



Relation between BaP and PAH4 in mussels and consequences for the Norwegian consumption advisories

Summary

Along the Norwegian coast the seabed might be contaminated with polycyclic aromatic hydrocarbons (PAHs) due to e.g. previous or ongoing industrial activity. Several of the PAH compounds are genotoxic and carcinogenic. Mussels are filtering organisms living at the seabed and might thus accumulate environmental contaminants. The Norwegian Food Safety Authority issues consumption advisories on mussels from PAH contaminated harbours and fjords. Risk assessments performed by the Norwegian Scientific Committee for Food Safety (VKM) form the basis for such consumption advisories.

Benzo[a]pyren (BaP) is one of the most studied and more potent carcinogenic PAHs. Until recently BaP has been regarded as a good indicator for all PAHs in different food. The Norwegian Food Safety Authority has issued consumption advisories for mussels in areas where the BaP content has been 5nanogram per gram (ng/g) or above. Within the EU, the upper limit for BaP has been 10ng/g. However, EFSA concluded in 2008 that the sum of four PAHs (PAH4; benzo[a]pyrene, chrysene, benz[a]anthracene and benzo[b]fluoranthene) is a more suitable indicator of carcinogenic PAHs in food than BaP. During the spring 2011, new EU upper limits for PAHs in bivalve molluscs have been proposed; 30ng/g for PAH4 and 5ng/g for BaP.

VKM has previously performed risk assessments of PAH in mussels based on BaP as marker. VKM therefore wanted to examine whether PAH4 is a suitable marker for carcinogenic PAHs also in Norwegian mussels. Review of analytical results for blue mussels from different localizations along the Norwegian coast showed that the EU's proposed upper limit for PAH4 (30 ng/g) provides slightly better protection than the Norwegian action limit for consumption advisories (5ng BaP/g), which is identical to the proposed new EU upper limit for BaP. Furthermore, the proposed EU upper limit for PAH4 provides clearly better protection than the present EU upper limit for BaP (10 ng BaP/g). Based on evaluation of available analytical results in blue mussels, the existing geographic extent of consumption advisories for mussels along the Norwegian coast do not need to be revised as a consequence of the proposed EU upper limit for PAH4 in bivalve molluscs (30 ng/g).

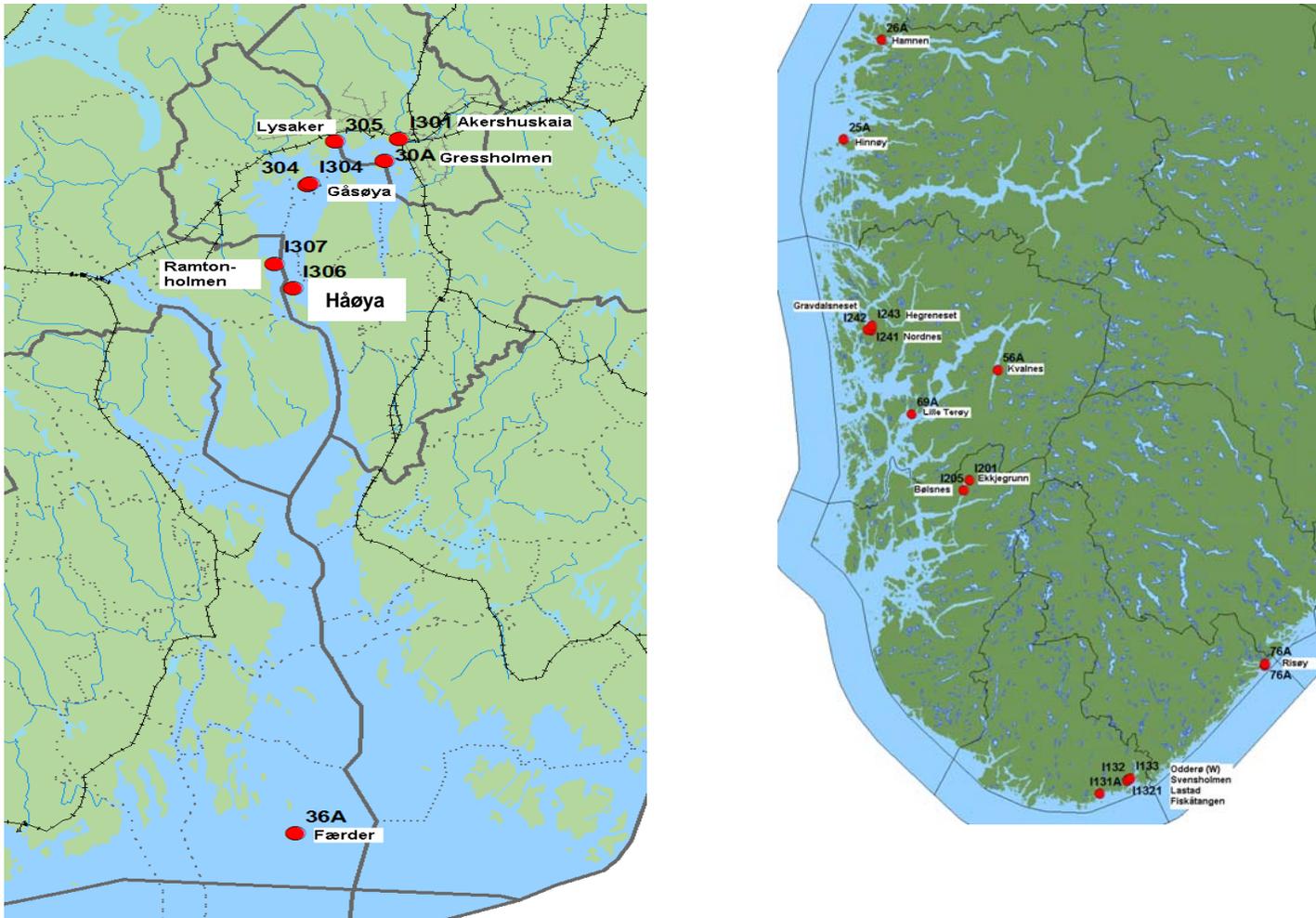
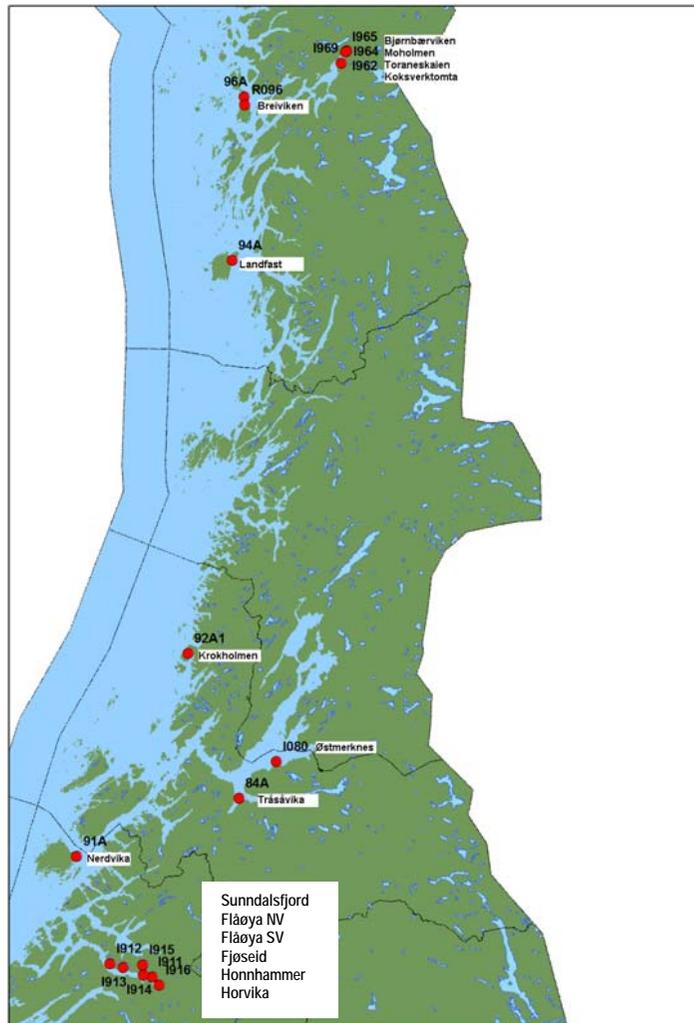


Figure 1. Map indicating the sampling stations (blue mussels) within the Coordinated Environmental Monitoring Programme. Oslo Fjord (left) and southern part of Norway (right).



Forts. Figure 1. Map indicating the sampling stations (blue mussels) within the Coordinated Environmental Monitoring Programme. Central Norway (left) and northern Norway (right).

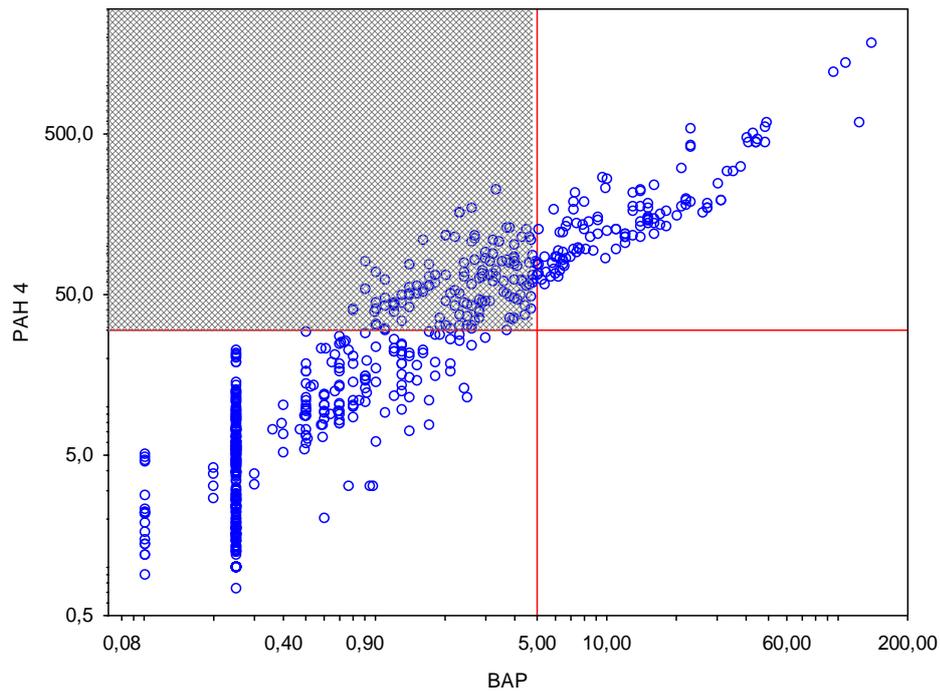


Figure 2. Concentrations of benzo [a] pyrene (BaP) plotted against concentrations of PAH4 (sum of the compounds benz [a] anthracene, benzo [a] pyrene, benzo [b] fluoranthene and chrysene; ng/g wet weight) in blue mussels along the entire Norwegian coast (1992-2007). There is considerable variation in the concentrations and in order to provide a clear presentation of the data, both axes are in logarithmic scale. Both the EU's proposed limit for PAH4 (30 ng/g) and the national action level for consumption advisories for shellfish (5 ng BaP/g), are indicated by red lines in the plot. Linear regression is used and the line is represented by the equation $PAH4 = 12.9 \cdot 10.5 \cdot BaP$ ($R^2 = 0.86$; no log-transformation).

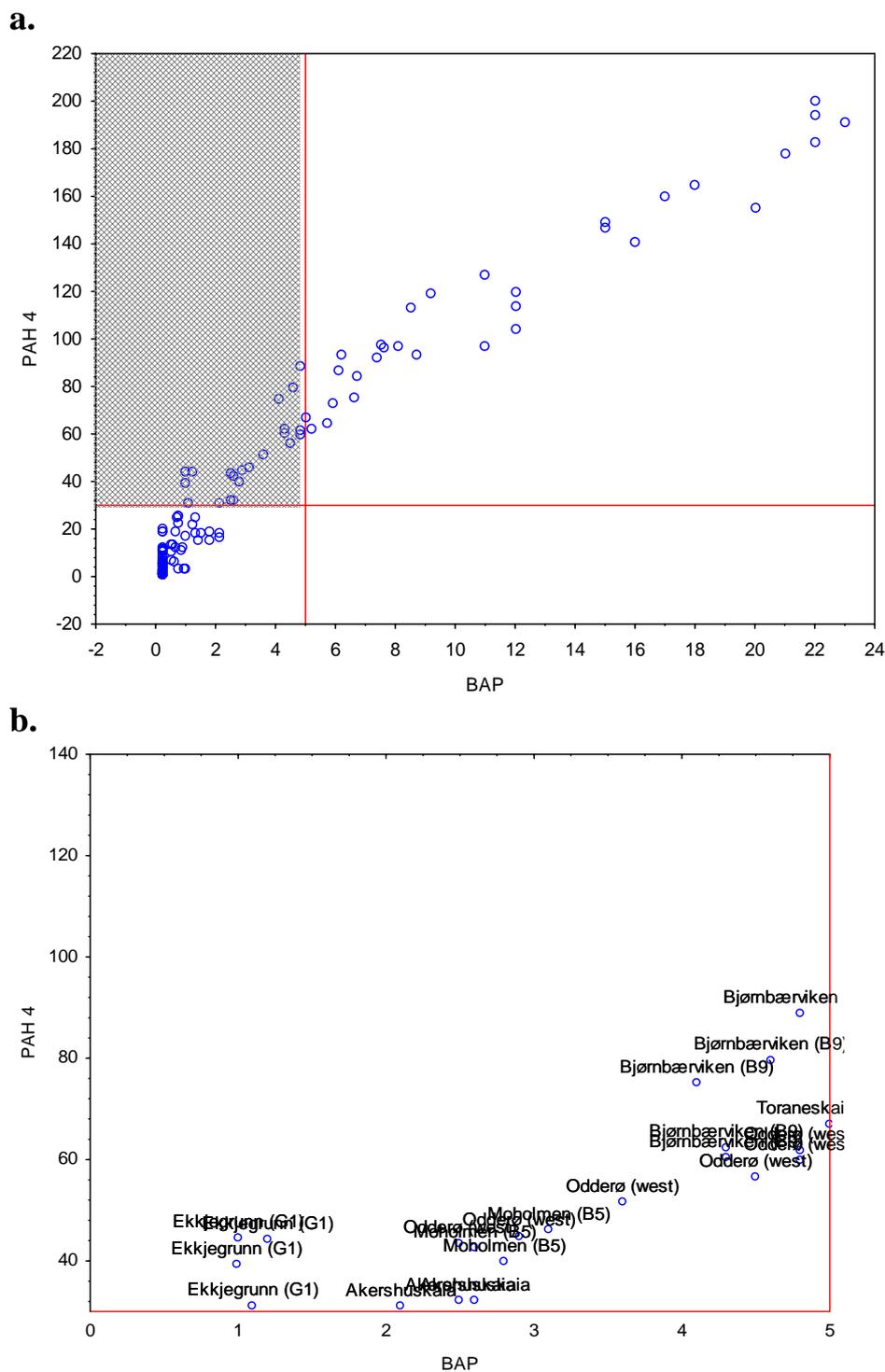


Figure 3. Concentrations of benzo [a] pyrene (BaP) plotted against concentrations of PAH4 (sum of the compounds benz [a] anthracene, benzo [a] pyrene, benzo [b] fluoranthene and chrysene; ng/g wet weight) in blue mussels sampled along the Norwegian coast from the years 2005-2007. Less tension in concentrations between the samples allows linear scale on both axes.

(a). The EU proposed limit for PAH4 (30 ng/g) and the national action level for consumption advisories for shellfish (5 ng BaP/g) are indicated by red lines in the figure. Linear regression is used and the line is represented by the equation $PAH4 = 7.77 + 9.02 * BaP$ ($R^2 = 0.86$).

(b). Part of the upper left-sector (shaded) from Figure (a) where the data are presented with localization and station names. In other words, the figure shows only mussels that concurrently contain PAH above the EU's proposed limit for PAH4 (30 ng/g) and below the national used action limit for BaP (5 ng/g).