



Understanding the organisational structure of fisheries crime in well-regulated fisheries

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ABSTRACT

Illegal, Unreported and Unregulated (IUU) fishing is recognised as a global environmental, economic, and social problem, taking place in all kinds of fisheries. Preventing it is however difficult and there is a continuous need to expand the knowledge base on how the issue can be addressed. In this article we study fisheries crime from an environmental criminology approach by conducting a crime script analyses to describe the organisational structure of unreported fishing in a well-regulated fishery. The approach gives detailed insights into the different steps in the crime commission process in the Norwegian coastal cod fisheries. The crime script technique is expanded to also include an analysis of the regulatory framework designed to prevent illegal fishing activities. The main MCS mechanisms to prevent illegalities are present but the diversity in the industry makes the implementation of universal prevention mechanisms difficult. The analysis highlights the fisher-buyer dialogue and interactions prior to misreporting as a core aspect to the organisation of the violations, and difficult to regulate. When linking regulations and guardianship to different steps of the crime we discuss the identified vulnerabilities in the resource control system and present some possible intervention points and prevention mechanisms to be considered by policymakers.

1. Introduction

Illegal, unreported, and unregulated (IUU) fishing is often associated with fisheries in regions with weak institutions and monitoring, control, and surveillance (MCS) capabilities [19]. However, IUU fishing also occurs in well-regulated fisheries [11]. Norway's fisheries management is well recognised, with established institutions and a comprehensive set of rules and regulations. Still, serious violations such as unreported fishing and trading of illegally caught fish are highlighted as problems that need to be addressed [33,31,17]. Unreported fishing creates increased uncertainty in the stock assessments, and hence uncertainty in resource control, in addition to involving tax evasion and creating unfair competition among fishers and among fish buyers and distorting competition in the market (ibid.).

The Norwegian Directorate of Fisheries has identified the economically important cod fishery as a risk area for unreported fishing [31]. We use the term unreported fishing in line with the FAO definition of IUU fishing (FAO, website), to denote all violations of the requirements to report catches, including not reporting, under-reporting, and mis-reporting of catches. The scope of unreported fishing is unknown, but it

is well-known that authorised fishers and fish buyers abuse their exclusive access to a limited resource by adding unregistered fish into the supply chain and misreport catches. Offender motivations can be diverse and vary with different ways of not reporting correctly, but weaknesses in the fisheries regulations, low risk of detection, and market challenges have been pointed to as conditions conducive for this behaviour [10,17,29]. In 2019 a government-appointed expert commission investigated ways to ensure compliance with the fisheries regulations, including improved documentation and control of verifiable data, increased information exchange and better organization of the control authorities [17]. Compliance by design, a concept referring to digitalized information gathering and processing, was highlighted as the best way forward (ibid.).

To ensure targeted preventive measures in-depth knowledge about the problem of unreported fishing is needed. Our study contributes to this by analysing Norwegian fisheries regulations and violations by applying a crime script analysis. By breaking down the criminal activity into different paths and steps, we provide an overview of how different offenses occur and thereby identify why unreported fishing is difficult to prevent. The questions raised are “What are the common ways of

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unreported fishing in the Norwegian coastal fisheries and which regulations are violated?” and “Which prevention mechanisms and possible intervention points are identified?”.

The term crime commission process is used for describing the way crimes are carried out outlining all stages from intention to accomplishment. Crime script analysis is a technique used by crime analysts to detail the crime commission process [7] and develop analytical and prevention-focused thinking to disrupt the behaviours of organized criminals [14]. The ultimate objective of scripting the crime commission processes is to obtain a fuller range of intervention-points in order to disrupt the script before completion [12]. The logic behind the approach is that criminality is a rational and goal-oriented behaviour. Understanding and identifying routine activities and procedural aspects associated with the behaviour will provide a basis for mapping suitable prevention mechanisms [13,15,28]. Within fisheries the technique has been applied by Petrossian and Pezzella [18] to describe organized IUU fishing and associated regulations in the EU and the United States. In our study, the crime script technique was used to describe the different phases of illegal activities in a well-regulated fishery in Norway. By scripting unreported fishing in the Norwegian coastal cod fisheries and including an analysis of the regulatory framework designed to prevent illegal fishing activities, we expand the script technique. This broadens the analysis and provide useful insight into a topical area for the authorities in their work to further development of the resource control system and prevent unreported fishing.

The study identifies limited land-based controls as representing a critical point of vulnerability in the enforcement infrastructure. The fisher-buyer dialogue and interactions prior to misreporting was identified as critical for the organisation of the violations. To reduce fraud, resources ought therefore to be directed at these steps in the crime commission process.

The next section provides a brief overview of the Norwegian fisheries sector and how it is regulated, followed by an outline of the crime script approach and the methodology applied. Based on this, the Norwegian coastal cod fishery is scripted, and various types of violations and prevention mechanisms are discussed.

2. Background – the Norwegian cod fisheries and its regulation

The fishing industry in Norway is subject to several regulations and registration requirements overseen by dedicated authorities that collect data and perform surveillance and control activities. The main authorities are the Ministry of Trade, Industry, and Fisheries and the Directorate of Fisheries, which adopt rules and regulations. The regulations rely heavily on research and dialogue with the fishing industry and other stakeholders, as well as international cooperation on shared stocks. All regulations are discussed with the industry and other interested organisations before final decisions are made. Adjustments are made throughout the year based on the fishing taking place and input from the industry. Although the regulations are being adjusted or replaced, there has been no major changes in the overarching regulatory framework the last decades.

The regulations are directed at access and harvest control. Access control relates to the catch capacity and provide actors access to fish based on set criteria [3,22]. This study is based on an analysis of possible violations of actors with access rights to the commercial coastal cod fisheries. In 2021 there were nearly 1900 registered vessels in this group, divided into five sub-groups, where the two smallest vessel groups (less than 11 m and 11–15 m) amount to 1500 vessels. The coastal fleet is allocated around 52% of the total cod quota regulated with individual vessel quotas, fishing with gillnet, longline or Danish seine. In 2021, this fleet registered 56,000 landings of cod. Catches can vary between a few hundred kilograms to 60–70 tonnes, depending on the vessel size. The fishery is highly seasonal and around 70% of the cod is landed during the winter season in the north of Norway (see Fig. 1). The total Norwegian catch of cod was nearly 471,000 tonnes, with a

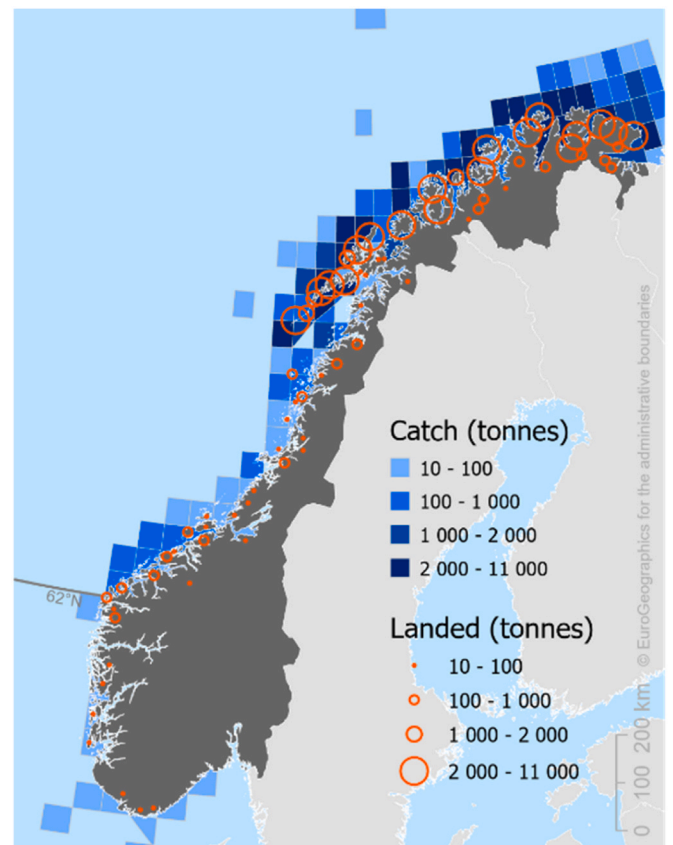


Fig. 1. Map of Norway highlighting the most important areas for the coastal cod fishery in 2021.

first-hand value of NOK 8,6 billion (app. € 87,4 billion) and an export value of NOK 9.82 billion (app. € 99,8 billion). The first-hand value of cod from the coastal fisheries amounted to NOK 3.3 billion in 2021 (app. € 33,5 billion).

Harvest control regulations include annual fisheries quotas and technical regulations imposing restrictions on how much can be fished, the use of gear, etc. [24,27]. A basic principle is the landing obligation prohibiting the discarding of fish [2]. An important aspect of the fisheries regulation is to control the first-hand sale of fish from the fisher to the fish buyer, obliging all first-hand sale of wild marine resources to take place through or with the approval of a fisher’s sales association [1]. The Norwegian Fishermen’s Sales Organisation handles the sale of codfish, that mainly take place in the middle and north of Norway. Anyone who is to buy catch from a vessel (first-hand trade) must be registered as a buyer in the Norwegian Directorate of Fisheries’ register of buyers [26]. In 2021 there were 276 registered fish buyers in the region and 322 landing facilities [16]. Over 90% of the cod is exported, either packed as fresh, whole fish or further processed into other products like fillets, dried and salted fish. Although there are some exceptions, buyers are in general not allowed to own fishing vessels. Many of the buyers are parts of larger companies owning several production facilities and export the fish through their own companies, while others operate as single producers exporting their fish through others.

Accompanying the access and harvesting regulations are regulations directed at MCS, both at sea and upon landing. At sea, the regulations on position and electronic reporting [20,23] require vessels to have on-board position-reporting equipment and report electronically to the Directorate. This includes tools like Vessels Monitoring Systems (VMS), which is a satellite surveillance system for monitoring location and movement, and Electronic Reporting System (ERS) for transmitting fisheries data like catch and landing details to the Directorate. Bigger

vessels (>15 m) must report their position regularly, generally on an hourly basis. All vessels longer than 13 m must report their catch (species and estimated weight) before landing, including information on when, where, and with what gear the fish were caught. There is also a requirement for prior notice on where to land the catch, generally two hours before landing. All fish must be weighed upon landing, and a landing note followed by a sales note are to be filled out by the buyer and signed by both parties [25]. The catch registrations are vital for the resource and quota control, and for statistical purposes. Some countries require catch certificates to accompany the imported fish, and these are issued and approved by the fisher's sales organisations [21].

The main control authorities are the Directorate of Fisheries, including their Fisheries Monitoring Centre, and the Norwegian Fishermen's Sales Organization, both of which are involved in the registration of catches, landings, and sales of fish as well as the physical inspection of fish landings. At sea the Coast Guard and the Sea Control Agency, a branch of the Directorate of Fisheries, conduct physical control of the fishing vessels and their activities. The level of physical control is very low and is based on intelligence, surveillance, and risk analysis. Less than 0.5% of landings are controlled and even less at sea. Most of the MCS is based on self-reporting and is increasingly moving towards digital reporting.

Adding to the fisheries regulations are general rules and regulations on taxes, food safety, and customs that are adopted and enforced by authorities with a wider mandate than just fish sales and export. These are important for understanding the economic aspect of fisheries crime and as instruments to prevent and detect such activities. All exported fish must be accompanied by a paper-based shipping note with detailed information about the load. There are also documentation requirements related to regulations in the import countries like food hygiene and traceability. All exporters must also complete an export declaration that forms the basis for customs duties. In recent years the cooperation and sharing of data between the different authorities has been improved to strengthen the MCS of the fisheries [17].

3. Methodology

We analyse fisheries crime from an environmental criminology approach by conducting a crime script analysis. Within this field of criminology, the focus is on how the surrounding environment creates and shapes crime opportunities. The purpose is to analyse the criminal activity and the settings of criminal acts rather than investigating the characteristics of the offender, based on the assumption that to prevent crime and adopt targeted prevention mechanisms you need to understand the relationship between criminal activity and the immediate environment [32].

3.1. The crime script approach

The crime script analysis, or technique, was introduced by Cornish in 1994. It represented a new way of analysing the crime commission process, with a focus on organising and systematizing the process into separate events and episodes [7]. The approach has been applied within a wide range of crime categories [9]. The crime script is a tool to break down and identify the process of a criminal act step-by-step, including the decision-making needed to carry it out. Cornish [7] included nine steps as a generic structure of the script analysis, which was later simplified to seven steps by Clarke and Eck [6]. The actual crime act is one of the steps. Before this there will be preparation and after the crime is committed there will usually be some efforts to hide traces of the crime. *Preparation* is the very first step and refers to acquiring the necessary tools and selecting co-offenders, *Entry* refers to entering the crime scene, *Precondition* involves facilitating a successful crime act, *Instrumental initiation* is the commissioning of the crime and approaching the goal before the actual crime is carried out in the *doing step*. The two last steps are *Exiting*, leaving the crime scene undetected, and *Aftermath*,

involving necessary steps to reduce the risk of detection.

Scripting the crime commission process is not necessarily following the same steps. In their review of crime scripting, Dehghanniri and Borrion (2021) found that most scripts have been adapted to the crime being committed and the steps have been generated intuitively without following a recognized scripting protocol or a specific method. The number of steps might therefore be reduced or increased according to the objective of the crime script. Scripts can also be conducted at different levels, from a *universal* crime script describing a general type of crime, like fisheries crime, to a very detailed *track* performed for a specific case, like discarding. Universal scripts can be "...abstracted into a set of generalized scenes, which are indeed similar regardless of the scripts they come from" (Leddo and Abelson, 1986, in [7]:160) and can be a useful device for helping to develop fuller and more detailed scripts ([7]). Lower-level scripts, or tracks, are necessary to attain an understanding of the particularity of a particular rule violation.

In this study we identify five scenes when breaking down the fisheries crime commission process. The script highlights relevant regulations and public authorities operating as guardians who should prevent illegalities in the different scenes. Guardians is the term used for formal and/or informal mechanisms, including people such as regulatory inspectors or co-workers and regulatory technologies that can discourage offending behaviours. The presence of ordinary people may also prevent an offender from committing a crime. In this study however, we focus on the formal regulatory authorities as the primary guardians, as we want to identify gaps in the regulatory framework, including capable guardianship, with regards to the scenes in the crime script.

3.2. Data collection

To make the crime script of the coastal cod fisheries in Norway, we started by identifying violations taking place based on a survey by Svorken and Hermansen [30] where fishers and fish buyers listed different ways of engaging in unreported fishing. This was updated by information from fishers in 2021, providing information on some new methods. The different types of violations were then organized according to the crime script model.

The scenes in the crime script were generated based on existing knowledge of how actors in the fisheries sector violate regulations. As unreported fishing in the coastal cod fisheries is a recognised problem by both the authorities and the industry in Norway, the knowledge about different types of violations, as well as challenges in preventing them, is already substantial. Information was gathered through meetings and personal conversations with a reference group of eight key actors involved in fisheries control and development of the national resource control system. This group had representatives from the Directorate of Fisheries, the Ministry of Trade and Fisheries, The Coast Guard, the National Authority for Investigation and Prosecution of Economic and Environmental Crime, the Norwegian Seafood Federation, the Norwegian Fishermen's Association North, and the Norwegian Fishermen's Sales Association. The information was used as a basis for mapping the scenes in the crime script together with document studies of relevant laws and regulations. The script was presented to the reference group for feedback on the different scenes and relevant regulations and guardians. In addition, the script was presented, and feedback was given, in a closed annual meeting on illegalities in the national fisheries arranged by the Directorate of Fisheries, the Tax Administration, and Customs.

4. The crime script of trading unreported fish in a well-regulated fishery

Unreported fishing is a complex issue and involves a wide range of violations, from discarding fish at sea to organized deals between fishers and authorized fish buyers. We have divided them into three scripts based on how they are organised: "Trading of misreported fish between fisher and authorised fish buyer", "Trading of misreported fish outside

authorised fish buyer (side stream)”, and “Discards” (see Fig. 2). For each script there are different tracks, the lowest level in the crime script analysis, denoting the particular type of violation. This way we illustrate how different kinds of unreported fishing are separate actions, but also how they connect to each other in terms of type of crime and regulatory framework. Even though violating the same regulations, each of the tracks involve different actions.

While dumping fish at sea is a common track in the Discards script, sales of fish from tourist fishing and sale of fish meant for consumption within the fishers’ families are examples of tracks taking place in the Side streams script. Most offences, however, takes place when the fish is landed and traded between the fisher and the authorised fish buyer with incorrect numbers on the landing note. This script we have called ‘Trading of misreported fish between fisher and authorised fish buyer’. All the tracks in this script are part of the same supply chain, from harvesting at sea, landing, and processing to export out of the country (domestic consumption accounts for about 5% of the total catch). The fish enters into the same supply chain as the correctly registered fish, where it is mixed and traded together [29]. The National Authority for Investigation and Prosecution of Economic and Environmental Crime regards this type of crime as critical [33], with reference to the high value of the unreported fish that is withheld from the community and hidden from taxation. When scripting the crime commission process of unreported fishing in a well-regulated fishery, we therefore focus on making a script of fish traded between a fisher and an authorised fish buyer.

4.1. The crime script scenes

The script of unreported fishing in the Norwegian coastal cod fisheries can be grouped into five key scenes; *Conspiracy*, *Positioning*, *Concealment*, *Falsification*, and *Disguise*, as illustrated in Table 1.

The first scene, *Conspiracy*, refers to the decision to not report correctly. At some point a dialogue needs to be established between the fisher and the buyer. While some have an agreement on delivery before they start fishing, others start the dialogue at a later stage when the catch is known. The scene might therefore unfold throughout several stages of the crime commission process, especially overlapping with the *Positioning* and the *Concealment* scenes and culminating with the misreporting in the *Falsification* scene. It is common for vessels to relate to one buyer, often the local, where they have established practices for conducting the trade. The dialogue between the fisher and the buyer continues when the fish is landed, and they agree on the price based on the quality of the catch. It is worth noting that the buyer might organise multiple conspiracies with different vessels at the same time and carry out a series of irregular transactions throughout the day.

The *Positioning* scene refers to the actions needed to take place for the misreporting to happen. For the fisher this involves the decisions on where to fish and land the catch. Here the vessel size is important. The small vessels usually fish nearby their home community and are more dependent on landing the fish at the closest buyer. Bigger vessels can transport the fish over longer distances and can therefore be more selective on both the choice of fishing ground and buyer. The fish buyer does not necessarily need to make any actions to facilitate the incorrect reporting before the catch is landed and it does not have to be pre-planned to misreport. In the peak season when large quantities of fish are landed in a short period of time, the capacity of the processing plants might be overloaded. A possible action for the fish buyer is to reject vessels in favour of those who engage in unreported fishing.

In the *Concealment* scene, the parties might prepare for the incorrect reporting by hiding signs in the estimated catch numbers and in the weighing of the catch. Before entering the port, the fisher electronically reports the catch and port to the Directorate of Fisheries. If the crime is replanned, the fisher might intentionally underreport the estimated

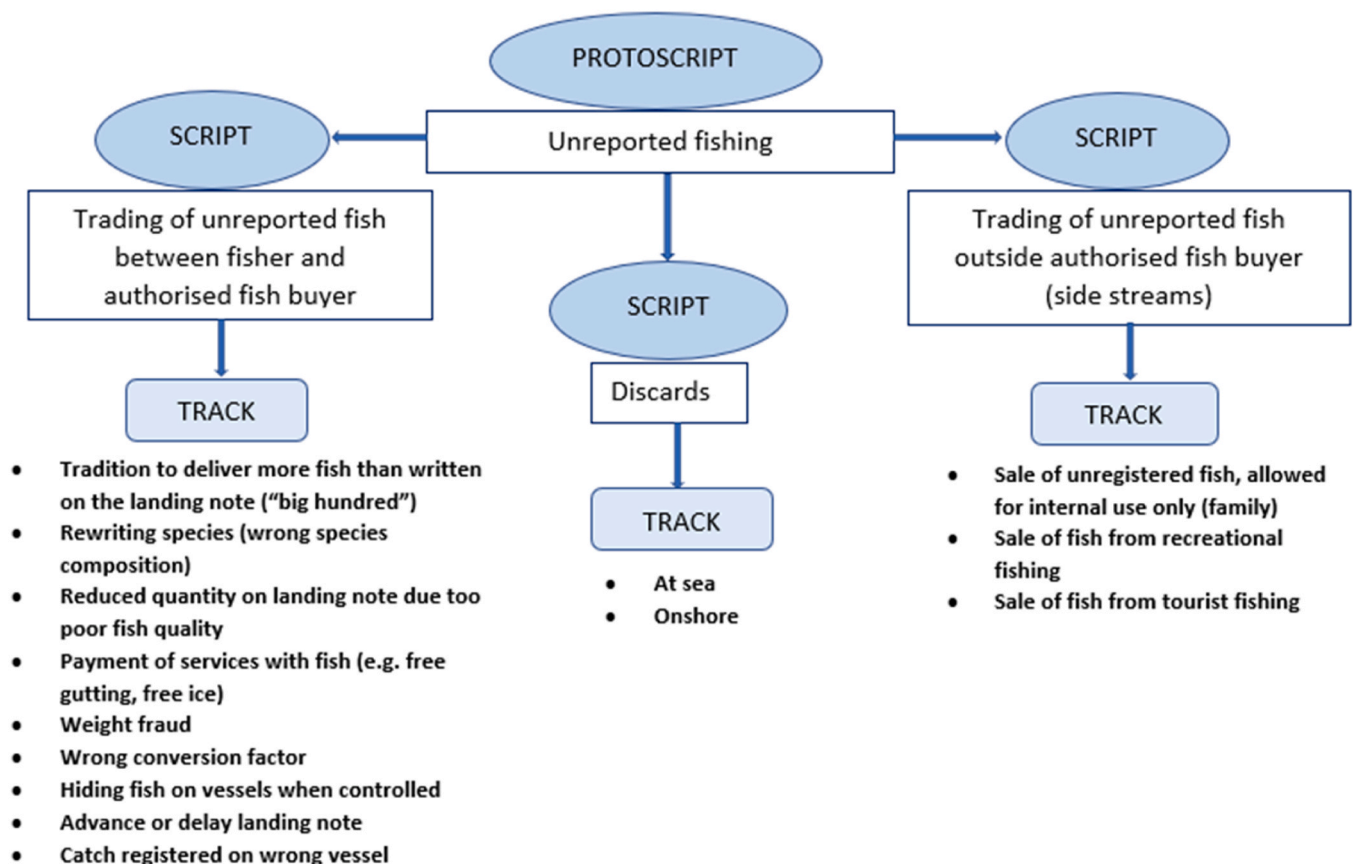


Fig. 2. Different violations and ways unreported fishing that take place in the Norwegian coastal cod fisheries.

Table 1
The crime script of misreported fishing in Norway and associated regulations and public guardians.

Scene	Script actions	Regulations designed to prevent unreported fishing	Authorities acting as guardians		
Conspiracy	- Dialogue between fishers and buyers				
Positioning	- Choose fishing ground - Fish - Choose a port and buyer - Buyer might reject vessels in favour of the ones engaging in unreported fishing or vice versa	- Harvesting regulations - Regulation on food hygiene	Directorate of Fisheries Food Safety Authority	Fishermen's Sales Organisation	Coast Guard
Concealment	- Vessel might misreport catch and landing site to the Directorate - No presence of physical control - Weigh catch with scale manipulation, or avoid weighing part of the catch	- Landing Regulation - Regulations on ERS for Norwegian fishing vessels - Regulation on requirements for non-automatic weights - Regulation on food hygiene			Metrology Service
Falsification	- Write the landing note with incorrect information	- Landing Regulation - Act on first-hand sale - Accounting Regulation			
Disguise	- Production of final product and mix the unregistered fish with the registered fish - Store the fish - Pack the fish - Sales and export - Possible misreporting on export papers	- Landing Regulation - Catch certificates - Customs Regulation			Customs Tax Administration

catch. There are different methods for avoiding weighing the whole catch. Part of the catch might be sent into production without being weighed, or the scales are manipulated to show less than is landed. The presence of guardians, mainly the Directory of Fisheries and the Fishermen's Sales Organisation, can disrupt planned violations, so a very important precondition is to make sure that there are no control activities when landing the catch. If there is, the landing note will be correct. However, if there is a big discrepancy between the information reported electronically at sea and the landed catch, the vessel might be sanctioned for unreported fishing.

The actual violation is providing incorrect information about the catch on the landing note. The landing notes provide the basis for the authorities' documentation of catch and first-hand price, also used for the payments-arrangement between fisher and fish buyer, accounting, and taxation. The catch information also forms the basis for calculating the annual quotas. The violation of the resource control regulation and the economic crime therefore takes place at this stage. In our script this is the *Falsification* scene. The Landing Regulation requires both the seller and the buyer to be present when the catch is weighed, and the landing note written. However, this is not always the case, especially in the busy high season. Even if the vessel operator does not witness the weighing of the catch or leaves port before signing the landing note, both the seller and the buyer are responsible for the correct completion of the note. If a

physical control is carried out after the landing of the catch but before it is sent into production and a discrepancy is revealed, both the fisher and the buyer are to be sanctioned.

The Disguise scene is about post-crime activities that cover up the violation. It involves sending the fish through production, storing, and finally the transport and export. This scene involves several steps, depending on the final product, like gutting, salting, drying, and cutting into main products and by-products before being packed and sold. The different steps in the production might involve weight loss and splitting the fish into several parts. This makes tracing and record keeping difficult because there will be a discrepancy between the original weight of the fish and the fish sold, thereby creating good opportunities to hide unregistered fish, and making mass balancing of input and output numbers difficult. The violation in this scene is conducted unilaterally by the fish buyer. A possible, but not necessary, action for the fish buyer is to underreport fish on the export papers, avoiding both taxes and customs and at the same time disguising the earlier un- or misreporting on the landing notes. In the same way the fisher unilaterally can violate regulations, i.e., by discarding fish at sea or selling it outside an authorized fish buyer.

For each scene in the crime script there are laws and regulations that actors should comply with (Table 1). The only scene with no associated regulations is the *Conspiracy* scene. The dialogue between the parties is

difficult to regulate because it is a necessary action in the trading of fish in the coastal fisheries and it is generally not based on any written or digital communication. The *Positioning* scene mainly takes place at sea, and in addition to the obligation to land all the catch the most important regulations related to resource control are on quotas and registration of the estimated catch. In the scenes taking place when the fish are landed and processed, the main regulations are the Act on first-hand sales and the Landing Regulation. The first forbids trading and processing of wild marine resources outside an authorised fish buyer, while the Landing Regulation provides provisions on catch/landing reporting, reporting procedures, and requirements for record keeping throughout the production. The Customs Regulation requires that every consignment of fish that is exported is to be accompanied by a shipping note, providing information about the amount, species, where it is from, etc.

Furthermore, the table shows the authorities responsible for enforcing the regulations. The Directorate of Fisheries is the authority with competence to monitor and control the fisheries throughout the whole value chain. Their physical presence at sea or in port is the most likely to interrupt the crime before completion. Together with the Coast Guard and the Fishermen's Sales Organization they conduct physical controls of the catches. In addition to the physical controls, data collection and -management are important tasks in the risk-based control work. The Food Safety Authority, the Metrology Service, Customs, and the Tax Administration are other authorities that might be present at the processing plant, either alone or as part of joint controls with the Directorate of Fisheries. Their main task, however, is not on catch control, but on other issues like food safety, control of the scales, customs, and taxes. Irregularities detected in their control activities will be sanctioned based on rules that are broken within their respective regulations. However, they might be in the position to suspect that misreporting is being camouflaged and their presence probably has a preventive effect. They should also share their information with relevant authorities.

Table 1 summaries the script with the five scenes detailing the crime commission process, accompanied with the regulations and authorities in place to prevent unregistered fish from entering the supply chain, thereby describing the regulatory environment of the fisheries industry in Norway.

5. Intervention points and prevention mechanisms

The assumption in environmental criminology is that to adopt appropriate prevention mechanisms you need to understand the relationship between crime actions and the environment. When applying a crime script approach, the crime commission process is described to identify possible intervention points likely to disrupt the crime.

When scripting unreported fishing in the Norwegian coastal cod fisheries, we first identified actions needed for the crime to take place. It shows relevant regulations and official guardians, but not the risk of control and possible detection of violations or the level of sanctions, all critical points to prevent misreporting. In Norway, catch reporting is basically based on trust and self-reporting through digital tools like VMS and ERS at sea and the digital transfer of landing notes. It is acknowledged that these mechanisms are not sufficient to ensure compliance, and violations still take place. Which intervention points and prevention mechanisms are present, and where they are lacking, are therefore pertinent questions. Below we present recently implemented and suggested prevention mechanisms and discuss their preventive effect and possible unintended effects. Further, we discuss identified intervention points where prevention mechanisms are still lacking and present some possible tools to be considered.

The authorities have in recent years introduced several prevention mechanisms to improve the resource control and prevent illegal activity. The implementation has, however, turned out to be difficult. Physical control of landings is highlighted as the most effective way of preventing unreported fishing, but the landing pattern in the Norwegian coastal cod

fishery makes it impossible to physically control all the 56,000 landings at the more than 300 landing stations. Other prevention mechanisms have therefore been developed, such as introducing new control points in the supply chain and applying digital tools. As the weight of the fish changes during the production due to factors like gutting and splitting into different parts, water loss, maturation, the quality of the fish, and warehousing, there are good opportunities for hiding unregistered fish in the *Disguise* scene. In 2014 the Landing Regulation [25] were revised to ensure detailed record keeping throughout the production. Many of the companies were however not able to fulfil all the new requirements, like keeping the catches from the small vessels separate until the landing note is written and keeping the production log as detailed as required. Most of the new requirements were therefore withdrawn, and the efforts to adopt situational prevention mechanisms in the *Disguise* scene mostly failed.

A more successful prevention mechanism introduced for the big scale pelagic fisheries [4,25] to ensure correct registration and record keeping of the catches, was directed at actions taking place in the *Concealment* scene and involved the requirement for the use of electronic scales. The Directorate of Fisheries and the Metrology Service have proposed this to be mandatory also for landings of white fish, where manual scales are used today. With electronic scales the weight of the fish from a vessel will be directly transferred to the Directorate of Fisheries and any later corrections will be visible to the authorities. Writing a different number on the landing note than what is on the scale will therefore be suspicious. A new prevention mechanism is therefore introduced. It is still possible to create side streams of unweighted fish, and the preventive effect would be improved if combined with the withdrawn requirements on detailed record keeping in the Landing Regulation. The introduction of new intervention points and increased risk of being detected in the *Disguise* scene would most likely have a preventive effect. The big variations in company size and production lines among the fish producers however makes it difficult to apply the same tools for all companies. To disrupt the crime in this scene has therefore proven to be particularly challenging with universal rules for the industry.

In the harvesting stage the resource control has been improved by requiring reporting of the fishing activity electronically while at sea. With ERS, catch numbers submitted at sea can be balanced with the landing numbers both electronically and when performing physical landing controls. If the discrepancy between the reported catch and landed catch is too high, the vessel will get an infringement fee. However, the electronic catch report at sea is based on estimates because the vessels are not obliged to carry scales on board. Therefore, the uncertainty in the numbers makes it an unsuitable tool for detecting crime without a physical control of the catch. The vessels must report when a fishing trip starts and to give prior notice of landing port. This information is used to target the control to specific vessels and fish buyers. The electronic catch report is therefore a useful tool in the risk-based planning of physical controls and might have a preventive effect on the fishers' inclination to misreport. As such, this could serve as a good example of interrupting the crime by introducing a new prevention mechanism.

Interrupting the crime in this way, however, also creates the opportunity to misreport on the landing note without violating the ERS Regulation. When estimating the catch at sea some margin of error is allowed. The Regulation does not address this, but an established practice is to allow a 10% deviation from the weight registered at the landing. If the underreporting is pre-planned, the fisher intentionally estimates the catch to be 10% less than the actual catch in the electronic report. If there is a landing control, the number on the landing note will be 10% higher than in the electronic report, which is considered acceptable. However, if there is no physical control, it is possible to underreport even more (up to 10% less) and still be within this margin of error. The result is the registration of 20% less fish than caught, or the delivery of 20% more fish than registered, fish that are not included in the resource estimates and that evade taxation. To decide whether

under-estimated catch in the ERS report is a mistake or planned fraud is difficult, hence the margin of error provides a handy rationalisation if caught for those with pre-planned intentions. However, if the fisher fails to provide accurate estimates of the catch without having an intention to underreport on the landing note, the introduction of the ERS has created a new type of violation where vessels may be sanctioned. This especially applies for the smallest vessels where it is more difficult to accurately estimate the catch. Another aspect is the distribution of costs between the vessel and the fish buyer. If the crime is interrupted before landing, the fisher is sanctioned for misreporting in the ERS, while the buyer is not held responsible. If the misreporting is pre-planned, the vessel will bear all the cost, illustrating the complexities of effects of introducing prevention mechanisms.

Another prevention mechanism further down the value chain is catch certificates. Many countries require catch certificates to document the legality of imported fish. In Norway the certificates are based on the landing notes and could be used to balance the landing and export numbers. The catch certificate system of today, however, is not good enough due to the lack of documentation of the processing of the fish (cfr. the failed revision of the Landing regulation). Furthermore, the fish will in most cases already be exported when a possible discrepancy between landing notes and catch certificates is discovered, and the possibility to prove and sanction the misconduct is then impossible. The Directorate of Fisheries and CatchCertificate (an organisation owned and run by the five Norwegian Fishermen's Sales Organisations) are, however, working to improve the system to make it useful in resource control as well as applying it in crime intelligence.

One essential issue in the crime commission process is the decision to misreport. In the crime script we refer to this as the *Conspiracy* scene. We highlight the dialogue between the fisher and the fish buyer, but there are also cases where the fisher unilaterally misreports (discards) and cases where the fisher claims to be defrauded by the buyer, especially among the smallest vessels. These fishers are not always observing the weighing of the catch or present when the landing note is written, despite required to. In these cases, the buyer may unilaterally decide to misreport. A critical aspect here is the power balance between the fisher and the buyer. When access to fish is good during the winter fisheries or in years with high quotas, the buyer may have the power to push the small vessels to accept the quantity and price written on the landing note and to deliver more fish for a lower price. For the larger vessels the balance of power may, on the contrary, be the opposite, especially when access to fish is poor. When the misreporting takes place in agreement between the parties, a dialogue needs to be established before the *Falsification* scene. Interrupting the dialogue would be a way of interrupting the crime. The intervention point is, however, conditioned by when and how the dialogue takes place because the dialogue probably is dependent on the type of misreporting (e.g., unilateral weight fraud, agreed reporting of less fish, wrong species, or wrong conversion factor from gutted to whole fish). Sometimes the misreporting takes place when a challenge arises. The misreporting might also be planned for the whole season as an informal contract between the fisher and the fish buyer. This script is too general to distinguish between the dialogues taking place in the different tracks, which clearly requires different prevention mechanisms at different intervention points.

One possible intervention to prevent the opportunity to plan misreporting is an auction system, where the fish are sold to the highest bidder, administered by a neutral party like the Fishermen's Sales Organization. Such an arrangement is already in place for frozen fish, generally applying to the ocean-going fleet. The buyer would then be unknown, making it difficult to plan to conduct fraud by offering a lower catch than the actual one. An auction system would primarily work for the bigger vessels in the coastal fleet able to sail longer distances. Another possibility, suggested by the Fishermen's Sales Organization, is to make the first-hand sales prices public. If the first-hand price per kilo deviates greatly from the average, this is an indication of unreported fishing. This information is available to the guardians (i.e., the Fisheries

Directorate and the Sales Organisation), but making it public would allow for guardianship from competitors. Transparency contributes to social control and may have a preventive effect. However, purchase price is considered a trade secret, and the Norwegian Seafood Federation (the fish companies' industry organisation) claims transparency in real time will undermine the competitiveness of the industry in the international market. When considering prevention mechanisms, trade-offs will have to be made between enhancing resource control and taxation, and the industry's competitiveness in the international market.

In script analysis the focus is initially on preconceived non-compliance. In the case of unreported fishing, however, there can be different entry points. Misreporting is not always pre-planned but may unfold responsively in a particular situation. Especially the *Positioning* and the *Concealment* scenes may play out differently depending on this. With a preconceived plan to misreport, the fisher will consider who to sell the fish to, whereas a more responsive fraud may not involve such positioning. Similarly, a fisher will not consciously underestimate catch without an intention to underreport. To differentiate between entry points is therefore important when identifying intervention points and introducing prevention mechanisms. New prevention mechanisms often incur expenses, involve increased administrative reporting, and are often met with scepticism and resistance. From a regulatory perspective, interventions should interrupt the crime commission process and prevent the crime. Measuring the impact, or success, of a prevention mechanism in the fisheries sector is, however, difficult. The scope of unreported fishing is unknown and there are few serious cases detected, probably due to the low level of physical control and lack of verifiable data throughout the value chain. Minor offences are subject to an infringement fee with no further consequences for the offender. The low risk of being caught is considered a main challenge of the regulatory system. A prerequisite for new measures to be preventive is therefore that they have legitimacy in the industry and enhance compliance.

6. Conclusion

The crime script analysis describes the crime commission process of fisheries crime in the Norwegian coastal cod fishery. By breaking down the criminal activity into separate scenes and actions and connecting them to relevant regulations and authorities, we identify how offences occur and reveals the challenges facing the resource control.

The script details the extensive crime commission process, spanning the entire supply chain from fishing at sea through landing and processing to export. It involves both the fishing fleet and the industry on land, either individually or together. MCS mechanisms to prevent illegalities are present, but the script reveals intervention points where preventive mechanisms are lacking, especially in the dialogue between fisher and buyer (the *Conspiracy* scene) and in land-based control (the *Disguise* scene).

The analysis demonstrates the diversity of fisheries crime throughout the supply chain. This illustrates that unreported fishing should not be considered as a single problem, but rather as different offences conducted by actors in different situations, alone or together. As the preventive effect depends on the specific violation, finding universal prevention mechanisms for unreported fishing is difficult. A systematic analysis of the drivers could inform development of new mechanisms. The crime commission process is shaped by both structural and situational factors like fishing practice (vessel size, fishing gear, fishing season, quality of the fish etc.) and the type of production (fresh, salting, etc.) because the opportunities for misreporting are different. Quota fluctuations and market conditions, and the functioning and legitimacy of the regulatory system itself, are also critical factors influencing the actors' behaviours. When considering the preventive effect of a prevention mechanism, like the ERS or electronic scales, the environments shaping the opportunities for different actors should therefore be considered.

When linking prevention mechanisms to different steps of the crime

this study provides a better understanding of the connection between the organisation of the crime commission process and the resource control system. As such, the crime script technique is a useful tool when searching for new and different intervention points to prevent fisheries crime as well as evaluating existing prevention strategies. In the Norwegian coastal cod fishery, the conspiracy scene is identified as the only scene with no associated regulations, revealing the need for more information about how the decision to engage in unreported fishing takes place. How to interrupt this scene is, among others, dependent on the power balance between the actors and whether it is per-planned or not. The script also shows how the newly implemented ERS-regulation pose some challenges and might have limited preventive effect. When considering new prevention mechanisms, trade-offs will have to be made between enhancing resource control and other considerations.

According to situational crime prevention theory, measures ought to be directed towards five specific mechanisms, namely increasing the effort for the offender, increasing the risk of detection, reducing the rewards, reducing provocations, and removing excuses [5,8]. In the Norwegian resource control, the effort has been centred around the first two mechanisms with the focus on compliance by design and technological solutions. Our analysis shows that compliance by design will not solve all types of unreported fishing. Even with the introduction of digital tools like ERS there are still good opportunities for pre-planned misreporting, and new challenges arise with it. Conducting a crime script on a track level, scripting a specific action of misreporting (like using another conversion factor or reporting less fish than what is landed), and analysing the deeper contextual drivers that influence the choices and behaviours of the industry actors could contribute to identifying other prevention mechanisms.

Author contributions

All authors contributed to the analysis and the writing of the manuscript. All authors read and approved the final manuscript.

Data availability

The data that has been used is confidential.

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