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Article

# Ethics and compliance in the common fisheries policy

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**Abstract:** Public oversight of the law is an important subject for Economics, with a special link to Ethics. IUU (Illegal, Unreported and Unregulated) Fishing is one of the most obnoxious problems that persecute the development of the fisheries sector, worldwide. The political, economic, social and environmental issues involved with “crime and punishment” problematic are absolutely relevant. Currently, the European Union is taking an “on-going” reform of the so-called Common Fisheries Policy (CFP). One of the fundamental points in discussion refers to the Monitoring and Control system. This article explores these issues. The analysis combines the fundaments of the basic bio-economic model of fisheries with Becker's theory of “Crime and Punishment” and it is applied to the CFP case.

**Keywords:** ethics; law; enforcement; illegal behavior; compliance; common fisheries policy; green development

## 1. Introduction: Enlightened anthropocentrism and fisheries

The literature on Environmental Ethics assumes that the traditional (western) ethical perspective is anthropocentric. Value is assumed from a human and utilitarian perspective, that is, humanly centered. It follows Aristotelian logic (Nature created all things for the benefit of Human Being); and it has its foundations in Judeo-Christian thought (Human Being was created in the image of God, hence his primary position in the organization of the Universe).

In this literature there is a distinction between the instrumental value (that is, the value of things as a means to an end) and the intrinsic value (the value of things in themselves, regardless of their utility). When, in the early 70s, Environmental Ethics emerged as an independent discipline, a change in the positioning was observable. The moral superiority of Human Being was questioned and the possibility of rationalizing an intrinsic value for Nature was investigated, regardless of its importance in human terms. These circumstances have given rise to a "soft" or enlightened anthropocentrism, a kind of prudential anthropocentrism. This Enlightened/Prudential Anthropocentrism suggests concerns with aspects such as regulation and economic policy, in a broad sense, visible in the conceptualization and methodological posture of the Economics of Natural Resources and the Environment. There are, in fact, more "profound" proposals, such as the so-called "Deep Ecology", which go so far as to reject individual atomism and the essential role of Human Being, deepening the intrinsic value of Nature. But the most usual position is the one that brings us closer to the view of the referred soft anthropocentrism. The case of fisheries is, in this context, very suggestive to assess these issues from an empirical perspective.

92The case of fisheries is unique. First, we highlight the creation of the Exclusive Economic Zones (EEZs), as a consequence of the approval of the paradigmatic new Law of the Sea (abbreviately, UNCLOS 1982) (United Nations, 2024). Moving away from the (secular!) principle of the "freedom of the seas" and creating exclusive fishing property rights for coastal states, a new ethical position is revealed.

Since the 50s, the fundamental result of modern Fisheries Economics states that, in conditions of free access and competition, the market does not lead to socially efficient solutions in the allocation of the resources. The “common property” nature of fish resources and the presence of externalities in the capture process lead to market equilibrium solutions that imply the overexploitation of the resources and the overcapacity in the sector (Gordon, 1954; Scott, 1955; Schaeffer, 1957). That means we will not have an “invisible hand” that steer the sector towards the optimum. In fact, the sector development will be conducted to a clear example of the Hardin’s “Tragedy of the Commons” (Hardin, 1968).

In his famous Science’s article, Hardin stressed that “freedom in a commons brings ruin to all" (Hardin, 1968). In the case of fisheries, the pursuit of individual interest leads fishermen to a "prisoner's dilemma" in which no agent has incentive to conserve resources. What is interesting is that the ethical stance proposed by Hardin is already "nuanced". Despite the traditional defense of freedom as a fundamental value, and the western societies "horror" to the word coercion, sometimes, facing the evidence of tragedy, according to Hardin, the coercion/regulation may be justifiable. The need to conserve resources requires a perspective of regulating the activity of the agents. An ethical position close to the enlightened anthropocentrism is revealed: the "necessity", the value of sustainability in the future, the conservation objectives, all impose themselves in this new positioning more focused on economic policy and green development.

The European Union's Common Fisheries Policy (CFP) and, in particular, the Control and Monitoring system (one of CFP most important constitutive domains) is a good example of this kind of preoccupations and constitutes a relevant empirical case to study those issues.

## 2. The problem(s) and the methodology

Public oversight of the law, that is, the use of public agents to detect and sanction violators of legal norms, is an important, theoretical and empirical, subject for Economics, with a special link to Ethics. Early literature came from the eighteenth century, especially with authors as Beccaria and Bentham. Interestingly, after Bentham's sophisticated analysis, the topic lay essentially dormant in economic studies, until Becker's influential 1968 paper, "Crime and Punishment: An Economic Approach." (Becker, 1968; Polinsky and Shavell, 2000)

From the point of view of Economics, the problem can be seen as an externality. This externality arises because exclusive property rights are absent. This absence depends, among other things, on the costs of defining and enforcing exclusivity (Cheung, 1968; Alchian and Demsetz, 1993; Demsetz, 1967). We add that the establishment and enforcement of a system of rights depends on considerations of efficiency, certainly; but, also, on the individual preferences, and the ethical, political,

and social realities of a community, including the lack of means, or other insufficiencies, of the administration, to enforce legal rules (Coelho, Lopes and Pires, 2020).

Despite the importance of the topic, the issues of control and enforcement were ignored in the study of fisheries management. The article explores this issue with a formal model to show how fishing companies' behavior and fishing policies are affected by law enforcement. The analysis combines the fundaments of the basic bio-economic model of fisheries (Gordon/Schaefer model) (Clark and Munro, 1975; Clark, 1985; Scott and Munro, 1985) with Becker's theory of "Crime and Punishment" (Becker, 1968). Mathematical conceptualization of expected utility is in the center of this analysis and supports a rule of optimal behavior for a "homo economicus", rational operator: for a given stock size, the company sets its catch rate at a level higher than the allocated quota, where marginal profits equal the expected marginal penalty (Sutinen and Andersen, 1985).

In methodological terms, the approach to the problem is carried out in two stages. In the first, we approach the generic literature on the problem of "crime and punishment" and try to transpose and adapt it to the particular case of fisheries. We highlight the "inspiration" from mathematics conceptualization of expected utility in this development, even if there are some criticisms about the use of this concept.

In the second phase, we approach an extensive literature on the Control Regime of the Common Fisheries Policy, including regulations, discussion/debate texts of the European Commission and the European Parliament, and, notably, the seminal documents, from the 70s and early 80s, that explicitly, or implicitly, define the philosophy of intervention in this area. The objective is to assess the extent to which the resulting regulation confirms the ethical predictions and good theoretical indications that have been assumed previously: The conclusions of the theoretical model are used to discuss the design of the control regime of the European Union's CFP, and the ethical concerns that underpin this control and management regime.

## 3. The conceptual framework

### 3.1. IUU fishing

By definition, anything that is a violation of the law is illegal.

Illegal fishing has always existed. In recent decades, there has been a sharp increase due to technical progress in the motorization of fleets, freezing and transshipment. On the contrary, new equipment for detecting and catching violators of the regulations has been introduced, facilitating enforcement procedures.

The environment of "creeping jurisdiction", underlying the entire evolution of international maritime law, has put (almost) an end to the principle of free access. The creation of EEZs, and the slow slippage into the sphere of jurisdiction of coastal states of areas and resources previously considered international common property, brought new possibilities for regulating and conserving resources. The need for monitoring and controlling fleet activities in regulated areas has increased.

Illegal fishing, from a European perspective, encompasses a range of behaviors that can occur at various levels: national, European Union and international. It is impossible to quantify or qualify violations. They happen at all levels and take

different forms, at different times. Some infringements are detected, but many remain unidentified. Infringements take the traditional forms of fishing beyond the permitted quota or the use of unauthorized mesh sizes, but they are also present in many other situations as, for example, unauthorized by-catches, or transshipment at sea. Illegal fishing occurs at all stages of fishing activity. Fraud can occur along the entire production chain, from capture to marketing. The possibilities for fraud after landing are immense.

Part of the blame lies with national administrations. Its ineffectiveness in controlling activities is the fundamental reason for many inspection problems. But there are also many difficulties at the international level. Beyond the limits of EEZs, national jurisdiction stops, and the capacity of intervention, in areas where the principle of the free access still persists, is a problem. The proliferation of the so called "flags of convenience" is a clear example of Illegal, Unreported, and Unregulated (IUU) Fishing, as it has been highlighted by the United Nations and the specialized agencies, FAO (Food and Agriculture Organization) and IMO (International Maritime Organization) (Coelho and Filipe, 2021; Temple, Skerritt, Howarth et al., 2022).

### 3.2. "Crime and punishment": modelling the fisheries case

The issue of control and enforcement has, always, been the neglected element in Fisheries Management (Sutinen and Hennessy, 1986). The analysis of fisheries enforcement we follow combines the basic model of Gordon/Schaefer with Becker's theory of "Crime and Punishment".

To avoid the tendency to over-exploit resources is the fundamental objective of fisheries policy. Methods of regulating and reducing fishing effort towards green development include direct and indirect restrictions, such as total allowable catches (TACs) and non-transferable quotas, licenses and other forms of entry limitations, technical conservation measures (closures and protected areas, limitation of net mesh size and size and technology of vessels, minimum caught fish dimension, quality restrictions, among others), pigouvian taxes and other "green taxes", transferable individual quotas, etc. (Clark, 1985; Carr and Heyman, 2016; Coelho, 1989; Scott, 1979; Nostbakken, 2008).

Suppose that, whatever means are used to reduce catch rates, any level of catch above the quota level allowed for a particular fishing enterprise, q*, is illegal. If we assume a system of non-transferable individual quotas, the amount of the single proprietorship's catch above its quota ($q_i$ - $q_i$*), $q_i > q_i$*, is illegal.

If this fraud is detected and condemned, a penalty is imposed on the company with a value given by f, such that:

$$f = f(q_i - q_i^*), \quad (1)$$

where $f > 0$, if $qi > qi^*$, and $f = 0$, in the opposite case; with $df/dq > 0$ and $d^2f/dq^2 > 0$.

Hypothetically, the function f(.) is continuous and differentiable. The penalty has a finite upper limit, and all companies face the same standard of penalties.

Under these conditions, the profit of a sole proprietorship before the penalty is given by:

$$\Pi_i(q_i,x) = p\, q_i - c_i(q_i,x), \quad (2)$$

where p denotes the price of the fish, x is the size of the stock, and c(.) is the cost function.

We assume that companies are price-takers.

Suppose that the probability of detection and conviction is given by Θ and, for simplicity's sake, let us assume that all firms face the same probability.

If the violation is detected and duly condemned, the company's profit will be:

$$\Pi_i(q_i,x) - f(q_i - q_i^*), \quad (3)$$

Otherwise, it will be $\Pi_i(q_i,x)$.

So, the expected profits are:

$$E(\Pi) = \Theta[\Pi_i(q_i,x) - f(q_i - q_i^*)] + (1 - \Theta)\Pi_i(q_i,x). \quad (4)$$

Assuming that firms are risk-neutral, each $q_i$ is determined by the first-order condition:

$$\Pi'_i(q_i,x) = \Theta f'(q_i - q_i^*), \quad (5)$$

The equation has a clear economic significance. The model supports a rule of optimal behavior for a rational operator. It states that for a given stock size (x), the firm sets its catch rate at a level that exceeds its quota when the marginal profits equal the expected marginal penalty. If there was no penalty for fishing beyond the legal quota, or if there was no probability of being detected and convicted, ($f = 0$ or $\Theta = 0$), the company would determine its catch by the free-access catch rate, i.e. the one which is equivalent to the total dissipation of rents (Clark and Munro, 1975). In a regulated and supervised fishery, a fishing company must establish its compliance conduct by considering the potential marginal gains, that is, the expected utility resulting from two different events: going into fraud, being detected and paying the fee that is associated; and the possibility of going into fraud and not being detected. This means that the size of the penalties and the probability of detection are central variables in this game.

This approach also reveals the importance of empirical studies trying to estimate the factors that ensure compliance with the regulation. According to Stigler (Stigler, 1970), public authorities have four basic means to improve compliance: minimize the chances of non-detection of violations, that is, increase Θ; maximize the likelihood that sanctions will actually follow the detection of breaches; speed up the monitoring process, from detection to the allocation of sanctions; increase the size of penalties (increase of f).

There is a dispute among experts about the best alternatives. Other authors highlight the level of expenditure oriented towards monitoring activities. Sutinen and Andersen (1985) examine how optimal management policies are affected by costly, imperfect enforcement. To detect and convict violators require inputs: patrol vessels, aircraft, police, judicial personnel. The quantities of such inputs can be represented by a vector k, which has an associated vector of unit prices. The probability of detecting and convicting fraud is assumed to depend on the inputs:

$$\theta = \theta(k). \quad (6)$$

Assuming that the least cost combination of k is chosen for each level of k, one can introduce an enforcement cost function.

Optimal policies are based on the usual criterion of maximising the discounted sum of net social benefits. In each period these net benefits are given by:

$$\int_0^q p(q)\,dq - c(q,x) - E(q,x), \tag{7}$$

where p(q) is the inverse demand function, c(q,x) is the aggregate cost catch function, and E(q,x) is the enforcement cost function. The aggregate cost function depends on the fixed set of quotas and doesn't include penalty fees, and, since quota allocation is assumed exogenously determined, q* is suppressed as argument in the enforcement cost function. Then, one introduces the usual stock dynamics standard differential equation:

$$\dot{x} = F(x) - q, \tag{8}$$

where F(x) is the natural growth rate of fish stock.

Optimal policies are found by maximizing:

$$\int_0^\infty \left[\int_0^q p(q)\,dq - c(q,x) - E(q,x)\right] e^{-\delta t} dt \tag{9}$$

$$\text{subject to } \dot{x} = F(x) - q,$$

where the parameter $\delta$ is the discount rate over time.

We solve the problem with Optimal Control Theory/Maximum Principle of Pontryagin (Dorfman, 1969; Clark and Munro, 1975). First we construct the Hamiltonean and then apply the Optimality Conditions of Pontryagin (Pontryagin, 1986). In this context, we are conducted to a transformed golden rule that determines the steady-state optimal size stock, the optimal catch rate, and the resulting price.

Interesting conclusions are made if we compare this result with the situation where we assume costless and perfect enforcement, that is, when catch rates are perfectly controlled at zero cost (Clark and Munro, 1975). By comparing the two golden rules it can be concluded that the presence of costly, imperfect enforcement results in a smaller optimal stock size than otherwise; higher enforcement costs result in a lower optimal stock. The rationale is the following: Assuming that some kind of quota system is in effect to regulate access, enforcement would involve monitoring the compliance with these quotas and assigning penalties on those found in violation. If the quotas are so large as to be consistent with free access equilibrium, enforcement costs would be zero: no enforcement would be necessary to ensure compliance. But, moving away from free access equilibrium increases both net benefits and enforcement costs. In the model, as the steady-state population size is increased, marginal enforcement costs increase and marginal net benefits decrease. At the efficient population size, with enforcement costs, the net marginal benefit equals the marginal enforcement cost. This necessarily involves a smaller population size than the efficient population size ignoring enforcement costs (Tietenberg and Lewis, 2018).

## 4. Ethics and compliance in the common fisheries policy

### 4.1. The philosophy of the regulatory regime. ethical emphasis

The main objective of the Common Fisheries Policy is to ensure the sustainable exploitation of fisheries resources. CFP is the second really supranational Common policy, the other being the Agricultural Common Policy (in fact, the CFP's first inspiration). In this context, the Community rules must be applied effectively and uniformly. The results of fisheries policy depend on the compliance of the operators

involved with the rules of the CFP. Member states are responsible for ensuring the correct application of the rules on their territory. To ensure fairness in the Union's control and monitoring, the Commission's inspectors supervise the activities of the national services. Periodically, the member states must report to the Commission on several aspects of their enforcement activities.

From its formal beginning, in 1983, the Blue Europe/CFP has attached particular importance to the issue of control and has placed a strong ethical emphasis on its definition. Our reflection highlights the philosophy of intervention that the Community has adopted in the formulation of the fisheries policy (Coelho, 2018; Borges, Cá, Coelho et al., 2021). From the outset, the Commission rejected a liberal proposal that would only determine a set of common rules for the access to the activity, and declared itself in favor of a policy of effective regulation that would contain the over-exploitation of resources that could result from free access to Community waters.

In its first design, fisheries policy reflected a balance between two contradictory principles: the principle of free establishment (inscribed in the Rome Treaty) and the so-called principle of "relative stability". Social constraints were in the foreground. The Commission emphasized the objective of minimizing the social costs of the fisheries policy. In an early proposal, (COM (76) 500 final), the Commission expressed the preoccupation with social inclusion in the fisheries sector and European cohesion. The commissioners stated that the management regime should assure an equitable distribution of the limited resources between the member-states, and maintain, as far as possible, the level of employment and income in the coastal areas mostly dependent on fisheries. The European Parliament made pressure in this direction, too. Accordingly, the guarantees of employment and social inclusion were irreplaceable objectives, at least in the short term.

Facing these constraints, the choice of policy instruments was very clear: a system of TACs and quotas (non-transferable) was a simpler solution for the problems of equitable distribution of fishing opportunities (Holden, 1994). As it works in regular practice, the key-formula of definition and allocation of use rights in European fisheries is, in fact, very stable, and dependent upon several factors like the dependency on fisheries of some coastal areas and the level of employment. That´s what one calls the "Principle of Relative Stability". This principle shapes the CFP and is a fundamental element for agents' operations stability. It can be seen as a means of establishing a balance between the promotion of economic efficiency, in the long run, and the necessary social-economic equilibrium in the coastal areas, in the short run (Filipe, Ferreira and Coelho, 2007; Coelho, Filipe and Ferreira, 2010; European Commission, 2001).

This choice of policy instruments reflected an implicit assessment of the advantages/disadvantages of the different instruments available. In this context, the control and supervision regime played a central role. The implementation of EU policies in the member states is never easy, especially when short-sighted individual interests do not correspond to long-term collective interests. Clearly, this is the case of fishing. According to the European Commission, fishermen are no more prone to altruism than the rest of society. Thus, they are not concerned of preventing fraud and promoting the "healthy" conservation of resources, if they suspect that their competitors are less scrupulous. In other words, without a clear and effective policy

of control and enforcement, the Commission was certain that the "Tragedy of the Commons" would emerge and that overfishing and overcapacity would occur. That means that the straightforward implementation of the principle of equal access would lead to the rapid exhaustion of the resources, and the consequences of such a situation would be unacceptable (Wise, 1984). In these circumstances, the issue of trust is fundamental, and the Commission explicitly posed the problem of control in ethical grounds. In an early, political-discussion document, between the Commission and the European Parliament, it was firmly stated that it was the only way to ensure that the sacrifices of some member states in the recovery of stocks were not in vain because of the irresponsible action of others (Wise, 1984).

The Commission also knew that there are significant differences among the legal administrations of the member states, and that the administration of justice has a particular inertia characteristic. The capacity and efficiency of the application of the legislation of the member states is not only a question of the financial means dedicated to their mission. It has, also, cultural and historical roots. It is virtually impossible to put all member states in a uniform position in terms of speed and severity in the application of penalties. Anyway, as the surveillance and inspection of fisheries entails the establishment of administrative and technical structures, since 1978, the Commission implemented a series of provisions for financial support for member states' expenditure. In the 1990s, the Community introduced a more comprehensive aid scheme to support the establishment of control structures, such as remote fishing control systems.

### 4.2. The “reforms” and the evolution of the fisheries control system

The Common Fisheries Policy has been reformed, several times, especially in the new millennium. Assessing the first two decades of the development of this policy, the so-called "2003 Reform" brought an important evolution in the European fisheries control system. A new structure and a more complete body of regulation were introduced and the obligation for remote vessel monitoring (VMS) was extended. With new countries joining the Union, the monitoring structures of some of these countries needed to be modernized quickly. For the sake of clarity, the measures eligible for financial support and their procedural arrangements were redefined. To get better implementation, increasing expenditure on surveillance means was the central element of the regime.

The cooperation between member states and the coordination of inspection activities have been intensified by establishing a common, supranational, inspection structure - the European Control Agency (established in 2005, based in Vigo, Spain).

The Commission committed to increase transparency in information related to member states' compliance with their enforcement obligations, and has included, for the first time, an annual compliance scoreboard. This dashboard was a clear and easily accessible source of information on states' control activities, and represented a pure example of the environment of trust that was intended to develop.

In 2013, a new reform of this Policy was developed. Applying the described framework of "crime and punishment" to the guidelines proposed for the 2013-reform, suggests the following observations: As said, the implementation of EU common

policies in the member states is never easy, especially when individual interests compete with long-term collective interests. The reform proposed in 2013 insisted on the ethical reasons and gave interesting signs. According to Becker, individuals rationally decide whether or not they want to engage in criminal activity by comparing the expected returns from crime to the legitimate business. So, the main thesis is that crime is less attractive if the government increases the likelihood and severity of punishment. The Commission's proposals (after turned into regulations) paid particular attention to increasing the likelihood of detection as a means of deterring criminal behavior and increasing compliance with regulations. The introduction of severe penalties was not yet a priority. Of course, penalties, and their fairness and severity, were considered, and an important effort was made to define and clarify the legal procedures for penalizing offenders. However, the severity of the sanctions was not at the heart of the European fisheries policy. The Commission believed that the financial support would guarantee the indispensable means of surveillance and control to the member states, and that would uniformly increase the capacity for deterrence and control in the member states. Consequently, that would rise the transparency and trust among the partners. That means, the fundamental variable was Θ, not yet f.

### 4.3. Perspectives for the future

The actuality brings new perspectives for the future. In the current situation, there is a great deal of discussion about the CFP as a whole and, in particular, about the control system. In this particular domain, a new "on-going" reform has been developed. There is an urgent need for corrective intervention by public policies to address the socially efficient solution in the use of resources.

The fundamental conclusion of the debate that the Commission has promoted among the stakeholders is that CFP has failed to achieve its fundamental objective of sustainable exploitation of resources. The member states have not been able to reduce the capacity of the fleet. The main objective of the policy, which was to bring the fishing capacity of the European fleet to adequate levels, in line with the available biological resources, was not met. The overcapacity and overcapitalization of the sector have been identified as the main failures of the CFP.

In the domain of control, the results of the previous reforms (reflected in some Union key-regulations such as Reg 1224/2009, Reg 768/2005, Reg 2371/2002) are subject of intense discussion. Under the Union's REFIT (Regulatory Fitness and Performance Program), new studies have been carried out in the area of fisheries. Several current problems have been identified. These included the non-uniform application of the rules; complexity of the regulatory system; incomplete data; lack of coherence with other Union policies, in particular with the environmental policy; difficulties with small scale fisheries and recreational fishing.

A new regulatory proposal emerged (European Commission, 2018) which amended and replaced much of the previous legislation. Council agreed its general position in June 2021. After negotiations, in May 2023, the European Parliament announced the agreement between the co-legislators.

The Commission's proposal includes important guidelines for the future:

- Stricter signals for small-scale coastal fisheries/artisanal fisheries, which will now no longer enjoy a special situation of less demanding in terms of severity of penalties and prosecutions. Therefore, greater harmonization with the rules applicable to other segments of the sector;
- In the same direction, stricter signs of enforcement have been linked to recreational fishing;
- Development of new information systems, taking advantage of all the new possibilities of the digital economy;
- Approximation to other Community policies (especially with Environmental policy);
- Above all, heavier penalties, with a new system of aggravated penalty points.

This basically means that, in a new Europe, with fewer financial resources and many states, the main objective, now, is to lead to the "uniform use" of the rules, with greater penalties. Now f (the level of penalties) turns the most important variable and the issue of conservation, in a context of less budgetary relief, further deepens an ethical position of enlightened anthropocentrism, with an accent to regulation.

In the EU Council press release on combating overfishing, of 13 November 2023, the Council gave final green light to the revision of EU fisheries control regime. Luis Puchades, Spain's Minister of Agriculture, Fisheries and Food, said:

"The adopted regulation will ensure that our fisheries control regime remains up-to-date with the latest technological developments in order to effectively prevent overfishing. This will benefit the environment and ultimately also benefit fishing communities and help ensure the social and economic sustainability of the sector."

Note the importance given to the environment issue and the attention to the promotion of the Sustainable Development Goals. The new proposed regulation updates around 70% of the existing rules for the control of fishing vessels, which will help ensure that EU vessels and other vessels fishing in EU waters comply with the rules of the CFP.

Key changes include:

- Vessel monitoring systems (VMS) and electronic catch recording – To ensure compliance with the CFP, all fishing vessels will be tracked by means of a VMS and will have to record all their catches by electronic means; certain small-scale coastal fishing vessels, of less than 9 meters in length, will be able to obtain exemptions from the VMS requirement until 31 December 2029;
- In the case of larger vessels, electronic monitoring tools will be used to ensure that unwanted catches are not discarded, but rather brought ashore;
- Recreational fishers targeting specific species will record and report catches by means of an electronic system. Although initially a limited number of species are covered, the number may increase based on scientific advice;
- Revision of the sanctions system – An exhaustive list of serious breaches of CFP rules is established at EU level. Member states shall ensure that effective, proportionate, and dissuasive administrative penalties are imposed on offenders. In addition, or alternatively, criminal sanctions may be imposed;
- Improving digital traceability along the supply chain – In order to avoid misreporting, new rules on the margin of tolerance (or error) in the estimation of

catches will be introduced. Derogations will apply to small pelagic fisheries, industrial fisheries and purse seine tropical tuna fisheries, in particular if the catches are landed in "designated ports" where special landing and weighting conditions must be ensured;

- Certain larger vessels will be equipped with an engine power measuring device to ensure that their fishing capacity remains within the limits set out in the CFP;
- New rules for imported products – In the context of the catch certification scheme for illegal, unreported and unregulated (IUU) fishing, a digital system (called "CATCH") will be introduced. The aim is to ensure that catch certificates and other related documents will be managed in a single, EU-wide digital environment, thereby improving the ability of authorities to detect IUU fishing products. Non-EU countries will be able to generate and validate catch certificates directly in the CATCH digital environment. For fishery products imported into the EU, importers will also have to submit catch certificates through CATCH.

The fundamental objective, according to the political powers, is that "The Union's fisheries control system should promote fair competition between operators in all Member States, while contributing to the achievement of the other objectives of the CFP" (PE-CONS 38/23) (European Union. 2023; Said, Pascual-Fernandez, Amorin et al., 2020; Guillen, Holmes, Carvalho et al., 2018; Teixeira, Coelho, Gil et al., 2024).

## 5. Final remarks

In many fisheries, economic and normative factors are trending toward less compliance and are putting more burdens on enforcement (King and Sutinen, 2009; Salomon, Dross and Markus, 2014). According to (King and Sutinen, 2009) the results of a survey of fishers, managers, scientists and enforcement officials, made in the first decade of the new millennium, indicated that noncompliance was a significant problem in the Northeast multispecies groundfish fishery, as it had been for, at least, 20 years. The percent of total harvest taken illegally was estimated to be 12%–24%, significantly higher than the estimates of 6%–14%, in the 1980s. According to these authors, fishers, fishery managers and fishery enforcement staff believed that the combined adverse impact of all violations on the health and manageability of fish resources was significant, highly significant, or extremely significant. Many fishers believed that illegal fishing prevented them from ever benefiting from stock rebuilding programs. At the same time the authors concluded that, on the contrary, normative factors, such as moral obligation and peer and community pressure often induce fishers to be law-abiding, despite potential illegal gains.

A final reflection on the Portuguese case: After a relevant process of modernization of surveillance structures, several problems persist. The European Commission has provided the necessary financial support to ensure control structures. Increasing the deterrent capacity of control in the member states, in a uniform way, and increasing transparency and trust between partners, was a very well received "message" by the stakeholders of the Portuguese fisheries sector. In global analysis, this could lead to deterring criminal behavior and increasing compliance with regulation. But the differences in judicial and administrative systems (and their

effectiveness) have remained in the EU. In the case of Portugal, the dispersion of surveillance and control activities among various agencies (Maritime Authority, Port Administration, different police forces) is always referred as a fundamental root of inefficiency. Interested parties also put in evidence the late application of the penalties by the courts.

From the theoretical point of view, we introduce a note on the criticisms that usually persecute expected utility conceptualization and its use. The expected utility hypothesis is a foundational assumption in Mathematical Economics, in what concerns to decision making in situations of uncertainty. To model aggregate social behavior, microeconomics postulate that rational agents maximize utility and chooses between risky prospects by comparing their expected utility values, that is, (as we used in the fisheries case), the weighted sum of adding the respective utility values of payoffs multiplied by their probabilities.

In the analysis of "crime and punishment" of Becker, the objective is to show that the optimal amount of enforcement depends on, among other things, the cost of catching and convicting offenders, the nature of punishments (for example, fines or prison terms), and the responses of offenders to changes in enforcement. The fundamental research question is: "How many resources and how much punishment should be used to enforce different kinds of legislation? Put equivalently, although more strangely, how many offenses should be permitted and how many offenders should go unpunished" (Becker, 1968).

Note that the economic analysis of crime starts with one simple assumption: criminals are rational. In Becker's article it is suggested that a theory of criminal behavior, with such an economic approach, "can dispense with special theories of anomie, psychological inadequacies, or inheritance of special traits and simply extend the economist's usual analysis of choice." (Becker, 1968).

There are many criticisms about the use of expected utility. Only to cite many academic debates on this topic, we remember the Allais paradox that suggests that people may overweight extreme probabilities of small events; or the Ellsberg paradox that suggests that people may be averse to ambiguity; or even the Rabin paradox that suggests people may overweight small losses. But, as some authors stress, all of this just scratches the surface of decision theory (Allais, 1953; Ellsberg, 1961; Rabin, 2000; Rabin and Thaler, 2001; Wakker, 2010). In the case of Becker's theory, we signal the fundamental critiques. The first one puts in evidence the assumption of rationality as an oversimplification: human behavior is influenced by a full pocket of psychological, social, emotional factors that the model does not account; individuals have limited cognitive resources to process information and make decisions (as it is postulated by the bounded rationality concept). The development in Behavioral Economics has been challenging the rational actor modelling: findings suggest that individuals often act irrationally and are subject to several cognitive biases that affect their decision-making process. See, for example, the Kahneman and Tversky's works that demonstrate how preferences of individuals are inconsistent, depending on the framing of the choices, that is, the forms how they are presented (Kahneman and Tversky, 1979).

Moral and ethical considerations are absent from Becker's model. His economic approach is criticized because it is overly utilitarian and potentially ignoring moral and ethical issues, as justice, fairness, rehabilitation, etc. Also, the analysis neglects social

influences, in the sense that does not address how social contexts, cultural norms, family background and peer pressure, etc., influence criminal behavior. Concomitantly, it neglects the dynamics of evolution of those factors, and overlooks how social and economic inequalities influence the behavior of criminals.

The empirical validity is another relevant criticism. This put in evidence that some empirical studies do not fully support the model predictions. For example, sometimes, the proposed increasing severity of punishment does not correlate with lower crime rates. This critique also put in evidence various measurement issues. The perceived costs and benefits coming from fraud may be measured differently from individual to individual, so, the deterrent effect is not clear. The model assumes that increasing severity or certainty of punishment (f or Θ) is a straightforward solution to crime but there are substantial social costs that are overlooked, as the costs associated with incarceration, the impact on the families and communities, the burden on the justice system, etc. (Machina, 2014; Von Neumann and Morgenstern, 1944; Sharpe, 2023; Ehrlich, 1973).

All of these critiques are important and implies further investigation, theoretical and empirical. In our case, without putting less attention to its limitations, we want to stress how important the theory revealed. In fact, like any mathematical model, expected utility is a simplification of reality, but the model of "crime and punishment" provides a useful framework to analyze the substance and evolution of the European fisheries monitoring and control system. Despite the limitations introduced by the assumptions, the framework that was constructed to evaluate those issues seems to work very well. The fundamental advantage of this approach is that it calls the attention to the central variables for understanding the problem. In the case of the Common Fisheries Policy, and particularly its enforcement domain, the three most important factors of compliance are: (along the time) the expenditure on control structures, the probability of detection of violators, and, finally, the severity of penalties.

Note that our analysis tried to consider the dynamics and put a special emphasis on the ethical, social, and cultural factors explaining that evolution. The presence of an ethical perspective of "enlightened anthropocentrism" was highlighted, obviating the overly utilitarian criticism. In a certain measure, we tried to circumvent possible limitations of the analysis. Further investigation on sustainable use of natural resources, ethics and "crime and punishment" issues, with a more comprehensive approach, is still desirable.Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

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