GREENER UK

Wildlife and Countryside LINK

Joint NGO Response to the Call for Evidence on Remote Electronic Monitoring (REM)

Greener UK and Wildlife and Countryside Link welcome the opportunity to provide evidence in support of the expansion of Remote Electronic Monitoring with CCTV (REM) on vessels fishing in English waters. We are very encouraged to see the UK government taking this important step in what we hope will lead to fully documented fisheries in the UK.

It's been twenty years since REM systems were first piloted in the British Columbia Dungeness crab fishery. Since then, the use of REM has grown worldwide and has been found to be a robust and cost-effective tool for supporting sustainable fisheries management.[1] Following the UK's exit from the EU the government has voiced its intention to set a "gold standard for sustainable fisheries management around the world".[2] The implementation of REM will be a key tool for achieving this, monitoring the sustainability of UK fish stocks, contributing to vital data collection and assessment of non-target bycatch. It would also demonstrate the government's commitment to its claim of becoming global leaders and set an example we hope is shared by the Devolved Administrations (DAs).

The long-term social and economic sustainability of the UK's fishing industry is dependent on a productive and biologically diverse marine environment that supports healthy fish stocks. In order to ensure stocks are being harvested sustainably and to minimise, and where possible eliminate, negative impacts of fisheries on the wider marine environment, fisheries must operate in a fully transparent and accountable manner with fully documented catches and an ability to assess impacts on non-target species. To help achieve this, REM should be introduced as standard across UK fleets and vessels fishing in UK waters, prioritising a roll out for vessels over 10m and high-risk smaller vessels (such as gillnetters) in the first instance.

The benefits of REM are widespread and include:

- Increasing vessel accountability which benefits authorities, fishers, and other members of the supply chain;
- Improving compliance by helping to document conformity with conservation and management measures and international obligations;
- Contributing to important and much needed scientific data collection to support management decisions, stock assessments and bycatch rates of non-target species;
- Ensuring fully transparent and accountable fishing practices with fully documented catches and bycatch;
- Giving fishers the ability to demonstrate implementation of best practice;
- Addressing concerns raised by supply chain representatives – those in the retail and processing sectors – over compliance with key fisheries legislation, and the potential for illegality in the supply chain if compliance is low;
- Improving consumer confidence;
- Reducing the reliance on on-board observers for the collection of independent fisheries data and provides a cost-effective alternative, or vital back up for human observers where appropriate.

Full scale adoption of REM by the UK would demonstrate global leadership in fisheries management, leveraging the implementation of this essential tool within European fisheries operations and beyond.

1. Where are the best and worst examples of Remote Electronic Monitoring policy and usage across the world? And, what are your experiences or views of the Fully Documented Fisheries scheme?

[1] WWF, 2015. Available at: http://assets.wwf.org.uk/downloads/fisheriesmanagement__2_.pdf [Last accessed 16/11/2020]
[2] Defra, 2018. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/722074/fisheries-wp-consult-document.pdf [Last accessed 13/11/2020]

The benefits of using REM systems are widespread but to gain a true understanding of the successes and failures of a project you first need to know its initial objective. Most commonly, REM has been used to monitor the bycatch of marine megafauna (such as cetaceans, sharks and birds), unwanted catches and compliance with technical regulations and gear mitigation measures, amongst other things.[3] Each will have different criteria for success and should be judged accordingly.

The majority of fully implemented REM programs are currently found in the United States (US) and Canada, although others can also be seen in Australia, New Zealand and tropical tuna fisheries in the Indian Ocean and Atlantic. The main objective of most of these programs (particularly in Canada and the US) are management focused with REM systems being used to monitor compliance with fisheries management measures.[4] British Columbia, Canada trialled the use of REM systems to control catch and prevent theft in one of their most lucrative crab fisheries.[5] The successes seen from the trial resulted in fisheries authorities implementing a full REM program for their crab fishery which was paid for by industry and led to further trials for other fisheries in the area. In 2002, REM was tested in Alaskan Pacific halibut longline fisheries to test its effectiveness in monitoring compliance with bycatch mitigation regulations and to assess the feasibility of REM footage to detect and identify seabird bycatch.[6] In 2006, one of the largest REM programmes was introduced in the groundfish hook and line and trap fishery to monitor compliance with self-reporting responsibilities on about 200 vessels.[7]

Examples of the successful use of REM can also be found in Australia and New Zealand, with a main objective of its implementation usually being the monitoring of protected species bycatch. Australia has been using cameras in its federal longline fisheries[8] for a number of years and the Australian Fisheries Management Authority (AFMA) implemented an REM programme covering the Eastern Tuna and Billfish Fishery, Western Tuna and Billfish Fishery, and the Gillnet Hook and Trap fishery for scalefish and shark in 2015. New Zealand is currently in the process of introducing an integrated electronic monitoring and reporting system (IEMRS) on commercial fishing vessels with the understanding that this will enable a substantial improvement in several areas including: the monitoring of catch effort reporting; supporting the integrity of the Quota Management System (QMS); managing bycatch of protected species; providing more accurate information for decision-making by the commercial sector and government; and providing improved information to support sustainability certification and traceability for market development. [9]

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[3] Van Helmond A.T.M., Mortensen L.O., Plet-Hansen K.S., Ulrich C., Needle C.L., Oesterwind D., Kindt-Larsen L., Catchpole T., Mangi S., Zimmermann C., Olesen H.J., Bailey N., Bergsson H., Dalskov J., Elson J., Hosken M., Peterson L., McElderry H., Ruiz J., Pierre J.P., Dykstra C., Poos J.J. (2019) Electronic monitoring in fisheries: Lessons from global experiences and future opportunities. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12425 [Last accessed 16/11/2020]

[4] Van Helmond A.T.M., Mortensen L.O., Plet-Hansen K.S., Ulrich C., Needle C.L., Oesterwind D., Kindt-Larsen L., Catchpole T., Mangi S., Zimmermann C., Olesen H.J., Bailey N., Bergsson H., Dalskov J., Elson J., Hosken M., Peterson L., McElderry H., Ruiz J., Pierre J.P., Dykstra C., Poos J.J. (2019) Electronic monitoring in fisheries: Lessons from global experiences and future opportunities. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12425 [Last accessed 17/11/2020]

[5] Ecotrust, 2020. Available at: https://ecotrust.ca/wp-content/uploads/2020/03/Electronic-Monitoring-Area-A.pdf [Last accessed 17/11/2020]

[6] Ames, R.T., Williams, G.H., Fitzgerald, S.M. (2005) Using digital video monitoring systems in fisheries: application for monitoring compliance of seabird avoidance devices and seabird mortality in Pacific halibut longline fisheries. NOAA technical memorandum NMFS-AFSC-152. Available at noaa.gov [Last accessed 25/11/2020]

[7] Van Helmond A.T.M., Mortensen L.O., Plet-Hansen K.S., Ulrich C., Needle C.L., Oesterwind D., Kindt-Larsen L., Catchpole T., Mangi S., Zimmermann C., Olesen H.J., Bailey N., Bergsson H., Dalskov J., Elson J., Hosken M., Peterson L., McElderry H., Ruiz J., Pierre J.P., Dykstra C., Poos J.J. (2019) Electronic monitoring in fisheries: Lessons from global experiences and future opportunities. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12425 [Last accessed 17/11/2020]

[8] Australian Fisheries Management Authority, 2020. Available at: https://www.afma.gov.au/monitoring-enforcement/electronic-monitoring-program [Last accessed 17/11/2020]

[9] Van Helmond A.T.M., Mortensen L.O., Plet-Hansen K.S., Ulrich C., Needle C.L., Oesterwind D., Kindt-Larsen L., Catchpole T., Mangi S., Zimmermann C., Olesen H.J., Bailey N., Bergsson H., Dalskov J., Elson J., Hosken M., Peterson L., McElderry H., Ruiz J., Pierre J.P., Dykstra C., Poos J.J. (2019) Electronic monitoring in fisheries: Lessons from global experiences and future opportunities. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12425 [Last accessed 17/11/2020]

Some evaluations of earlier trials in Scotland can be found here[10] – as can be seen there were mixed responses to the success of the trial depending on whether or not you had participated as those who did received extra quota and therefore benefited economically, yet whether the conservation objective of cod avoidance was achieved is doubtful as not all participants reported change of behaviour or gear. There are definitely lessons to be learned.

2. Do you think it is right to maximise the benefits from any Remote Electronic Monitoring systems so that they are not just an enforcement tool, but could also be used to monitor our fisheries and collect scientific data? Have you any evidence or suggestions on how best to achieve potentially multiple outcomes from the technology?

Yes. The benefits of using REM are widespread and systems can be adapted to reflect the objectives of policy or management objectives be they data collection, discard monitoring or wildlife bycatch monitoring and assessment of success of mitigation measures.

Advances in camera technology and decreasing costs of electronic monitoring systems are creating new possibilities for fisheries to demonstrate responsible practices and contribute to the UK's commitment to an ecosystem-based approach to fisheries management. Cameras not only support compliance, but also have the ability to capture much needed scientific data which can be used in the creation of effective fisheries management policies, contribute to stock assessments and provide insight into the type and frequency of other species incidentally caught in fishing gear[11].

Importantly, REM can also help to build business and consumer confidence in the sustainability of their seafood by providing a much-needed level of transparency.

However, again returning to the policy objective, it will mean being clear about this when setting up camera systems as not all cameras positions and set ups will successfully simultaneously monitor the full fishing process. We might expect that REM systems set up to monitor bycatch, unwanted catches, compliance and monitoring of data will vary. For example, marine mammals often fall out of fishing gear as it is being hauled onboard the vessel, so it is essential to position REM over the side of the vessel looking at the water where the gear is being hauled. If REM is only placed on the deck, only a portion of bycatch will be accounted for and bycatch rates will be underestimated.[12]

REM as a tool for data collection

To ensure stocks are being harvested sustainably and to minimise, and where possible eliminate, negative impacts of fisheries on the wider marine environment, including sensitive species bycatch, fisheries must operate in a fully transparent and accountable manner with fully documented catches. Rolling out REM would mean we would have better scientific data about what is being caught and discarded, which would provide invaluable insights into the status of commercial stocks. 60% of UK shellfish stocks have unknown status and data could also help inform the interactions with, and status of, vulnerable bycatch species for which there are currently large uncertainties.[13]

Key for data collection will be to ensure that those reviewing the data have the right level of knowledge to capture the data needed for management purposes. Artificial Intelligence (AI) and machine learning is now improving and should be able to help with this.

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[10] https://www.gov.scot/publications/2011-fully-documented-fishery-trial-economic-evaluation/

[11] Bradley, D., Merrifield, M., Miller, K.M., Lomonico, S., Wilson, J.R., Gleason, M.G. 2019. Opportunities to improve fisheries management through innovative technology and advanced data systems. *Fish Fish*. 2019; 20: 564– 583. Available at https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12361

[12] Scheidat M., Couperus B., Siemensma M., 2018. Available at: https://edepot.wur.nl/466450 [Last accessed 19/11/2020]

[13] Defra, 2019. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/921262/marine-strategy-part1-october19.pdf [Last accessed 17/11/2020]

Supporting confidence in the supply chain. The roll out of cameras would help fishers show how their activities are sustainable and would provide transparency for retailers and consumers who increasingly want evidence of the sustainability of their seafood. In response to concerns regarding their snapper fishery, the Ministry for Primary Industries in New Zealand has implemented a REM program on vessels participating in this fishery. The main objectives of the program are to: improve the reliability of data; gain a better understanding of numbers of juvenile snapper killed; and provide more transparency around commercial fishing operations, amongst other things.[14][15]

Monitoring sensitive species bycatch

In UK waters, thousands of animals, including cetaceans, seals, seabirds, turtles and elasmobranchs die every year, as a result of incidental capture and drowning in the gears of fishing vessels. Recent estimates of the annual UK fisheries toll include over 1,500 small cetaceans, predominantly comprising harbour porpoise and common dolphin, 400-600 seals[16], and concerning and increasing levels of entanglements of humpback and minke whales off the coast of Scotland.[17] A recent study[18] commissioned to inform the UK Seabird Bycatch Plan of Action is the first attempt to estimate seabird bycatch mortality from UK-registered fishing vessels in UK waters. The report highlights that at least 10 species were recorded as bycatch and identifies bycatch hotspots in longlines operating in the northwest of Scotland and gillnets in the southwest and northeast of England. These preliminary findings are caveated with uncertainty due to poor monitoring. Nevertheless they indicate a seabird bycatch problem that requires comprehensive monitoring and targeted action. Bycatch of other Endangered, Threatened, or Protected (ETP) species such as turtles, sharks and rays also occur, though likewise there is insufficient monitoring to determine rates of bycatch or the potential impact on populations. Tackling such bycatch is an essential component of achieving sustainable and responsible fisheries.

Effective monitoring is a key component of a successful strategy in order to assess bycatch rates and identify high-risk fisheries, assess the efficacy of mitigation and ensure compliance with best practice. Current UK monitoring of bycatch of ETP species is not fit for purpose.[19] However, REM can supplement existing bycatch and stranding monitoring programs to offer better, unbiased coverage at a fraction of the cost. REM has been successfully trialled for monitoring cetacean bycatch in Denmark and the Netherlands, where bycatch rates were found to be higher than those documented by visual observers.[20] Introducing REM as standard practice offers the UK the chance to improve fisheries management and lead the way in monitoring bycatch of ETP species as well as ensuring wider fisheries sustainability and accountability.[21][22] The monitoring of data for wildlife bycatch events will likely differ given the relatively rare occurrence of bycatch events. 100% reviewing of data will be

[14] Ministry of Primary Industries, New Zealand, 2020. Available at: https://www.mpi.govt.nz/fishing-aquaculture/sustainable-fisheries/snapper-1-management-plan/progress-of-electronic-monitoring-in-the-snapper-1-trawl-fishery/ [Last accessed 17/11/2020]
[15] Ministry of Primary Industries, New Zealand, 2020. Available at: https://www.mpi.govt.nz/dmsdocument/28446-Reports-on-technical-fixes-and-progress-reported-for-the-electronic-monitoring-trial-in-the-SNA1-trawl-fishery [Last accessed 17/11/2020]
[16] ICES, 2017. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/WGBYC/wgbyc_2017.pdf [Last accessed 17/11/2020]
[17] Ryan, C., Leaper, R. & Evans, P. G. H. 2016. Entanglement: an emerging threat to humpback whales in Scottish waters. Available at: https://www.seawatchfoundation.org.uk/wp-content/uploads/2016/12/Ryan_et-al_IWC.pdf [Last accessed 17/11/2020]
[18] Northridge et al. (2020) available at http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=20461&FromSearch=Y&Publisher=1&SearchText=bycatch&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description
[19] WWF, 2017. Available at: https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf [Last accessed 17/11/2020]
[20] ASCOBANS Workshop on remote electronic monitoring, 2015. Available at: https://www.ascobans.org/sites/default/files/document/ASCOBANS_WS_REM_2015_Report.pdf [Last accessed 19/11/2020]
[21] WWF, 2017. Available at: https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf [Last accessed 17/11/2020]
[22] https://www.wwf.org.uk/sites/default/files/2020-11/whatsinthenetfinal.pdf

required but using a fast forward screening of footage can be applied. AI is developing and should be able to help with this in time.

Tool for demonstrating best practice and responsive management

Cooperation between scientists, managers and fishermen is key to a well-managed fishery, and the roll out of REM provides fishermen the opportunity to contribute the most data at the lowest cost whilst demonstrating their commitment to best practice. REM provides unbiased and fully documented evidence to support challenges faced by the industry and allows for the implementation of adaptive and dynamic management strategies as fisheries authorities have much quicker access to data collected through REM than they do to traditional observer data. Currently observer coverage for scientific research purposes is low but costs are relatively high; and the data takes time to be manually entered on to a database, checked and then formatted for annual stock assessment purposes. This process can take up to a year to complete. REM sensor and positional data can be available in near-real time, while video review data can be completed and uploaded within two weeks of receipt of the raw data. This can allow managers to respond more quickly to events on the fishing grounds and give fishermen the best opportunities based on what they are currently (or very recently) experiencing, rather than historical events.[23]

Improved staff welfare

The presence of REM can help incentivise good health and safety compliance and where human observers are present can be used to support observer observations on vessel practices. It has been acknowledged that the Covid pandemic has affected observer programmes around the world with observers unable to go to sea due to safety risks associated with a lack of social distancing. REM should be seen as a useful alternative to sending humans to sea in certain circumstances.

3. If there were to be further trials of Remote Electronic Monitoring in England what should their focus be on? For example, which type of vessel, fleet segment, gear type or location would be most appropriate and why?

The efficacy of REM is already well tested, and previous trials in the UK and globally have established it can be employed for both compliance and scientific purposes. Initially the REM trials in the UK were aimed at the North Sea fleet which targeted cod (nearly 40% of cod catches in 2016 were from vessels equipped with REM), but both Scotland and England have now trialled systems on a range of vessels and in different fisheries including *Nephrops* trawlers, gillnetters, longliners, beam trawlers, pelagic trawlers (both freezer and refrigerated seawater), under-10-metre vessels, shellfish creeling vessels (in a separate European Fisheries Fund (EFF) funded study), and scallop dredgers. The conclusion of all these trials was that REM with CCTV can allow fishing effort to be monitored, catches to be verified and discarding to be detected.[24] For the purposes of roll-out, REM should focus on high-risk vessels. Where this is related to wildlife bycatch, it should be applied initially to known high-risk vessels, including gillnets for harbour porpoises, common dolphins and seabirds, mid water trawls, including pair trawls, for common dolphins and other dolphin species and longliners for seabirds. It is also likely that for a period after the adoption of REM, human observers should be retained for purposes of verifying that the REM system is optimised for purposes of picking up a wildlife bycatch event. Where the focus is discard monitoring the recommendations made by EFCA should be used as guidance.

Other leading governments in fisheries management, including the US, have also already stated their views that further trials of REM are not required. At the International Fisheries Observer and Monitoring Conference (IFOMC) in 2016, Jane Dicosimo, a representative of the United States government and manager of the US National Observer Programmes, stated that they "would no longer

[23] WWF, 2017. Available at: https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf [Last accessed 17/11/2020]
[24] WWF, 2017. Available at: https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf [Last accessed 17/11/2020]

fund REM pilot projects". This was because they acknowledged that the technology providers and operators have demonstrated that the REM systems are advanced and reliable enough to be used in nearly all fisheries, and that all future REM-allocated funding would be used in making full monitoring programmes operational in US fisheries.

In short, REM works, so there is no need to test it anymore. We therefore do not believe further trials of REM for efficacy are needed prior to implementation and urge the government to focus instead on the full roll-out of REM systems across the fleets. If a degree of prioritisation is needed across the over 10m application, REM should first be rolled out onboard high-risk vessels (e.g. those at high risk of non-compliance, those targeting data-deficient fisheries, stocks that are already depleted, or those that have a higher risk of incidental bycatch of target and non-target species).
There will likely be a period needed during which alterations can be made to optimise application.

4. Depending on the outcome of further trials, do you think a Remote Electronic Monitoring programme should be mandatory or voluntary? Please explain your reasons.

We believe that any implementation of REM in the UK should be mandatory. It will be very difficult to achieve fully documented catches and reduce bycatch without participation of the entire fleet, and it would also arguably be difficult to encourage vessels to sign up to a voluntary scheme without significant incentives and may result in an un-level playing field within the fishery. See again the evaluation of the Scottish trials where the lack of level playing field led to tensions. We do not support the use of reference fleets as these tend not to represent the actions of the rest of the fleet and again lead to a lack of level playing field. We also believe REM should be mandatory for international vessels fishing in English waters.

The mandatory use of REM has already been implemented in a number of jurisdictions. For example, the use of REM on certain commercial fishing vessels is mandatory under New Zealand legislation.[25] In addition, The Disposal and Bycatch Law in Chile came into effect on 1 January 2020, setting out a phased implementation scheme focussing initially on vessels over 18 metres in length. These jurisdictions recognise that REM is vital in providing more accurate and up-to-date information to better inform decision-making by Government and the fishing industry and that mandatory use results in a level playing field for the fisheries management.

There are some examples of fully implemented REM programs for which participation is voluntary. REM programs were initiated in two Spanish tuna purse seine fisheries after the International Seafood Sustainability Foundation (ISSF) required participating companies to source tuna only from purse seine vessels that could demonstrate 100% observer coverage.[26] This provided a financial incentive for the fishing industry to implement REM and also demonstrates a support for and recognition that REM is the most effective way to obtain full documentation of catches, as this was the option chosen by the industry themselves to implement. This is an extreme example of where a voluntary scheme may work, however we do not believe this is appropriate for all fisheries. Effective implementation of REM requires command and control leadership as a voluntary approach will almost always miss those vessels most likely to be problematic. The UK should follow the lead of other countries and make the use of REM mandatory for future programs.

5. If Remote Electronic Monitoring were to become a mandatory requirement for any or all vessels fishing in English waters should there be a lead in time to allow industry to prepare for this? Please provide any details or supporting evidence on how long this should be or whether you think it should be different for different parts of the fleet.

[25] New Zealand Fisheries Regulations, 2017. Available at: http://legislation.govt.nz/regulation/public/2017/0156/latest/whole.html?search=ts_act%40bill%40regulation%40deemedreg_fisheries_resel_25_y&p=1#DLM7328419 [Last accessed 20/11/2020]
[26] https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12425#faf12425-bib-0058

While we do not have particular expertise on the specific time scales required for the lead in time to allow the industry to prepare, we reiterate that this should be done in a way that prioritises high-risk fisheries and would expect implementation of REM for the highest risk to take no more than12-18 months.

6. Are there any vessels, gears, fleets, or locations that you feel Remote Electronic Monitoring would not be appropriate for? If so, please provide further information.

No. REM has been trialled globally and in the UK in a range of different fisheries and vessel sizes including *Nephrops* trawlers, gillnetters, long-liners, beam trawlers, pelagic trawlers (both freezer and refrigerated seawater), under-10-metre vessels, shellfish creeling vessels and scallop dredgers. There have even been successful trials in New Zealand of an "in-trawl" video system to monitor by-catch where underwater video footage was recorded with high-definition video cameras mounted inside trawl nets.[27] Technology is moving at such a pace that there are options for REM for all vessel sizes and circumstances with many manufacturers of REM systems offering 'lite' systems more applicable for smaller vessel use.

7. Do you have information on the financial costs of Remote Electronic Monitoring, both initial and ongoing costs, and whether this delivers value for money?

Initial and ongoing costs

Developments in the REM marketplace, with new suppliers and equipment options becoming available have driven down both the initial and ongoing costs associated with the implementation of REM. Specific costs will differ depending on the needs of each program as the objective will often determine the number of cameras required and subsequent effort needed to monitor the recorded information following fishing activities.[28] There has recently been a move towards using additional cameras to enable greater transparency, resulting in some REM manufacturers now supplying systems that can use up to eight or even twelve cameras depending on the needs of the programme. However, below (Figure 1) we have provided estimated costs (which are based on average estimates received from three leading REM technology suppliers who have been kept anonymous to protect commercial confidentiality) of rolling out and monitoring REM systems fitted with six cameras which better reflects current practices in the UK. These estimates include the annual salary (£25,000) of independent analysts, each of which will review 10% of footage from 15 vessels.

[27] Vanessa F. Jaiteh A C , Simon J. Allen A , Jessica J. Meeuwig B and Neil R. Loneragan A, 2014. Available at: https://www.publish.csiro.au/mf/MF13130 [Last accessed 17/11/2020]

[28] WWF, 2017. Available at: https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf [Last accessed 16/11/2020]

ITEM DESCRIPTION	UNIT COST (£)	90% EMFF CONTRIBUTION (£)	ACTUAL COST TO UK/ DEVOLVED GOVERNMENT (£)	COST PER VESSEL PER YEAR[1] WITHOUT EMFF (£)	COST PER VESSEL PER YEAR[1] WITH EMFF (£)
REM hardware – 6 camera system[2]	8,269	7,442	827	1,654	165
Installation costs[3] (Dinsdale, 2013)	2,400	NA	2,400	480	480
2 additional hard drives per vessel	90	81	9	18	2
Hard drive swapping per year (courier service)[4]	120	NA	120	120	120
Maintenance costs[5] (Dinsdale, 2013)	1,200	NA	1,200	1,200	1,200
Video analyst salary[6]	25,000	NA	25,000	1,667	1,667
Review software licence[7]	2,271	NA	2,271	151	151
Total				5,290	3,785

1 Assumes a five-year lifespan.
2 Includes six digital cameras and associated activity sensors.
3 Assumes this cost is not included in the normal running costs, is not to be paid by the owner and is not eligible for EMFF funding.
4 Assumes monthly hard drive swap at £10/month per vessel.
5 Includes annual service and regular checks of system as well as any ad hoc repairs.
6 Based on a salary of £25,000 per year and one analyst being able to undertake 10% video review, data entry and reporting for 15 vessels per year, does not include overheads and other staff costs.
7 Annual average cost of £2,271 per software licence and 15 vessels per analyst.

The overall cost of an REM system – software, staffing, installation, maintenance etc – falls between £3,785 and £5,290 per vessel (depending on whether the government chooses to subsidise the costs of hardware items using the European Maritime and Fisheries Fund (EMFF) or an equivalent). Despite a 38% increase in hardware costs due to increased specifications, this is still an overall reduction of approximately 19% from 2015 which demonstrates the current downward trajectory in REM costing due, in part, to advancements in technology. These savings are likely to increase as further advancements are also made in computer vision and image recognition software.

Value for money

Using these estimates, it would therefore cost between £4.7m and £6.5m respectively to equip and monitor the whole UK over 10-meter fleet (which comprises of 1,236 vessels and accounts for over 90% of fish caught in the UK), while reviewing 10% of the video and obtaining 100% of the sensor data.[29] This is roughly a quarter of what is currently spent on more traditional observer monitoring systems which deliver less than 1% at-sea coverage.[30] It is also less than 1% of the value of seafood caught by these vessels.

REM systems have also been found to generate economic benefits for fishing industries and coastal communities. Prior to the implementation of REM systems in New Zealand, the government undertook a cost/benefit analysis in 2017 which identified monetised costs of NZ$83.2m over 15 years (2018-32), compared to monetised benefits of NZ$158.6m in the same period. The projected

[29] House of Common, 2020. Available at: file:///C:/Users/Clara%20Johnston/Downloads/SN02788%20(3).pdf [Last accessed 16/11/2020]
[30] WWF, 2017. Available at: https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf [Last accessed 16/11/2020]

monetised benefits resulted in part from securing and increasing access for New Zealand's wild-caught seafood to premium markets that require assurance of sustainable fish production and better 'boat to plate' transparency – both of which could also benefit the UK fishing industry. To achieve a similar level of coverage using observer schemes would cost considerably more, and the numbers of observers required would be in the hundreds. Therefore, although cameras will never fully replace the need for on-board observers, the financial argument clearly shows that REM is an attractive supplementary option and should be implemented.[31]

8. Do you think there is a need to support vessels using Remote Electronic Monitoring and, if so, what do you think this support should look like? For example, financial support, training, quota etc.

Initially yes, but over time funding should become part of standard operational costs. The funding of REM monitoring programmes globally varies. REM programs in Canada and Alaska started under co-funding arrangements provided by the government and industry, however did eventually move to 100% industry funding.[32] Programmes on the US West Coast are also currently co-funded by government. A number of other fishing industries and some governments are also transitioning to covering only specific costs while industry will provide the bulk of the costs. In Australia a 50% recovery cost is applied[33]. We believe there is merit in the industry contributing to some costings from the outset, particularly hardware, as it is less likely to be damaged if this is equipment that industry themselves have to replace in order to go to sea.

Training

We think training resources would be welcome prior to the implementation of a REM program. New Zealand created a number of training resources for industry members to support the roll-out of full REM programs during the transition. These included informational videos and a webpage where additional information can be accessed.[34] The UK should look at these and other programmes to see what may best suit UK application.

Troubleshooting Support and Investment in Data Analysis

There should be support provided to assist in the case of troubleshooting technical issues and to allow fishers to ask questions. Fishers, management bodies and scientists will need ongoing communication and information exchange to work out any teething issues and to support ongoing management. This will ensure REM is used effectively, collecting the right information (I.e., cameras in the right places), fix technical issues, and improve technologies going forward. Government will likely need to invest in data management, resourcing and staff to support the successful delivery of the program similar to the approach taken in New Zealand. This has additionally provided support to fishers by ensuring these systems work allowing them to see the benefits of the data collection.

9. Are you aware of any other technologies which could also be used to monitor our marine environment and/or enforce fisheries management rules and/or data collection purposes?
Other alternatives

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[31] WWF, 2017. Available at: https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf [Last accessed 16/11/2020]

[32] Van Helmond A.T.M., Mortensen L.O., Plet-Hansen K.S., Ulrich C., Needle C.L., Oesterwind D., Kindt-Larsen L., Catchpole T., Mangi S., Zimmermann C., Olesen H.J., Bailey N., Bergsson H., Dalskov J., Elson J., Hosken M., Peterson L., McElderry H., Ruiz J., Pierre J.P., Dykstra C., Poos J.J. (2019) Electronic monitoring in fisheries: Lessons from global experiences and future opportunities. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12425 [Last accessed 17/11/2020]

[33] Australian Fisheries Management Authority Electronic Monitoring Program (2020) Program overview, Australian Fisheries Management Authority.
https://www.afma.gov.au/sites/default/files/australian_fisheries_management_authority_electronic_monitoring_program_june_2020.pdf [Last Accessed 25/11/2020]

[34] New Zealand Government, 2020. Available at: https://www.mpi.govt.nz/fishing-aquaculture/commercial-fishing/fisheries-change-programme/electronic-catch-and-position-reporting/ [Last accessed 17/11/2020]

Although some alternative technologies do exist, none provide the same level of un-biased documentation, transparency, accountability and confidence as those provided by fully implemented REM systems. Furthermore, no other method of monitoring is able to record the 'decision point' where a crewman decides whether to retain or discard a fish. REM can monitor this process and also provide a recorded evidence base in any further discussions or investigations.

There have been conversations about pelagic vessels operating without cameras and instead using only sensors and logbooks to monitor for discarding (or in the case of pelagics more likely slippage). We do not believe this would be acceptable. If discrepancies arise there is no visual evidence of whether or not a misdemeanour occurred. The use of video footage can prove beneficial to fishers to demonstrate good practice or negate untrue claims.

Reference fleets

Although not an alternative technology, the use of reference fleets is often suggested as an alternative to the full implementation of REM across a fleet. However we would not support the use of reference fleets in future REM programs. Trials where reference fleets have been used show notable differences between data recorded by the REM reference fleet and non-REM vessels recording their own data.[35] They also suggested that when considering a reference fleet approach instead of a 100% monitored fleet, the number of vessels chosen for monitoring must provide confidence of a level playing field and ensure that unfair commercial advantage does not arise from not having REM installed. The ability to fund a 100% coverage REM project is likely to be the main reason why a reference fleet approach may be considered. However, it is clear from the above studies that those vessels with REM installed will be placed at a commercial disadvantage compared to those without REM in a reference fleet scenario. The vessels without REM will likely continue to discard undersize fish as well as high grade the less valuable smaller grades of marketable catch and will therefore be able to maximise the returns on their limited quota by ensuring that only the larger more valuable fish are landed against it. Given that the main costs associated with REM tend to be staff costs related to video review, a fairer solution would be to install REM on all vessels within a fishery but reduce the footage randomly selected for review. That way vessels will all be operating to the same conditions because no-one will know if they will be selected to have their catch declarations verified by video and so will not risk non-compliant activity.

10. Is there anything else you would like to raise at this stage?

The Issue of Privacy

Arguments against the use of cameras on boats are often made as some fishers see them as an invasion of privacy. Addressing these concerns proactively is recommended including setting out data use, management and retention policies. [36] Cameras are also not placed in the living or recreational areas of the boat and focus purely on the fishing areas and boat gear. Certain segments of the industry have shown that they are not afraid of REM, and it could actually equip them with tools and supportive evidence[37]

Furthermore, in the UK and many other countries it has become standard practice to safeguard shared public resources and people through the use of cameras. It is used in supermarkets, banks, public transport, streets, houses, in most work spaces, road junctions, in fact almost anywhere there is a perceived need. Moreover, cameras are also used in slaughterhouses in the UK and the legal framework has already been adapted to address privacy issues. The Control Regulation will therefore

[35] Clara Ulrich, Hans Jakob Olesen, Heiðrikur Bergsson, Josefine Egekvist, Kirsten Birch Håkansson, Jørgen Dalskov, Lotte Kindt-Larsen, Marie Storr-Paulsen, Discarding of cod in the Danish Fully Documented Fisheries trials, *ICES Journal of Marine Science*, Volume 72, Issue 6, July/August 2015, Pages 1848–1860, https://doi.org/10.1093/icesjms/fsv028

[36] van Helmond, ATM, Mortensen, LO, Plet-Hansen, KS, et al. Electronic monitoring in fisheries: Lessons from global experiences and future opportunities. *Fish Fish*. 2020; 21: 162– 189. https://doi.org/10.1111/faf.12425

[37] https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12425

provide a sound legal framework for the fishing industry and protect privacy and data.[38] We therefore do not support arguments made against REM with regard to intrusions of privacy as we do not believe there is sufficient justification for these.

Level playing field

We appreciate the government has already vocalised their position on this point and are encouraged by the stance being taken, however we would like to reiterate our belief that the implementation of REM should not only apply to English vessels, but any international vessel wishing to fish within UK waters. This is for the sake of transparency and to deliver a level playing field, as well as data collection for scientific and management use. We also believe all recorded data should be made publicly available.

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[38] http://www.iuuwatch.eu/wp-content/uploads/2019/06/Remote-Electronic-Monitoring.pdf