The fish nematode problem in major European fish stocks

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Introduction

Over the last few decades, the presence of zoonotic nematodes in fish and seafood has become a great concern for stakeholders, administrations and consumers. In fact, although the first regulation related to the management of these parasites was issued by the Dutch Health Authorities almost 50 years ago, since then, sanitary/social alarms increased substantially, revealing a paradox by which zoonotic parasites in fish have been considered not only a classic hazard but also an emerging (or re-emerging) risk (D'amico et al., 2014). From the 1960's to 1990's, National Authorities in Germany, French, Italy and Spain introduced recommendations and regulations (some of them voluntary) as preventative treatments to help control the parasite hazards, especially focused on the process by which the fish industry guarantees parasite-free fish lots and to inactivate parasites in infected lots held to be sold for human consumption.

More recently, Commission Decision No. 93/140/EEC and the new Regulations introduced by the Hygiene Package (see No. 853/2004; 2074/2005; 1020/2008; 1276/2011) led to a radical change in the system of parasite control in fishery products. First of all, by defining the general framework (i.e., the visual inspection scheme) but not the specific methods or procedures by which a fish lot is determined to be fit or unfit for human consumption. Secondly, by transferring the responsibility for control in the fish value chain from veterinary inspectors to in-house programs managed by industry, in many cases by untrained or unskilled seafood operators. During the last 20 years, the above changes (i.e., an ambiguous decision criterion for inspection, devolved responsibility and the consequent unintentional failures to detect and remove visible parasites from fishery products that are obviously contaminated) have provoked serious economic problems in the EU fish production value chain (Llarena et al., 2015). Evidence of failure of the system, including rejection by consumers of unaesthetic heavily-infected fish species, the increased awareness of the already well-known clinical manifestations of anisakiasis and related allergies (Nieuwenhuizen and Lopata, 2014; Bao et al., 2017), seizure of infected fish lots during border controls or routine veterinary

official inspections, and the economic losses due to rejection of fish lots by industry as a consequence of Hazard Analysis Critical Control Point (HACCPs) procedures, recently became a topic of discussion in a meeting (“Working Group on the Implementation of the Food Hygiene Package”) hosted by the European Commission (DG Health and Food Safety; SANTE) in December 2016.

However, a positive aspect of the new Hygiene Package regulations was the introduction into the value chain of the Risk Analysis perspective for controlling seafood hazards. The approach based on risk was recognized by standard-setting international organizations (Codex FAO/WHO, WTO and EFSA, in the context of seafood security, seafood market and seafood safety, respectively) as being promising in risk control of the parasite hazards, by considering the entire sequential process (risk assessment, management, and communication) from net to plate. This holistic perspective made it possible to connect the advice derived from the scientific evidence (assessment) with the decision systems oriented towards solutions in the fish industry (management), and finally to transparently communicate verified risk information to end-users and seafood consumers. The risk analysis thus represented a declared guarantee that EU food safety regulations would be improved based on available knowledge, and that the control process in the industry would follow scientific criteria.

In 2010, according to the Scientific Opinion on risk assessment for parasites in fishery products provided by the European Authority (EFSA, 2010), it was widely recognized that risk management was currently limited by many biological, ecological, medical and technological knowledge gaps. In 2012, the Commission launched the first time, a specific call on the topic “Food safety and quality issues related to parasites in seafood” (FP7-KBBE.2012.2.4-02) to offer a funding scheme for a collaborative project that addressed three key performance issues: the surveillance and monitoring of fish species/areas, the diagnostic awareness of allergic reactions, and the interventions in the food web to inactivate parasites. This resulted in the PARASITE (Parasite Risk Assessment with Integrated Tools in EU-fish production value chains) project (GA-312068) (Fig. 1). The Consortium, which involved 21 partners (15 RTDs and 6 SMEs) from 9 EU countries and an additional 3 from Asiatic regions, was aware of the need to be outcome-focused. Therefore the project was market-aligned and connected across the institutional spectrum to explore the social usefulness of its research findings (Fig. 2).

Parasite Risk Exposure Assessment

The first aim at the PARASITE project was to provide baseline information on the molecular epidemiology of zoonotic parasites present in EU fish production value chains (Paoletti et al., submitted). The most ambitious surveillance plan ever conducted was carried out from 2013 to 2015 to ascertain current levels of exposure to the parasite risk in terms of fishing grounds affected, fish species infected and fish lots categorized under such a risk (Levsen et al., submitted).

Three transversal aspects were of great concern for the whole Consortium: a) the necessity of a harmonized parasite inspection method (Gómez-Morales et al., submitted); b) the adoption of a modern platform to manage and sharing of high-quality samples and traceable data (González et al., in press) consistent with EU Guidelines on Research Data Management (ORD, Open Research Data; DCF, Data Collection Framework); c) a willingness to pay (WTP) evaluation (Bao et al., submitted) to explore the socio-economic implications of risk exposure and d) a quantitative risk analysis that can be used by policy makers and informs industry, health professionals and consumers about potential underdiagnosed zoonosis (Bao et al., 2017). Once these pillars were established, the remaining action of the surveillance plan was obvious: to provide examples to lay the foundation stone for a long-term/large scale monitoring program of historical data for parasites of medical and zootechnic relevance in economically-important EU fish stocks. This collaborative work was implemented in important fishing fleets and fisheries through the combined efforts of fishing associations and companies actively participating as partners in the PARASITE Consortium.

Parasite Risk Management

In recent years, Regulatory Science has been described as the scientific and technical foundations upon which regulations are based. Regulatory Science also comprises, in a broad sense, the evidence of compliance with regulations. Risk Management should configure and consistently implement policies to ensure that scientific evidence is translated into action, while also considering aspects such as the key general principles established in EU food law (necessity, proportionality, minimum effect on competence

and guarantee of level playing field) that guarantee and protect the functioning of markets.

The overall conclusion drawn from the results of the contributions included in this special issue is the remarkably high level of risk exposure to zoonotic parasites present in major EU fish stocks. That risk undoubtedly needs to be managed in some way to achieve the high safety and quality standards for fish products demanded in European fish markets. At this point, the question is: what is currently driving parasite risk management, the Regulatory Science approach or market forces?

The PARASITE project has offered an important list of technical solutions, both market and policy-oriented (http://cordis.europa.eu/result/rcn/189395_es.html). A portfolio of transferable technologies and multilevel/multiscale tools has been widely presented and communicated in detail to stakeholders and policy makers at local, regional, national and European levels. The analysis of their market potential has also been addressed within the project, with the guidance and professional support of the ProBio Consortium (<http://www.probio-project.eu/>) to facilitate the uptake of some of the more exciting R&D results originating in the project (e.g., González et al., submitted).

One year after the project finished, it seems that the industry is responding to the central message of PARASITE by establishing communication channels with the aim to introduce management decisions on their own. This is understandable as the industry is justifiably concerned about market reactions once a social alarm in the media, following new results on the parasite hazards, is able to reach the consumers. In relation to the fish nematode problem, this should not be neglected, bearing in mind that according to the WTP study, EU consumers generally do not accept parasites on the plate, but they do not mind paying (slightly) more for *Anisakis*-free fish (Bao et al., submitted).

Although the National and European Administrations reacted positively, their inherent procedures and protocols provoke a slower reaction at the time of implementing the needs identified by the industry. Consumers and stakeholders expect an ability to respond to legislative changes and adoption of new technological challenges from the Administrations, which should promote interventions in the seafood chain to significantly reduce a high level of exposure to parasite risk. This is of the greatest importance since interventions could not only produce healthier fisheries but also lead to increased consumer and trade confidence in EU fish production systems.

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