Emerging Risks in the Dutch Food Chain report on project 2:
Application of indicator analyses on several critical points in the salmon production chain and identification of related data sources

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Summary

An indicator analysis was performed on the fish production chain by assessing the indicators which may be of importance for the detection of emerging risks. The indicators were embedded in a “risk pathway”, in which the relations between different indicators could be illustrated. The risk pathways illustrate the main characteristics of the salmon production chain. However further research is required in order to develop further interaction with other sectors, and production chains to bring emerging risk detection to the next level.
In relation to the assigned indicators, a selection of (electronic) data sources were identified in order to be able to combine data flows with indicators and risk pathways. The indicators were analyzed for availability, sources of data entry, validation of data sources, update frequency and delay in input.
The combination of risk pathways, indicators and data sources, will be one of the key information sources for the further development of an Emerging Risk Detection Support System (ERDSS).

1 Introduction

National and international food safety authorities have a need for robust and reliable methods to identify emerging risks related to food safety and animal health. Following the results of the "EMRISK" project on forming a global system for identifying food-related emerging risks (Noteborn, 2006) and the analysis of recent crises and definition of indicators in the "emerging risks in the Dutch food chain" project (Hagenaars, 2006 and Kleter, 2006) more specific research was needed.
In 2006 the options for pro-actively identifying indicators for emerging risks in a specific food production chain, were investigated within the Emerging risks in the Dutch food chain. For this purpose the fish production chain has been selected as food safety is one of the major concerns facing the fishing industry today. Fish and fishery products are in the forefront of food safety improvement because they are among the most internationally traded food commodities. Next to that fish and fishery products faces multiple pathways in which the product may be affected in terms of food safety (environmental impact, feed, trade flows, production increase, etc.). The performed project named as "Options for pro-actively identifying emerging risk in the fish production chain" was part of the Dutch research program "Emerging risks in the Dutch food chain", which is funded by the Ministry of Agriculture, Nature and Food Quality (LNV) in The Netherlands and coordinated by Dr. H.J.P. Marvin of RIKILT – Institute of Food Safety, Wageningen University and Research Centre. The steering committee was supported by the Food Safety Authority (VWA). The project continued in 2007 with the identification of 'risk-pathways' and the identification of related data sources for the salmon production chain. At the same time a prototype of an Emerging Risk Detection Support System (ERDSS) was developed (Hulzebos, 2008) and expert knowledge, information sources and indicators were incorporated from the pathway identifications. This report describes the development of risk pathways, and reports the data sources. Conclusions and discussions will not be reported, since the development of the pathways and implementation of data sources is an on-going process, which will be continued in the following year.

2 Objectives

The main objective of the Dutch research program is to develop a system for the identification of emerging risks in the Dutch food chain in an early stage allowing authorities to respond proactively . Subproject 2 focuses on the Salmon production chain "from feed to fillet". At several points in the production chain the 'risk pathways' will be identified and connections between the different indicators will be presented. In turn, the indicators will be linked with data sources in order to make integration within ERDS system possible.

- An indicator analyses will be performed on the fish (Salmon) production chain by considering the most important host environment interactions on the most critical points in the production chain. The indicator analyses results in pathways which depict the interactions, and which can be incorporated in ERDS system.
- Data sources on identified indicators are collected, and assessed on quality, reliability, updating frequency, etc. Data sources will allow identified indicators to be used in ERDS system and therefore the value and trends of these indicators need to be determined. These data sources are not confined to only websites and statistical data or scientific reports. It appears that results of meetings, conferences and symposia of organisations in the host environment as well as governmental organisations play an important role in the provision of data.
- Based on the risk pathways interactions and data source characteristics, the data sources should be prioritized. In the course of this project the indicators of the salmon production chain have been established and relevant data sources have been found. However the ranking needs to be executed by experts in the follow up project. Also the link with the yet to be developed model will be established at the same time.

The results of this study are reported in the following sections, the developed pathways will be reported in pathway overviews. The data sources and associated information is reported in table form.

3 Materials and Methods

An indicator analyses was performed, focussing on the salmon production chain. To this end several brainstorm sessions, with IMARES experts were performed in order to define the first pathways and to elucidate the importance of different steps in the pathways. Also the boundaries of the extension of the pathways were defined. The latter was required for exclusion of indicators, which are related to several parts of the pathway, but which were associated with the risk pathway indirectly. These indirect association was decided to exclude to keep the scope narrow. Based on the brainstorm sessions the boundaries were set on pathways for topics as Feed, Country, Farming, General Contaminants, Farm to Process etc. Topics which are associated with HACCP-principles were not discussed.
The defined topics were imbedded in a "risk-pathway' to enable to show the connection between the involved indicators and topics selected. To build the 'risk-pathways' Information was used from different sources:

- literature survey (peer reviewed and web sites)
- interviews with three world leading feed producers
- multidisciplinary expert judgement
- brainstorm sessions with project partners including a case-study.

Data sources were identified using internet blasts, since the digital availability is essential for the use of the data sources within the ERDS system.
By developing "risk pathways" and linking individual indicator within such pathway to identified data source (which has been assessed on several quality criteria, 4.2) we expect that the anticipated prioritizing of the data sources will not be necessary. However, the extent to which all information generated by the data sources can be utilized will highly depend on the technical possibilities of the ERDS system. Exclusion of indicators (and data sources with sufficient quality) in this stage of the development would mean a potential exclusion of interesting and important indicators. Many interesting indicators, with high influence are available in data sources, such as conferences, news bulletins, etc.

4 Results

4.1 Interviews

In the beginning of 2007 three World leading feed producing companies were visited. Major conclusions from the interviews are presented in the following table:

Company	Contact person	Function	Major Conclusions
Provimi	Ir. H. Boon	Assistant Manager Fish Feed	Malpractices in raw materials feed deserve attention Market prices influence the trade structure, and potentially the quality of the product Changes in trade flow is not a proper indicator since raw materials are bulk products, and trade flows are very disperse.
Skretting	Drs. H. Vink	General Manager NW	Companies confidential information is the key of successful trading, this is also information which is relevant for emerging risk issues Own information structures on pre-detection of food safety issues are in consideration, for direct food safety information structures are running (Nutrace) Data sources for Emerging risk indicators are usually available at company level, this is were the changes and signaling is. Data accessibility is very hard to realize. Setting up an emerging risk detection system for feed is considered to be a great task
Kemin	Dr. L.C. Moreno	Product Manager	Feed Additives are produced under strict procedures, were no food safety risks are expected

The different companies have different perception of risks. Some believe that the implementation of a HACCP system prevents them from any occurring food safety risks. Other companies already started the development of their own data management system to provide their management with a global overview of activities that might lead to changes for their companies. This system was not build with the aim for identification of food safety risks but more on traceability of sustainability aspects. Within this company they were positive about our developments and they realized with us that there is still a long way to go. They were willing to cooperate within our project if needed.

During these interviews the data accessibility was mentioned as a critical step. It is foreseen that many up-to-date information are hidden within the companies and/or marked as confidential. Besides that, for multinational companies this information , though VERY valuable, is not easy accessible even within their own organization.

4.2 Risk Pathways

Scientists with different expertise: fish farming, fish feed, fish technology, food safety, food economy, legislation and data modeling developed the following risk pathways. The risks pathways are multidimensional. The blue boxes indicate the connection to the different path ways and the red boxes indicate the potential occurrence of a food safety risk. The pathways tend to have "fuzzy-logic" characteristics, since a change of one single indicator does not necessarily mean that food safety issues occur. The fuzzy-logic characteristic is created by indicators which can only be functional when information from other pathways, and sectors (plant, animal) are also implemented. Also the pathways were designed in order to be capable to detect emerging risks which are not known at this stage. The decision was made not to simulate a particular case study, since this would strongly influence the ability to detect emerging risks. The general conclusion, which was drawn from the development of the pathways is that a risk detection system based on pathways, will only be functional and reliable when multiple chain influences from different sectors are combined. Parts of the global interacting pathways, such as the salmon production chain, will only be reliable when total chain management is incorporated.
Five pathways, which were developed during the course of the project are depicted below, indicating pathways on:

- Feed
- Country
- Farming
- Farm to Process
- General Contaminants

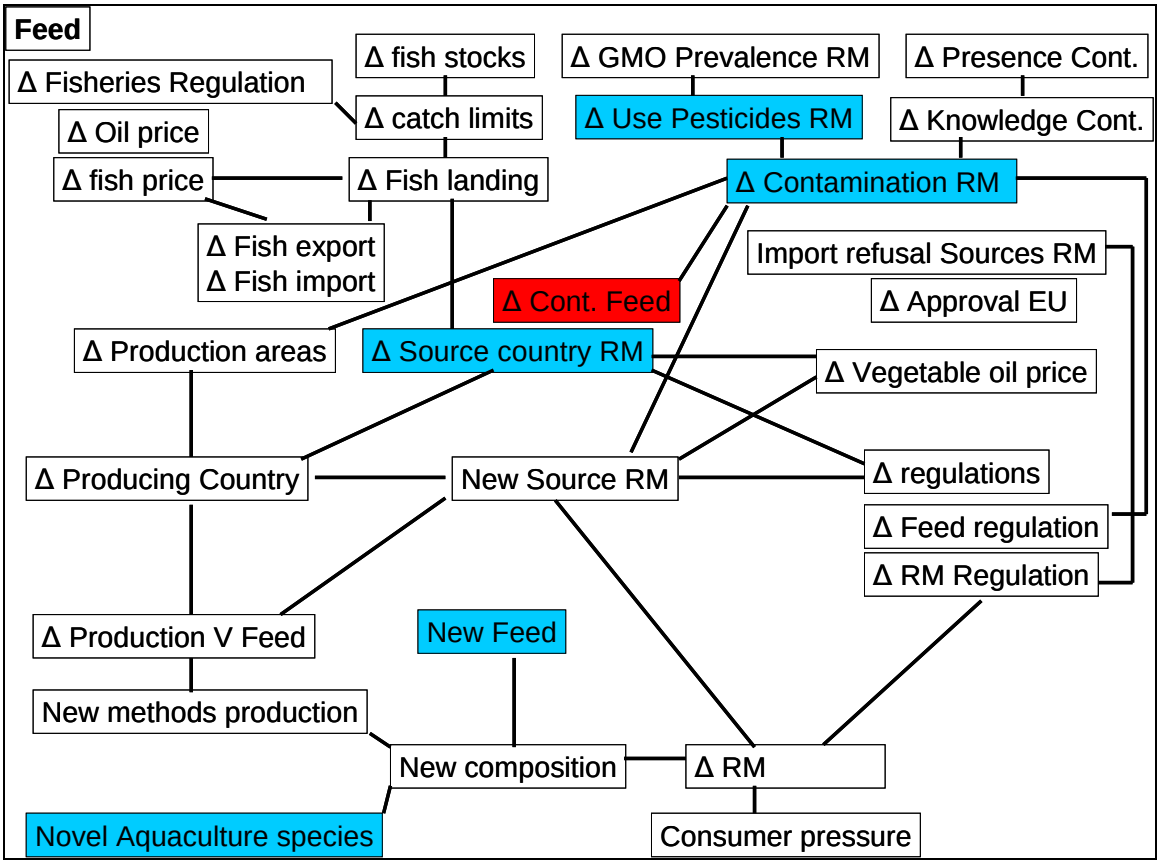
The risk pathways may be considered as input for the ERDS-system and will require further development towards 2008.

4.2.1 Pathway on fish feed production and use in fish farms.

In this pathway the risks indicator was identified: Contaminated Feed.
Raw Material is indicated as RM. Δ is indicated as a change of the indicator (nominal or quantitative).

The most crucial pathways lead to a risk starting points:

- Use pesticides Raw Materials (RM)
- Change in Contamination of Raw Material (also for vegetable oil)
- New Feed
- Change in source country Raw Material



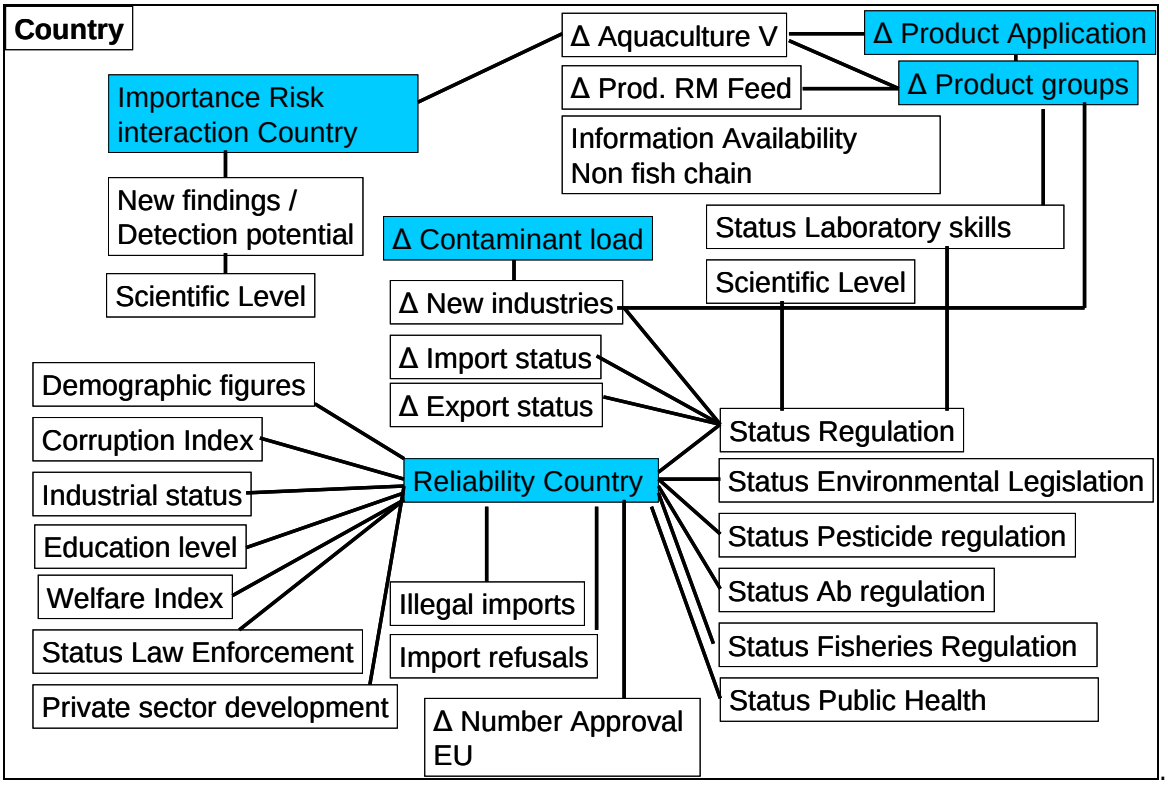
4.2.2 Pathway on Country and associated indicators

The pathway for countries is an important pathway, which should be connected to the activities, which are carried out in the country.
Volumes are indicated as V. Δ is indicated as a change of the indicator (nominal or quantitative).

In this pathway no risks indicators were identified.

The most crucial pathways lead to a risk starting points:

- Importance of Risk Interaction Country
- Change of product Applications
- Change of Product Groups
- Reliability of the Country
- Change in Contamination load (river, water, products)

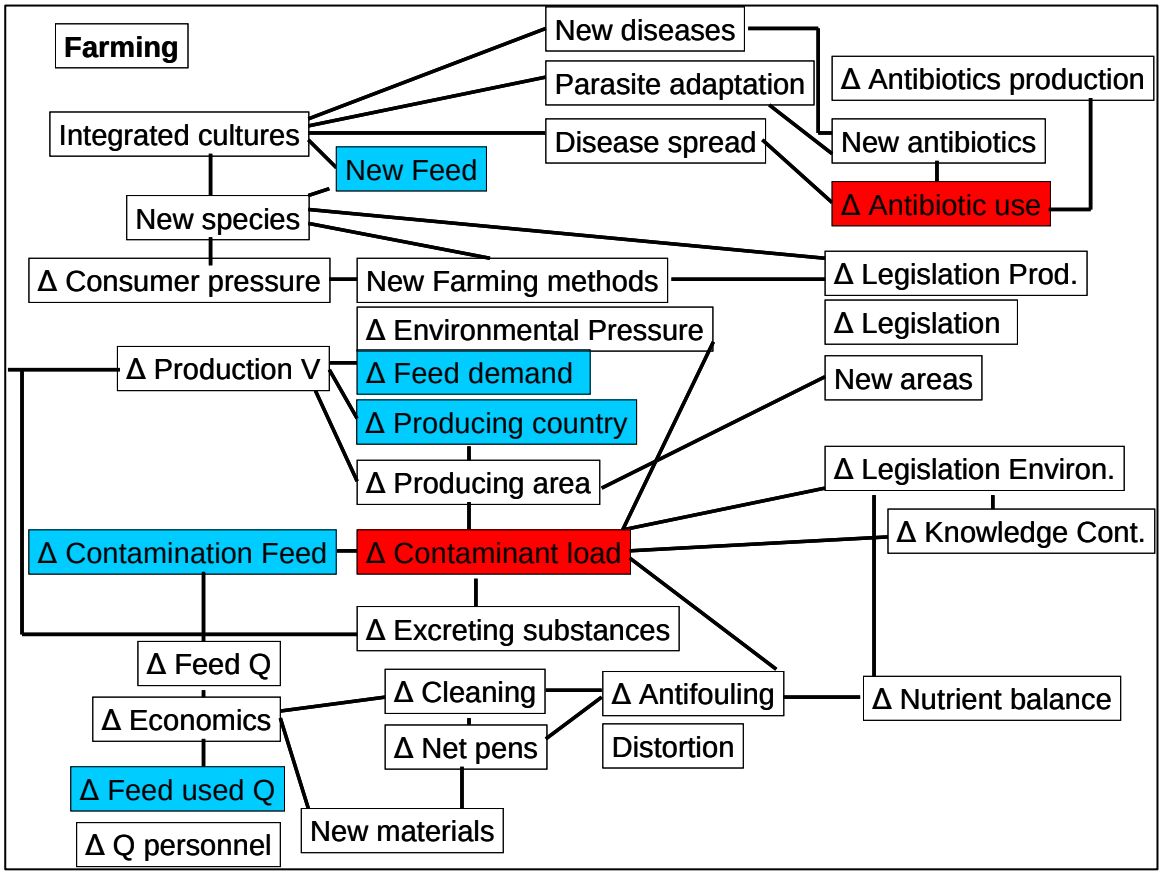


4.2.3 Risk pathway on Farming practices and associated indicators

In this pathway the two risks indicators were identified: Contaminant load and antibiotic use.

The most crucial pathways lead to a risk starting points:

Feed
New species
New farming methods



4.2.4 Risk pathways on Farm to process and associated indicators

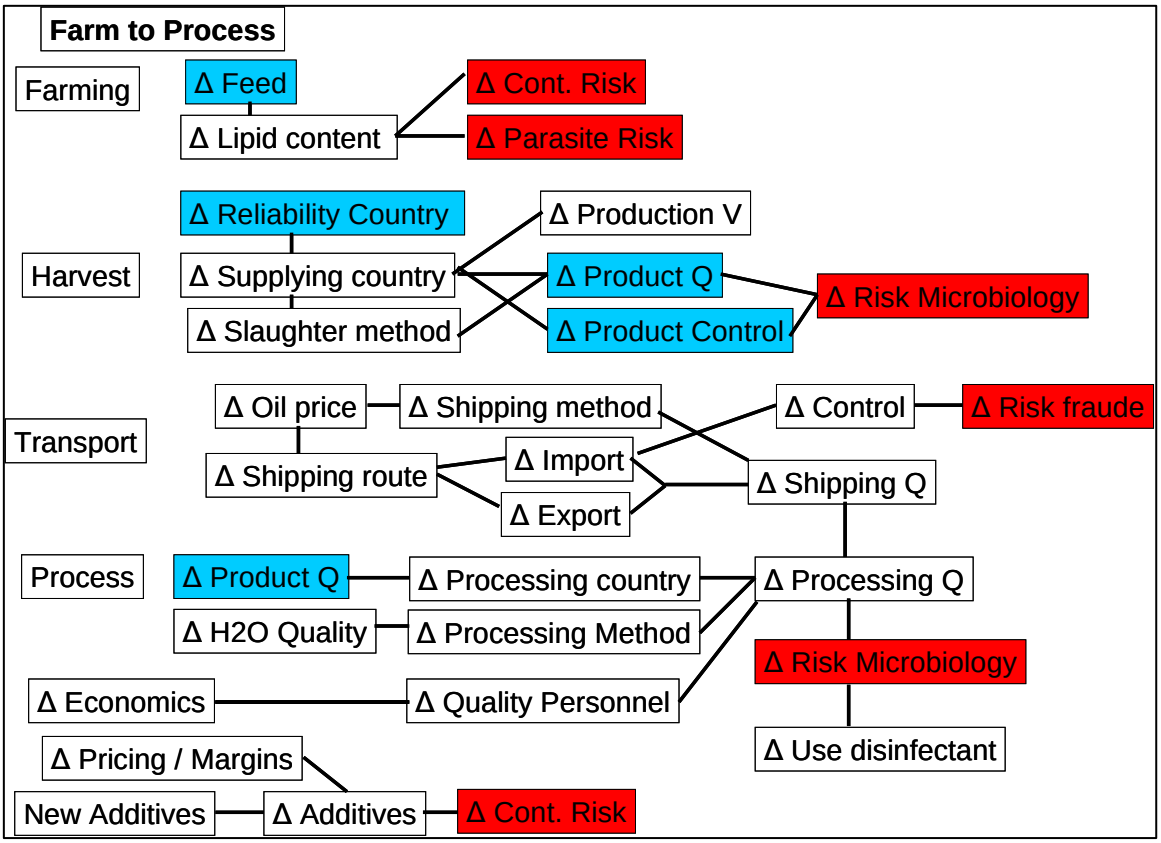
HACCP based issues were not included in the risk pathway.
Quality is indicated as Q. Δ is indicated as a change of the indicator (nominal or quantitative).

In this pathway the four risks indicators were identified: Contaminants Risks, Parasite risks, Microbiological risks and Fraud risks.

The most crucial pathways lead to a risk starting points:

- Change in Feed
- Change in Reliability Countries
- Change Product control
- Change Product quality

Within these pathways it was much more complicated to identify the most crucial risk starting points. All pathways seems to be related to on another. This implies a more complicated signal function from the data sources.



4.2.5 Pathways on indicators General Contaminants

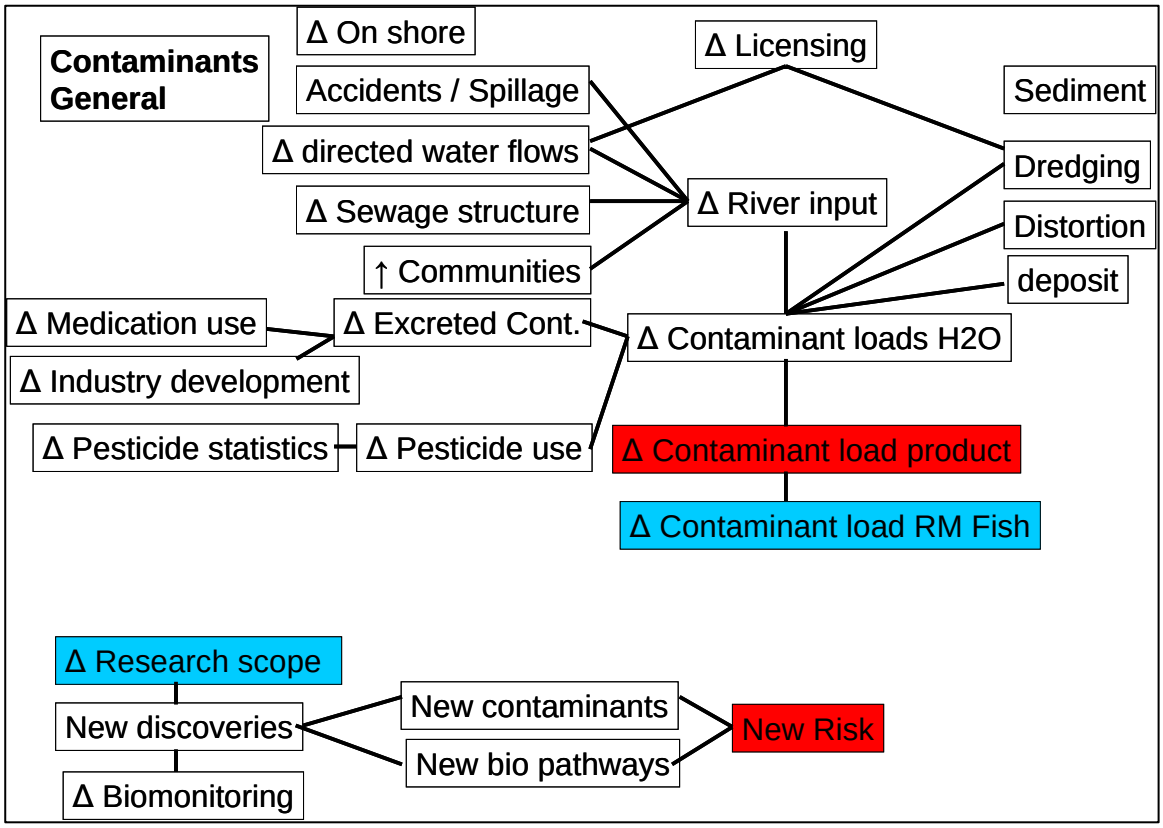
General contaminants have been identified to be (heavy)metals, PCB, Oily substances, antibiotic residues, flame retardants and unknown risks which are a result from contaminations in the sea.

Δ is indicated as a change of the indicator (nominal or quantitative). Raw Material is indicated as RM (in this case the fish fraction).

In this pathway the two risks indicators were identified: New contaminants/risks and Increased contaminant loads.

The most crucial pathways lead to a risk starting points:

- Change of Research scope
- Change of Contamination Loads in Raw Materials (Fish fraction)



4.3 Data source identification

Based on the risk pathways the data sources are identified using internet searches. This resulted in a preliminary list of 103 possible data sources (related to the indicators). The quality of the data sources were identified by using scales for the following quality criteria:

Quality aspects	**Criteria**				
Data input	Official	Private	Semi-governmental	Foundation	
Host Environment Importance	Important	Medium	Not-important		
Validation Data	yes	no	not applicable		
Authenticity	Very Good	Good	Medium	Bad	Very Bad
Accessibility	Very Good	Medium	Very Difficult	Unknown	
Availability	Official	Private	Semi-governmental	Foundation	
chance change parameter	High	Medium	Low		
Delay data entry	Week	Month	Year	2-year	Project based
Update Frequency	Daily	Weekly	Monthly	Yearly	Project based

The data required for the identification of Quality aspects was collected based on the website information. A selection of the data sources and the quality assessment are included in this report in Annex 1.

4.4 Interaction development ERDS system

The interaction with subproject 3 (development of ERDS system) was established during several working group meetings. A case study of Melamine in pet-food (and ultimately in salmon feed) in the United States was used to trace back the advantage of an ERDS system. The research questions we answered during a working group meeting:

- 'would it be possible to identify this as an Emerging Risk if an ERDS system was in place?'
- 'What information is needed to identify this case as an Emerging Risk?'

Besides that this was used to further develop the ERDS system, as reported in their overview of activities, it was concluded that this case only could have been identified as an emerging risk when a holistic approach would have been used. The risk pathways described before are multidimensional and are only successful in identifying Emerging Risks when they are used as such.

Annex 1. Overview Data sources related to Emerging Risk Indicators

The data set will be completed in the official publication. Due to technical constrains the data could not be incorporated in this draft document.

Indicator	Datasource	Comment	Source	Host Environment importance	Data Input	Validation data	Authenticity	Accessibility	Availability	Change Chance parameter	Up
Antibiotics	Anibiotic usage	news letter information	www.fao.org	Important	Semi-governmental	no	Good	Medium	Semi-governmental	Medium	Monthl
Approval EU	Approval EU	List of approved EU establishments	http://circa.europa.eu/irc/sanco/vets/ir	Important	Official	yes	Very Good	Very Good	Official	Medium	Monthl
New Aquaculture Species	Aquacultural species	Information on different fish species	http://www.fishbase.org/search.php	Important	Semi-governmental	yes	Medium	Very Good	Semi-governmental	Low	Monthl
New discoveries Contaminants	Contaminants Marine Environ	Risk Substances for the Marine Environment	http://www.ospar.org/eng/html/welcom	Important	Official	not applicable	Medium	Very Good	Semi-governmental	Medium	Project
Presence Contamination	Contaminants Marine Environ	Risk Substances for the Marine Environment	http://www.ospar.org/eng/html/welcom	Important	Official	not applicable	Medium	Very Good	Semi-governmental	Medium	Project
Demographic figures	Demographic figures	Demographic and Socioeconomic Statistics	http://www.who.int/whosis/whostat200	Important	Semi-governmental	no	Medium	Very Good	Semi-governmental	Low	Yearly
Disease Spread	Fish disease presence	Database on all fish diseases	http://www.europanda.net/EpiDB/pub/	Important	Semi-governmental	yes	Good	Medium	Semi-governmental	Medium	Yearly
Fish landings	Fish Landings	FAO Fishstat	ftp://ftp.fao.org/fi/stat/summary/defaul	Important	Official	no	Medium	Medium	Official	Low	Yearly
New Methods Production Feed	Fish meal information	International Fishmeal and Fish Oil Association	http://www.iffo.net/	Important	Private	no	Good	Medium	Private	Medium	Weekly
Pricing	Fish prices	Market reports of Fish	http://www.eurofish.dk/dynamiskSub.p	Important	Private	yes	Good	Very Good	Semi-governmental	Low	Daily
Pricing	Fish prices	Market reports on seafood	http://www.intrafish.no/global/	Important	Foundation	yes	Very Good	Medium	Foundation	High	Daily
Pricing	Fish prices	Market reports of Fish	http://www.globefish.org/	Important	Foundation	yes	Good	Medium	Foundation	Low	Daily
Producing Country RM	Import fish meal	Globe fish indicator listing	http://www.globefish.org/index.php?id	Important	Foundation	no	Good	Very Good	Foundation	Low	Monthl
Import refusals	import refusal	Data on refused companies for import USA	http://www.fda.gov/ora/oasis/ora_ref_	Important	Official	not applicable	Good	Medium	Official	High	Monthl
Import refusals RM	import refusal	Data on refused companies for import USA	http://www.fda.gov/ora/oasis/ora_ref_	Important	Official	not applicable	Good	Medium	Official	High	Monthl
Presence Contamination	PCB Salmon	Project based monitoring different countries	http://www.ewg.org/reports/farmedPC	Important	Semi-governmental	yes	Medium	Medium	Semi-governmental	Medium	Project
Pesticide statistics	Pesticide data	Registered Pesticide database	http://www.pesticideinfo.org/Index.htm	Important	Semi-governmental	yes	Good	Medium	Semi-governmental	Medium	Monthl
Pesticide regulation	Pesticide registration	Database on registered pesticides world wide	http://www.panna.org/	Important	Foundation	no	Medium	Medium	Foundation	Medium	Unkno
Status regulation pesticides	Pesticide regulation	Database on registered pesticides world wide	http://www.pesticideinfo.org/Search_C	Important	Foundation	no	Medium	Medium	Foundation	Medium	Unkno
Knowledge Contaminants	Toxicological Data	Agency for toxic substances and disease informatio	http://www.atsdr.cdc.gov/	Important	Official	yes	Medium	Very Good	Official	High	Project
New Aquaculture Species	Aquacultural species	World Aquaculture information site	http://library.thinkquest.org/22403/data	Medium	Foundation	no	Good	Very Good	Foundation	Low	Yearly
Disease Spread	Fish disease information	Database on fish disease information and prevelanc	http://www.europanda.net/epidb/	Medium	Foundation	no	Good	Medium	Foundation	High	Project
Private Sector Development	Private Sector Development	provide intelligent comment on private sector	http://psdblog.worldbank.org/psdblog/	Medium	Semi-governmental	no	Medium	Medium	Semi-governmental	High	Weekly
Production RM Feed	Soy bean production	Soy bean Production database FAO	http://faostat.fao.org/	Medium	Semi-governmental	no	Medium	Very Good	Semi-governmental	Medium	Yearly
Welfare Index	Welfare Index	UN Index for Welfare	http://www.icgg.org/downloads/CPI_2(	Medium	Official	no	Good	Very Good	Official	Low	Yearly

5 Quality Assurance

IMARES utilises an ISO 9001:2000 certified quality management system (certificate number: 08602-2004-AQ-ROT-RvA). This certificate is valid until 15 December 2009. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. The last certification inspection was held the 16-22 of May 2007. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2000 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2009 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation, with the last inspection being held on the 12th of June 2007.

Justification

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The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of Wageningen IMARES.

Approved: Marnix Poelman
Projectleader

Signature: 

Date: 30 October 2008

Approved: Ir. H.W. van der Mheen
Head of Department Aquaculture

Signature: 

Date: 30 October 2008

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