kesicka, A.; Pititto, A.; Abbagnano, U.; Scordella, G.; 2018, *Research for PECH Committee – Implementation and impact of key Maritime and European Fisheries Fund measures (EMFF) on the Common Fisheries Policy, and the post-2020 EMFF proposal, European Parliament, Policy Department for Structural and Cohesion Policies*; Australian Fisheries Management Authority, '*Electronic Monitoring Program Overview*' (2019) 27.



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Way forward

This paper shows that REM programmes (including CCTV) have been successfully implemented in multiple EU countries, in various types of fisheries, and on a diverse range of fishing vessels for over a decade. It also highlights that REM programmes benefit fishers as well as fisheries managers by improving the quality and cost-effectiveness of fisheries data collection and monitoring, leading to more sustainable, equitable and profitable fisheries. This evidence demonstrates that, going forward, no technical or political challenge should prevent the wide-scale use of REM in Europe.

The revision of the EU Control Regulation represents a critical opportunity to produce a fisheries management system that successfully promotes environmental sustainability whilst ensuring the economic viability of the fishing industry. As this paper illustrates, REM (including CCTV) has already demonstrated its unrivalled capacity to play a critical role in delivering such a system. Combined with the need for the EU to set the benchmark for efforts to eliminate illegal, unreported and unregulated (IUU) fishing in third countries, it is clear that this is also an opportunity for the EU to instigate global change in fisheries governance in the years to come.

The EU Fisheries Control Coalition recommends for the EU to:

- **Introduce Remote Electronic Monitoring (including CCTV) on a mandatory basis.**

  Fishers are already able to install cameras voluntarily, yet the vast majority decide not to do so. For accurate records of everything we catch, including sensitive and protected species, the use of Remote Electronic Monitoring (REM) must be mandatory. Actively monitoring and controlling how we fish will provide long-term protection to our marine habitats and species, as well as the many thousands of jobs supported by the fishing industry. At the same time, REM will enable fishers to boost profits by using the data that is collected to support new marketing strategies, enhance operating efficiency and improve the health of fish populations.

- **Extend the purpose of CCTV beyond enforcing the Landing Obligation.**

  The EU must embrace the vital role that CCTV can play in ensuring that management decisions effectively deliver on the rules and objectives of the Common Fisheries Policy, in particular, through the verification of catch data and the collection of accurate information on the bycatch of sensitive species.

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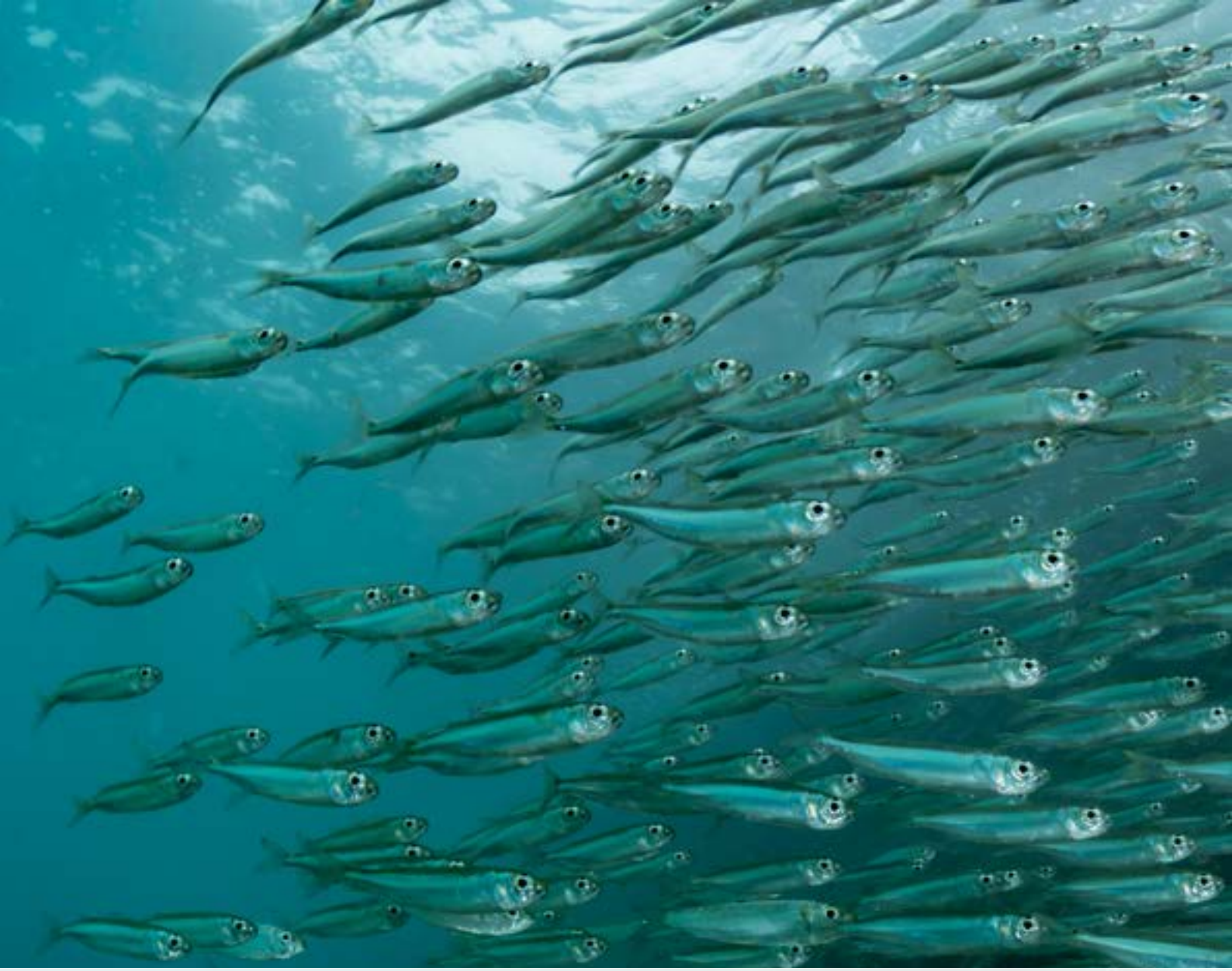

EU FISHERIES CONTROL COALITION

ClientEarth · EJF Environmental Justice Foundation · FISHSEC The Fisheries Secretariat · The Nature Conservancy · OCEANA · Our Fish · SCIAENA · SEAS AT RISK · WWF

About the Coalition

The EU Fisheries Control Coalition — The Environmental Justice Foundation, Oceana, Seas At Risk, The Nature Conservancy and WWF, together with Client Earth, The Fisheries Secretariat, Our Fish and Sciaena — is working to ensure that fisheries management in the EU safeguards ocean health and marine life for generations to come. A robust Control Regulation is essential for sustainable fisheries. It will ensure that fisheries activities are fully documented and will bring transparency to our seafood supply chains.

For more information, please visit http://www.transparentfisheries.org