RISK FACTORS ANALYSIS FOR CADMIUM CONTAMINATION IN MYTILUS GALLOPROVINCIALIS HARVESTING AREAS OF MARCHE REGION (ITALY) FOR THE PURPOSES OF CHEMICAL SANITARY SURVEY

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INTRODUCTION

Mussels are natural accumulators of Cadmium (Cd) from the environment. This happens because metals are accumulated by these filter feeding organisms through water, ingestion of suspended sediments or food. Commission Regulation (EC) 1881/2006 sets maximum levels of Cd in edible bivalve mollusc (wet weight) at < 1,0 mg/kg. According to Regulation (EC) 854/2004, bivalve molluscs can be harvested and commercialized only from classified areas. The classification is based on *Escherichia coli* contamination of bivalve molluscs. The classification can be correctly established only through a complete and preliminary sanitary survey. The sanitary survey is a procedure that studies the sources of fecal pollution and the environment characteristics of an area used for the bivalve mollusc production. To ensure public health shellfish harvesting areas have to be periodically sampled and monitored. Frequency of sampling and geographical distribution of sampling point are chosen by Competent Authority but, unlike during fecal bacteria monitoring, the plan of a sanitary survey is not a legally requirement for chemical contaminants.

AIM

This study apply the concept of sanitary survey on cadmium control on *Mytilus galloprovincialis* harvesting areas.

MATERIALS AND METHODS

It was discovered the most representative areas to control the Cd contamination in mussels and created a model that can help to build a better monitoring program following specific risk that is the base for any type of survey.

Six main risk factors for Cd contamination in the environment were studied:

1) type of industrial activity (table 1);
2) ports,
3) agriculture land (figure 1),
4) rainfall,
5) rivers,
6) sea sediments

These factors were compared with the historical Cd contamination in mussels in a ten years period (2009-2018)

Table 1. ATECO CODEX and industrial activity associated

Ateco codex	Economic activity
5	Coal mining
6	Gas oil extraction
7	Metals mining
8	Other kind of mining
19	Manufacture of products arising from petroleum refining and coking plant
20.01.00	Manufacture of basic chemicals, of fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms
20.02.00	Manufacture of pesticides and other chemicals for agriculture
20.03.00	Manufacture of paints and enamels, printing ink and mastics
20.05.00	Manufacture of chemicals
20.06.00	Manufacture of synthetic and artificial fibers
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23.02.00	Manufacture of refractory products
23.03.00	Manufacture and construction in clay
23.04.00	Manufacture of products in porcelain and ceramic
23.05.00	Production of cement, lime and plaster
23.06.00	Manufacture of concrete, cement and plaster
23.09.00	Manufacture of abrasive products and products in non-metallic mineral
24	Steel industry
25.05.00	Forging, pressing, stamping and forming of metal
25.06.00	Treatment and coating of metals; general mechanical engineering
26.01.00	Electronic components manufacturing
27.02.00	Manufacture of electric batteries

Figure 1. Map of agriculture land in Marche Region

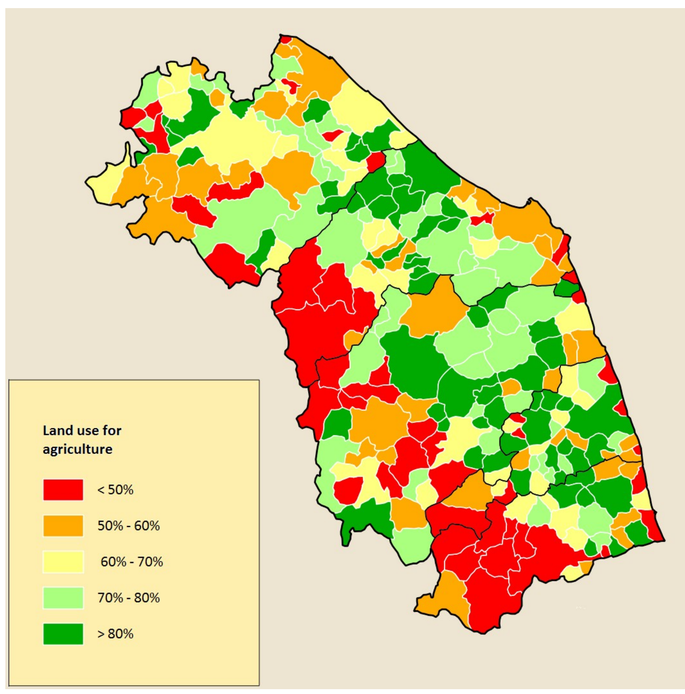


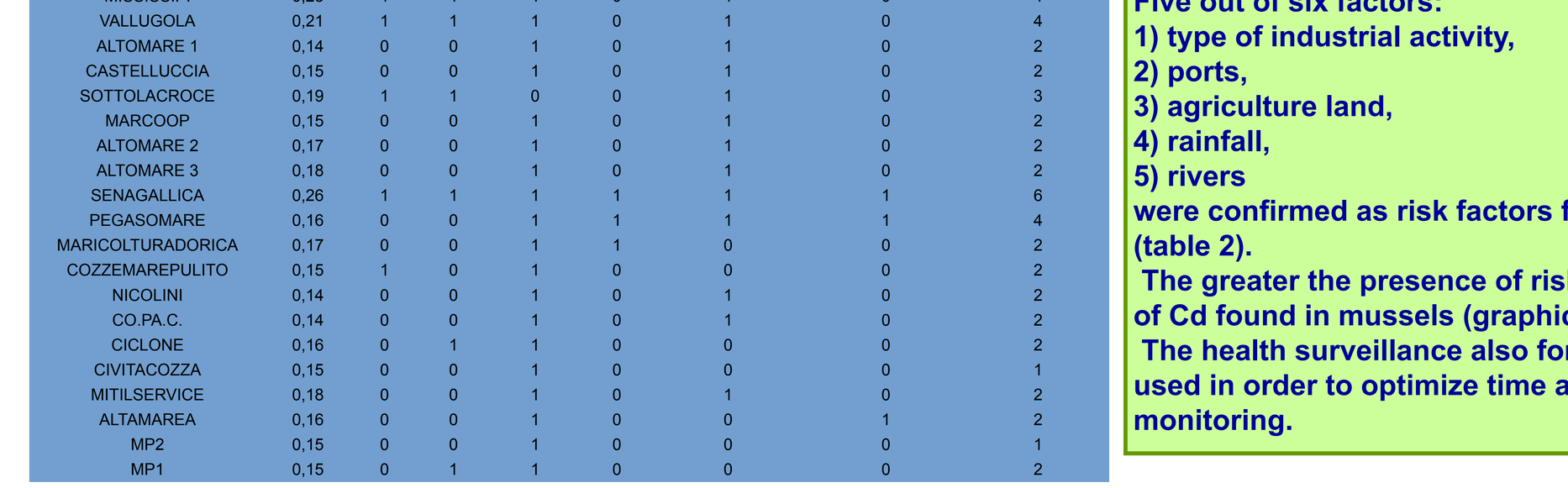
Table 2: Distribution of the risk factors in the mussels production areas.

	Average	Port	River	Sediments	Rainfall	Industrial activity	Agriculture activity	Total risk score
MISSISSIPI	0,28	1	1	1	0	1	0	4
VALLUGOLA	0,21	1	1	1	0	1	0	4
ALTOMARE 1	0,14	0	0	1	0	1	0	2
CASTELLUCCIA	0,15	0	0	1	0	1	0	2
SOTTOLACROCE	0,19	1	1	0	0	1	0	3
MARCOOP	0,15	0	0	1	0	1	0	2
ALTOMARE 2	0,17	0	0	1	0	1	0	2
ALTOMARE 3	0,18	0	0	1	0	1	0	2
SENAGALLICA	0,26	1	1	1	1	1	1	6
PEGASOMARE	0,16	0	0	1	1	1	1	4
MARICOLTURADORICA	0,17	0	0	1	1	0	0	2
COZZEMAREPULITO	0,15	1	0	1	0	0	0	2
NICOLINI	0,14	0	0	1	0	1	0	2
CO.PA.C.	0,14	0	0	1	0	1	0	2
CICLONE	0,16	0	1	1	0	0	0	2
CIVITACOZZA	0,15	0	0	1	0	0	0	1
MITILSERVICE	0,18	0	0	1	0	1	0	2
ALTAMAREA	0,16	0	0	1	0	0	1	2
MP2	0,15	0	0	1	0	0	0	1
MP1	0,15	0	1	1	0	0	0	2

RESULTS AND DISCUSSION

Five out of six factors:
1) type of industrial activity,
2) ports,
3) agriculture land,
4) rainfall,
5) rivers
were confirmed as risk factors for Cd contamination in mussels (table 2).
The greater the presence of risk factors the greater the quantity of Cd found in mussels (graphic 1).
The health surveillance also for Cd pollution can therefore be used in order to optimize time and locations of sampling for monitoring.

Graphic 1: Cd Mussels contamination in comparison with the presence (red columns) or the absence (blu columns) of risk factors. Yellow line shows the difference of the column



CONCLUSIONS

- ✔ **Sanitary survey for control of Cd in mussels, it works**
- ✔ **Descriptive analysis can be used for sanitary survey**
- ✔ **Risk factors must be considered togheter**
- ✔ **Risk factors affecting the spread of Cd in the seaside are more important**
- ✔ **Different approach is needed if contamination is close to the legal limit**

REFERENCES

References are available from the Authors