

**PRESENTATION OF DOGMATIS, AN INTER AND MULTIDISCIPLINARY PROGRAMME FOR THE ASSESSMENT OF THE IMPACTS OF GENETICALLY MODIFIED FISH, AND RESULTS ABOUT RISK OF FORTUITOUS IMPORT ON FRENCH MARKET**

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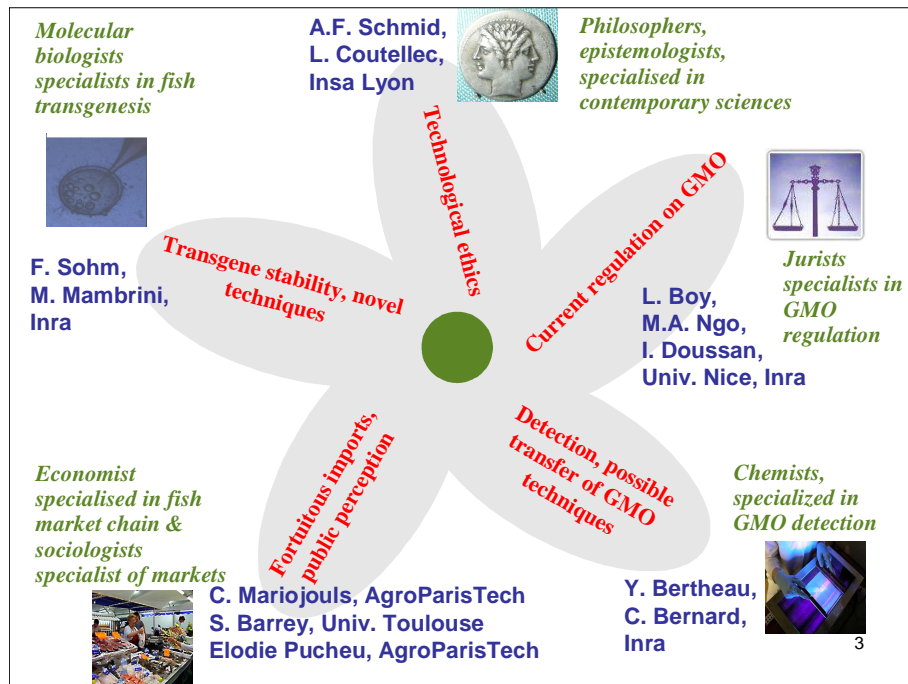
**ABSTRACT**

DOGMATIS is a research project funded by the French Research Agency (ANR, programme ANR-OGM 2007-2010). The transgenic technologies have been applied to fish since more than 20 years now and some strains are at the premarket or market stage in countries outside Europe. In Europe the main risk is a fortuitous import. Any rumour of uncontrolled arrival of GM fish on the European market may have strong impacts on the market chain, the research and innovation system and the trust in public regulation. The aim of DOGMATIS is to anticipate the answers. It associates specialists of fish transgenesis, GMO detection and regulation, fish market chain economy, consumer sociology and contemporary science philosophy and epistemology. To tackle this multifactorial subject, we developed original methodologies including assumptions based on the quantitative and qualitative knowledge from the different experts of DOGMATIS. We propose to present the programme and the results of our investigation concerning an assessments of the risk of fortuitous presence of GM Fish on the French market, which has been done by crossing the data from scientific literature gathered in a data bank and an expert analysis of filtered statistics of international trade, for the two farmed species concerned by transgenesis techniques and imported on the French market, salmon and tilapia.

**Keywords: GMO, GM Fish, interdisciplinary research, risk, fortuitous import**

**DOGMATIS : AN INTERDISCIPLINARY PROGRAMME TO ANTICIPATE ANSWERS TO A POSSIBLE PRESENCE OF GM FISH ON MARKETS**

Fig 1:



The transgenic technologies have been applied to fish since more than 20 years now and some strains are at the premarket or market stage in countries outside Europe. In Europe, the main risk is a fortuitous import. Any rumour of uncontrolled arrival of GM fish on the European market may have strong impacts on the market chain, the research and innovation system and the trust in public regulation. In Europe the main risk is a fortuitous import.

The aim of DOGMATIS is to anticipate the answers. This interdisciplinary programme associates specialists of fish transgenesis, GMO detection and regulation, fish market chain economy, consumer sociology and contemporary science philosophy and epistemology.

**Expected deliveries:**

- An evaluation of the technical feasibility of GM Fish and expected evolutions of techniques,
- Some possible methods for GM Fish detection, using the basis of the detection strategies for plants, and setting specific methods for GMF,
- An assessment of the risk of fortuitous presence in our market, by crossing the data from scientific literature and an expert analysis of filtered statistics of international trade,
- An assessment of public perception levels, using consumers focus groups and performing interviews with economic actors and NGO,
- Some drafts for dedicated regulations and laws, through analysis of the present regulation on GMO and of the gaps with the reality of GM fish and fish market chain,
- A description of GMF representations and ethical implications, beyond the classical -theory driven- representation of science used in the GMO debate up to now.

**IS THERE A RISK OF FORTUITOUS IMPORT OF GM FISH IN FRANCE ?**

According to our review of scientific literature, 1450 scientific papers related to transgenesis on aquatic species have been published, among which about 400 concern farmed species, and 80 patents are registered.

As for farmed finfish, research has concerned more than 30 species, but the transgenic lines considered as close to commercial consideration are for the followings: common carp (China), hybrid tilapia (Cuba), Nile tilapia (UK), Atlantic salmon (Canada), mud loach (South Korea). (Nam et al., 2007)

Four farmed species are potentially concerned by transgenesis AND present on French market.

Two are not imported and are produced in France where transgenesis is not used, **2 species are imported**

:

- **Tilapia** : very small volume on French market, poorly surveyed
- **Salmon**: the first consumed species on French market (apparent consumption 165,000 mt eq. live weight, 2.36 kg/cap), mainly imported, very good statistical survey

	Trout	Salmon	Carp	Tilapia
Production in Fr	++	# 0	+	0
Imports	# 0	++++	# 0	+
Consumption	++	++++	+	+

Table 1: Summary of the situation of the farmed species potentially concerned by transgenesis and present of French market

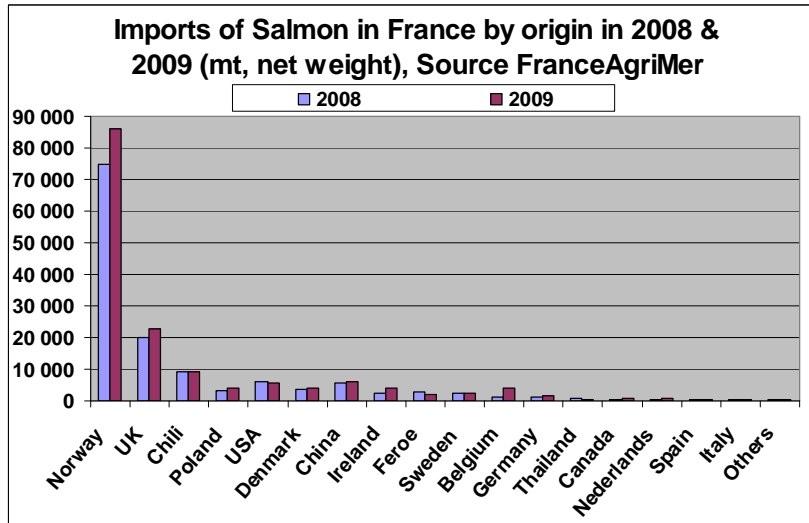
Thus salmon and tilapia are the two species for which a possible fortuitous import must be questioned, and studied.

**SALMON**

**Origins:**

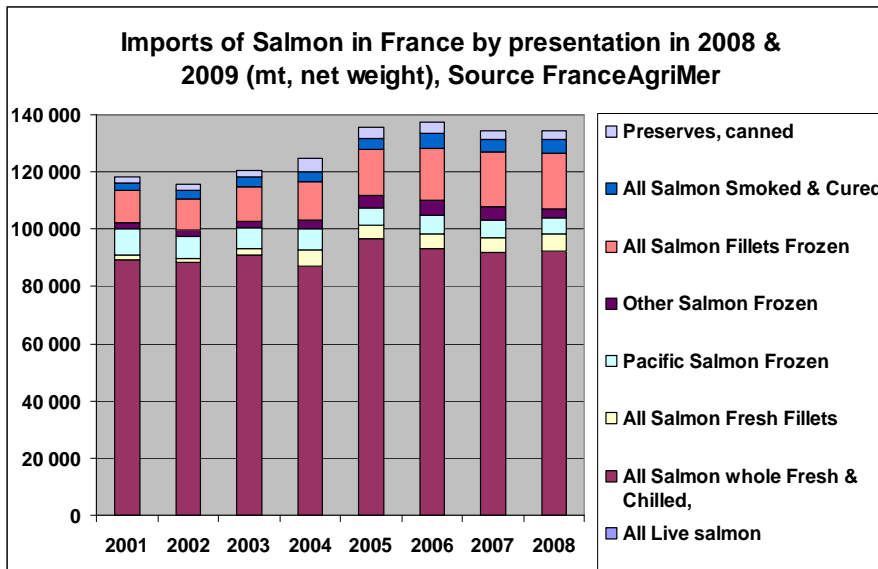
Mainly European countries supply France: Norway for 51% (eq.live weight, 2009) and EU countries for 29%, then Chili (8%). But, as shown in Fig.2 and 3, today a great number of countries (about 45) supply salmon to France under various presentations, and trade routes are complex, including re-exportation due to processing activities (Poland, China, Thailand,...) or trading.

Fig 2:

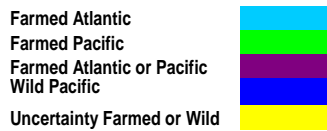


Others: Switzerland, Vietnam, Uruguay, Luxembourg, Iceland, Madagascar, Costa Rica, Turkey, Greece, Malaysia, Australia, Bulgaria, Finland, Portugal, Perou, Russia, Indonesia, Austria, Georgia, Iran, Ouganda, Estonia, Pakistan

Fig 3:



As shown in Table 2, the interpretation of import statistics allows to identify the production mode and concerned species for most of the origins but not for all, inducing uncertainty.



	Total (mt) 2008	GERMANY	BELGIUM	CANADA	CHILI	CHINA	SOUTH COREA	DANMARK	SPAIN	USA	FEROE	IRELAND
All Live salmon	66											
All Salmon whole Fresh & Chilled	89 365											
All Salmon Fresh Fillets	1609											
Pacific Salmon Frozen	9 181											
Other Salmon Frozen	2065											
All Salmon Fillets Frozen	11 096											
All Salmon Smoked & Cured	2849											
Preserves, canned	2149											

	Total (mt) 2008	ICELAND	JAPAN	MACAO	NORWAY	NEDERLAN DS	POLAND	UK	SWEDEN	SWITZERL AND	THAILAND	VIETNAM
All Live salmon	66											
All Salmon whole Fresh & Chilled	89 365											
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Other Salmon Frozen	2065											
All Salmon Fillets Frozen	11 096											
All Salmon Smoked & Cured	2849											
Farmed Atlantic	2149											

Table 2: Interpretation of salmon imports in France regarding to the species and production mode

**Discussion:**

According to our information, today GM Salmon is not produced and commercialised in any country, but for the near future the situation may greatly vary according to countries:

- The position of European fish farmers is clearly to not use GM Fish, as mentioned in the Code of Conduct of FEAP (Federation of European Aquaculture Producers, including Norway):

*“The FEAP does not endorse the use of genetically modified fish in aquaculture since it is concerned about the maintenance of the natural characteristics of the products, in addition to the environmental qualities of biodiversity. However, the results of genetic research may play an important part in the future development of global food production. The FEAP may review its position on this topic if such developments are acceptable to the consumer and do not pose any safety or environmental problems.”*

It is likely that the public opposition to GMO in Europe will keep the situation in this state for the near future.

- The U.S. Food and Drug Administration (FDA) is today considering approval of AquaAdvantage® Atlantic salmon eggs, produced by the company AquaBounty Technologies. Those eggs include a gene from Chinook salmon that provides the fish with the potential to grow to market size in half the time of conventional salmon. The company has applied for approval for about a decade but the recent period shows important steps forward, because of the publication by FDA in January 2009 of a guidance document for gaining market approvals of genetically

engineered animals, under the animal drug provisions of the Federal Food, Drug, and Cosmetic Act (FFDCA).

- Chile is considering some biosafety framework for GM aquatic species: in August 2006 the General Law of Fishing and Aquaculture N° 18,892 was modified to regulate the import or culture of aquatic species that have been genetically modified (Nelson et al., 2007).

**Conclusion:**

The situation of imports allow to conclude that the risk of fortuitous import of GM salmon today is null or very low. On another hand, the progress of the framework for an approval of GM salmon in USA, and Chile, lead to consider that fortuitous import may occur in a near future. Setting controls would be a difficult work, taking into account the complexity of trade network and multiplicity of products and origins, in addition to the need for adequate analytical methods and human means.

**TILAPIA**

**Consumption :**

- Tilapia is consumed at home, with important ethnic markets, and also out-of-home, in collective restaurants, chained restaurants, and less in individual restaurants.
- Data are available only for households consumption (source FranceAgriMer, Kantar Worlpanel): fresh: 418 mt in 2008, 148 T in 2009; frozen : 422 mt in 2009

**Imports:**

There is a structural difficulty for studying tilapia imports as this species is not isolated in imports statistics as a separate category, but included in “other freshwater fishes”. The interpretation of those statistics, according to the origin, allows to estimate tilapia imports at 3300-3500 mt in 2008, including:

- about 3000 mt of frozen tilapia, mainly whole, with a small share of fillets
- a few hundreds tonnes of fresh tilapia, mainly whole.

Those statistics, completed by inquiries in shops and interviews with stakeholders, show the following origins:

Fresh whole : Belgium, Netherlands, Asia

Fresh fillets : Zimbabwe, South America

Frozen whole: China, Thailand, Taiwan, Vietnam, Senegal

Frozen fillets: Thailand, China, Indonesia, Brazil, Ecuador, Costa-Rica, Chili

**Discussion:**

Despite the absence of publication related to transgenesis on tilapia in the concerned countries, questions may be asked on the state of the technologies for several countries:

- China is the first producer and exporter of tilapia in the world. China is notably advanced in transgenesis on carps but has not published on tilapia transgenesis. According to Nelson et al. (2007), in 2006 China had field trials for transgenic fish under quarantine conditions, and no transgenic fish have been released

for commercial production. There is a biosafety regulatory system for transgenic fish under the Ministry of Agriculture, and “biosafety monitoring is urgently needed once current field testing is completed.”

- Taiwan is famous for high capacities in tilapia farming. We do not have information on biosafety framework.

- Thailand has a developed aquaculture including tilapia, a very efficient R&D system, and is an important exporter. Thailand has a National Biosafety Framework developed in 2001 by the National Biosafety Committee(NBC), renewed in 2007 (Nelson et al., 2007). According to an interview performed with a high representative of Department of Fisheries (DoF), Thailand is not willing to farm transgenic fish today (Naruepon, pers. com. 2008).

### **Conclusion:**

Tilapia imports in France, despite a small volume, and structural difficulties for study, deserve attention regarding to the risk of fortuitous import of GM tilapia. While very little information is available to assess that risk, it may be recommended to survey in the supplying countries the evolution of the transgenesis use and regulatory framework in the next years.

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