

Project *brief*

Thünen Institute of Fisheries Ecology

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COFISHMAP – Assessment of Moroccan coastal fish habitat and water quality

Ulrike Kammann¹, Jan-Dag Pohlmann¹, Fatima Wariaghi², Hajar Bourassi², Klara Regelsberger¹, Ahmed Yahyaoui², Reinhold Hanel¹

- The Moroccan coastal benthic fish species conger and moray eel are moderately to significantly high polluted.
- Big specimens of European conger or Mediterranean moray can exceed the European food threshold for mercury. They should be consumed less often.
- European Conger from the Atlantic coast showed higher mean cadmium levels compared to fish from Mediterranean coastline.
- Contaminant levels of European conger from Moroccan coast are distributed heterogeneously.

Background and aims

The Atlantic coast of Morocco is one of the richest fishing grounds in the world. Altogether, Morocco's coastline covers 2,141 miles along the Mediterranean Sea and Atlantic Ocean. Fishing has been a major industry in Morocco since the 1930's and the industry experienced tremendous growth during the 1980's.

However, together with waste management and desertification, water quality and coastal pollution are considered the two major environmental issues. Estuarine and nearshore living benthic and demersal fish species are among the most vulnerable members of the marine food chain in terms of chemical pollution. While pollution of surface water is mostly periodic and linked to specific emission events, contamination in or near sediments remains persistent. Benthic fish species like freshwater eels, congers and moray eels considered stationary during their growth phase, live close to the sediment and are known to accumulate chemical pollutants due to their high position in the food chain and their high lipid content.

By analysing the contamination of European eel (*Anguilla anguilla*), European conger (*Conger conger*), Lusitanian toadfish (*Halobatrachus didactylus*), Snake blenny (*Ophidion barbatum*), Brown moray eel (*Gymnothorax unicolor*) as well as Mediterranean moray (*Muraena helena*) for heavy metals and PAH-metabolites (degradation products of fossil oil) at several estuarine sampling stations along the Moroccan Mediterranean and Atlantic coastline maps of coastal pollution have been created and a risk assessment of fish consumption in the area has been done. A country-wide study showing different contamination levels in fish was lacking so far.

The overall goal beside the scientific progress was to build a bi-national scientific network and to support young researchers.

Approach

The project was planned and conducted by Moroccan and German partners together. Twelve regions along the Atlantic and Mediterranean coastline of Morocco have been chosen for sampling. Fish was obtained from local fishermen or bought on local markets respectively. Chemical analyses took place at Thünen Institute in Germany, while the certain sampling campaigns were performed with support of Mohammed V University in Morocco. Students from Morocco have performed parts of the analysis themselves in Germany.

In total about 180 fish were investigated comprising six different species. 110 of the samples were European conger, sampled in nine different regions (Fig. 1).

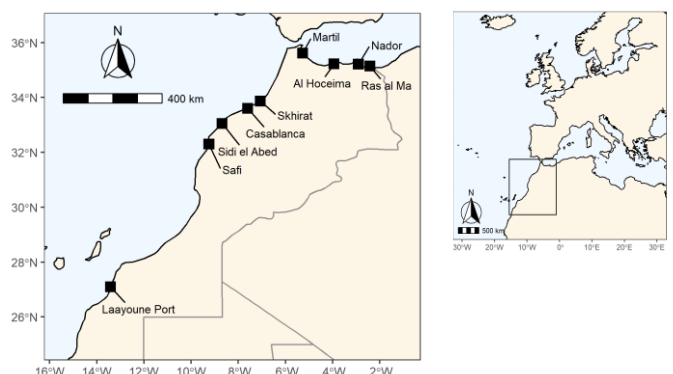


Fig. 1: Sampling regions for European conger (*Conger conger*) along the Moroccan coastline.

Results

Maximum contamination levels of mercury in single fish were 1123 $\mu\text{g}/\text{kg}$ wet mass for European conger and 849 $\mu\text{g}/\text{kg}$ for Mediterranean moray (Table 1). Big specimens exceeded the European threshold for mercury in fish as food: 500 $\mu\text{g}/\text{kg}$ wet mass. These fish should be therefore consumed less often.

Table 1: Number and mean (range) of Hg: mercury, Cd: cadmium und Pb: lead [$\mu\text{g}/\text{kg}$ wet mass] in most frequent fish species. PAH: PAH-metabolite 1-hydroxypyrene [ng/ml bile]; DL: detection limit

Species	N	Hg	Cd	Pb	PAH
European conger	75-111	251 (31-1123)	259 (1-1352)	94 (12-657)	9.4 (<DL-208)
Mediterranean moray	27-31	353 (140-849)	1093 (295-5308)	54 (15-225)	2.5 (0.02-19.7)
Lusitanian toadfish	11-22	142 (83-288)	270 (22-984)	35 (12-169)	5.4 (0.05-8.5)
European eel	7-15	241 (6-172)	58 (16-132)	536 (49-3160)	53 (8-174)

European conger was chosen for the regional comparison. Mercury and cadmium in European conger showed bioaccumulation (increase of concentration parallel with fish length). Bioaccumulation differed between the regions. Therefore, it became necessary to adjust contamination to a mean fish length in all regions under investigation. For the respective calculation a generalized linear model (GLM) was used covering all heavy metals.

Fig. 2 shows maps of the partly GLM-corrected mean concentrations of the heavy metals lead, mercury and cadmium as well as mean concentrations of the PAH-metabolite 1-hydroxypyrene. The regional distribution of the contaminants under investigation is heterogenous in European conger. Hot Spots with elevated levels of two or more contaminants under investigation could not be found. However, mean cadmium concentrations were higher in fish from the Atlantic coast than in fish from the Mediterranean coastline. Maximum cadmium values were analysed in European conger from Casablanca.

Conclusion

Coastal fish species from Morocco can be polluted in moderately to significantly high levels with different contaminants. Especially the heavy metal mercury in European conger or Mediterranean moray can reach concentration levels of concern. Regional distributions and hot spots of contaminants in the European conger could be shown for the first time.

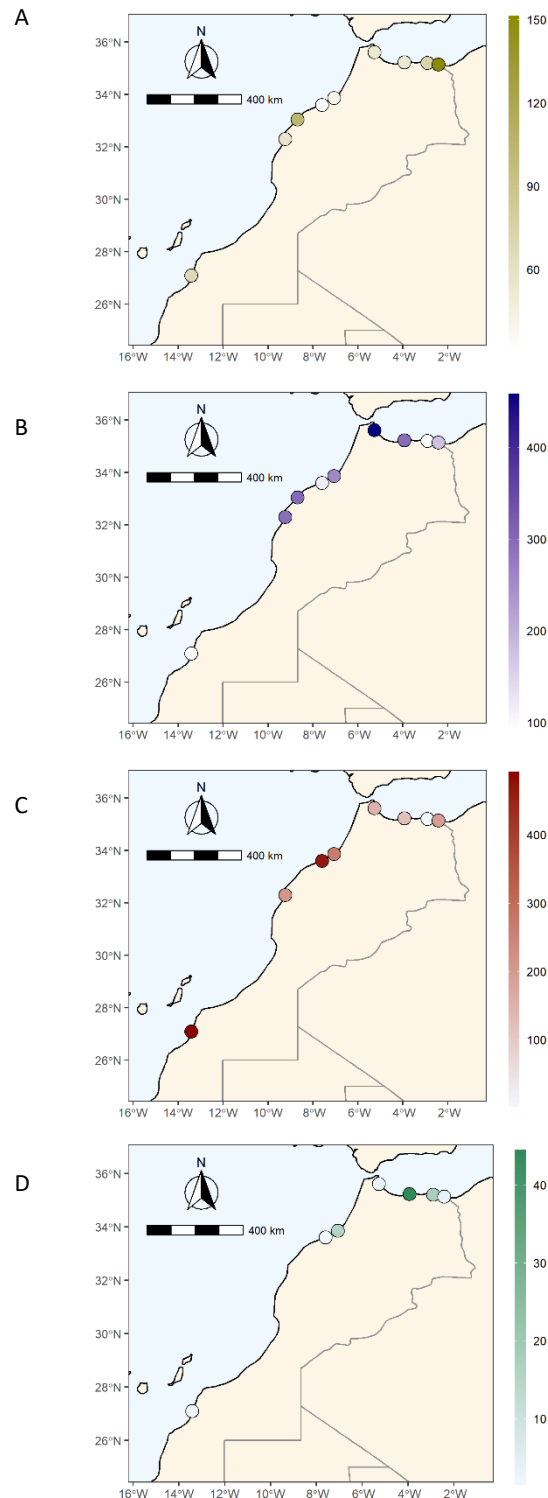


Fig. 2.: Mean concentrations of contaminants in European conger, partly corrected by GLM in $\mu\text{g}/\text{kg}$ wet mass. A: lead, B: mercury, C: cadmium, D: PAH-metabolite 1-hydroxypyrene in ng/ml bile.

Further information

Contact

1 Thünen Institute of Fisheries Ecology,
Bremerhaven, Germany
Reinhold.Hanel@thuenen.de
www.thuenen.de/en/fi

Partner

2 Faculty of Sciences, University Mohammed
V, Rabat, Morocco

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