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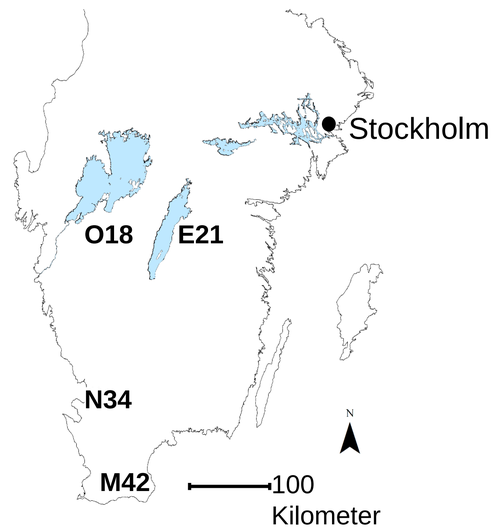
Biological assessment of pesticide effects in Swedish monitoring sites



HIGHLIGHTS

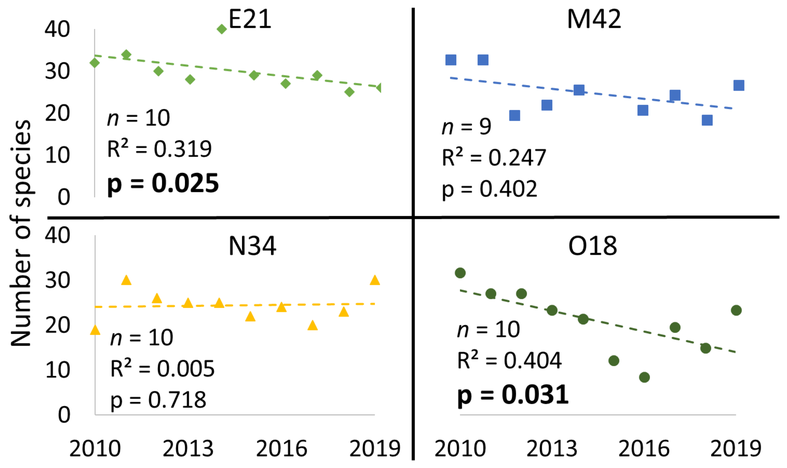
- **All four monitoring sites were affected by nutrients and pesticides.**
- **Assessment of biological effects of pesticides using benthic invertebrate and diatom samples.**
- **Indexes, i.e. SPEAR, PTI and diatoms, can lead to a better understanding of integrated effects of pesticides over time and quantify effects on organism communities[1,2,3].**

Introduction

Environmental monitoring data of pesticides show that organisms in streams are exposed to a mixture of substances. However, the assessment of effects of pesticides on primary producers and benthic invertebrates is not straight forward as there are several stressors that can affect ecosystems.

Monitoring data

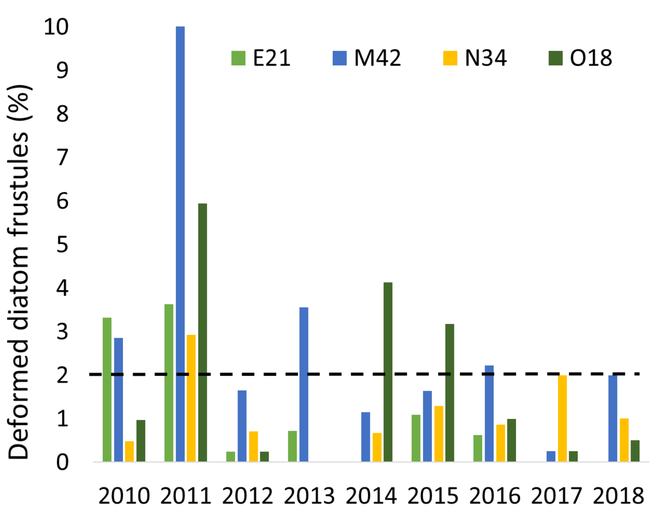
Data from 2010 to 2019 from four national monitoring streams in agricultural areas in Sweden were evaluated. Pesticide concentrations in water (time-integrated weekly sample) and biological samples, benthic invertebrates and diatoms (yearly samples), were included**.**



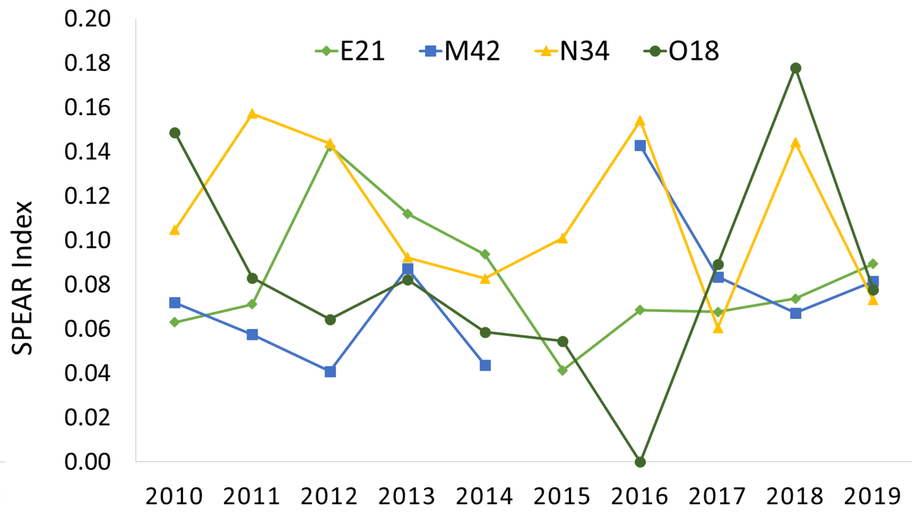
The number of taxa of aquatic invertebrates found in the four monitored streams during the period 2010-2019. Site E21 and O18 show a significant decrease (Mann-Kendall trend test p< 0.05).

RESULTS

- On average 23-30 aquatic invertebrate species per site
- Decrease of number of species at sites E21 and O18
- Eutrophication indexes indicate nutrient-rich conditions for all sites



Frequency of diatom deformities in the four monitored streams during the period 2010-2018. The dashed line shows the 2% threshold for what is considered "significant impact", according to HaV report 2018[4].



SPEAR values of the four monitored streams during the period 2010-2019. SPEAR is the relative log-transformed abundance of sensitive species (range 0-1), whereas values close to 0 indicate low abundance of sensitive species. No data for M42 in 2015.

Indexes

Frequency of diatom deformities[4]:

- Show on average a moderate ecological status, in some year's exceedance of the 2% level of impact, which indicate effects of heavy metals or pesticides.

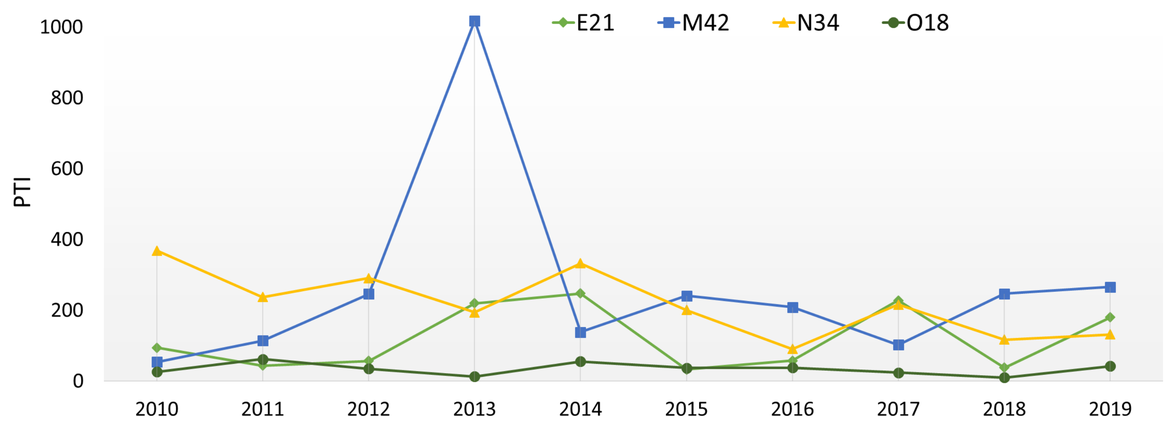
SPEcies At Risk (SPEAR) index[5]:

- Values between 0 – 0.18 at all sites, showing the amount of sensitive species compared to tolerant species is rather low

Pesticide Toxicity Index (PTI)[6]:

- Varies between years, the outlier for M42 in 2013 was most likely a point source of one single substance (i.e. methiocarb)

No specific time trends can be seen for the indexes.



Pesticide Toxicity Index (PTI) values of the four monitored streams during the period 2010-2019. PTI is the sum of all ratios between concentrations of detected pesticides and their toxicity levels (PNEC-values of EFSA-conclusions), per year. The index includes up to 120 of 170 analyzed pesticides.

References:

[1]BIGHIU, M. A., HÖSS, S., TRAUNSPURGER, W., KAHLERT, M. & GOEDKOOP, W. 2020. Limited effects of pesticides on stream macroinvertebrates, biofilm nematodes, and algae in intensive agricultural landscapes in Sweden. *Water research,* 174**,** 115640.

[2]STENSTRÖM, J. R., KREUGER, J. & GOEDKOOP, W. 2021. Pesticide mixture toxicity to algae in agricultural streams–Field observations and laboratory studies with in situ samples and reconstituted water. *Ecotoxicology and environmental safety,* 215**,** 112153.

[3]VON DER OHE, P. C. & GOEDKOOP, W. 2013. Distinguishing the effects of habitat degradation and pesticide stress on benthic invertebrates using stressor-specific metrics. *Science of the Total Environment,* 444**,** 480-490.

[4]Havs- och vattenmyndighetens rapport 2018:38. Kiselalger i sjöar och vattendrag vägledning för statusklassificering

[5]SPEAR: https://www.ufz.de/index.php?en=38122

[6]PTI: https://www.kemi.se/en and https://sverigesmiljomal.se

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