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Susceptible species

Liver tumours (neoplasms) in flatfish have been reported from several species from North America (Myers *et al.*, 1987, 1990, 1998a, b; Moore and Stegeman, 1994), including the English sole (*Parophrys vetulus*) and starry flounder (*Platichthys stellatus*), and European waters (Bucke and Feist, 1984; Vethaak and Jol, 1996; Vethaak and Wester, 1996) where the principle species exhibiting liver tumours are the European flounder (*Platichthys flesus*) and the dab (*Limanda limanda*).

Disease name

“Liver nodule” is the term used for macroscopic lesions visible on the surface of the liver which are, according to standard technical guidelines, greater than 2 mm in diameter (Bucke *et al.*, 1996; Feist *et al.*, 2004). Microscopic examination of histological sections of these nodules is used to eliminate the possibility that they may be inflammatory lesions attributable to parasitic infections and to discriminate between non-malignant neoplasms (hepatocellular adenoma, cholangioma, hemangioma, pancreatic acinar cell adenoma) and malignant neoplasms (hepatocellular carcinoma, cholangiocarcinoma, hemangiosarcoma, pancreatic acinar cell carcinoma). Using the OSPAR terminology, cases of liver nodules histologically confirmed as non-malignant or malignant tumours are called “macroscopic liver neoplasms” (OSPAR, 2008).

Aetiological agent

Liver tumours and their pre-stages (foci of cellular alteration) are associated with long-term exposure to anthropogenic carcinogenic contaminants, in particular polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) and their metabolites. Route of exposure is thought to be direct via exposure to contaminated sediments, but more likely through the diet via invertebrates which are unable to metabolize and thereby bioaccumulate these compounds.

Geographical distribution

Liver tumours have been recorded in European flounder, which are commonly found in inshore and estuarine locations along North Sea coasts but have rarely been seen in Baltic flounder (Stentiford *et al.*, 2003; Lang *et al.*, 2006). Lesions in dab have routinely been recorded throughout the North Sea, but particularly in the Dogger Bank and German Bight regions. However, the prevalence has declined during the past decade in the North Sea (Vethaak *et al.*, 2009). Dab exhibiting liver tumours and pre-neoplastic lesions have also been detected in the Irish Sea Liverpool Bay region.

Associated environmental conditions

The occurrence of liver tumours and pre-neoplastic lesions does not appear to be directly influenced by environmental conditions such as salinity or temperature.

Significance

It has been demonstrated that the occurrence of liver tumours increases with age but also that there are clear differences in prevalence between regions and that ‘age at

onset' for pre-neoplastic and neoplastic lesions also differs (Stentiford *et al.*, 2010). Prevalence of liver neoplasia can reach 40% in dab ≥ 7 years of age (Stentiford *et al.*, 2010), but the prevalence in dab and flounder populations in the North Sea has steadily declined in recent years (Vethaak *et al.*, 2009). The reason for this has not been established but numbers of older dab of larger size classes (≥ 20 cm) known to be more susceptible to lesion occurrence have been declining in most North Sea areas and in Dogger Bank and German Bight areas in particular.

Gross clinical signs

Liver nodules appear as discrete macroscopic lesions on or raised above the surface of the liver. Larger lesions often have conspicuous vasculature and different colouration to the surrounding liver tissue. Multiple lesions can occur and in extreme cases, many lesions can be present throughout the liver. There are no external macroscopic signs in fish with liver nodules although co-occurrence with skin ulcers, hyperpigmentation, epidermal hyperplasia/papilloma and emaciation has been recorded.

Control measures and legislation

There is currently no evidence to support an infectious aetiology. Macroscopic liver neoplasms, pre-neoplastic lesions and other histopathological liver changes are incorporated in the OSPAR JAMP guidelines for general and contaminants-specific biological effects monitoring for the OSPAR Coordinated Environmental Monitoring Programme (CEMP; OSPAR, 1997, 2005, 2008) and the current suite of biological effects of contaminants tools for use in the assessment of Good Environmental Status (GES) under Descriptor 8 (contaminants are not at levels giving rise to pollution effects) of the Marine Strategy Framework Directive (MSFD; Lyons *et al.*, 2010).

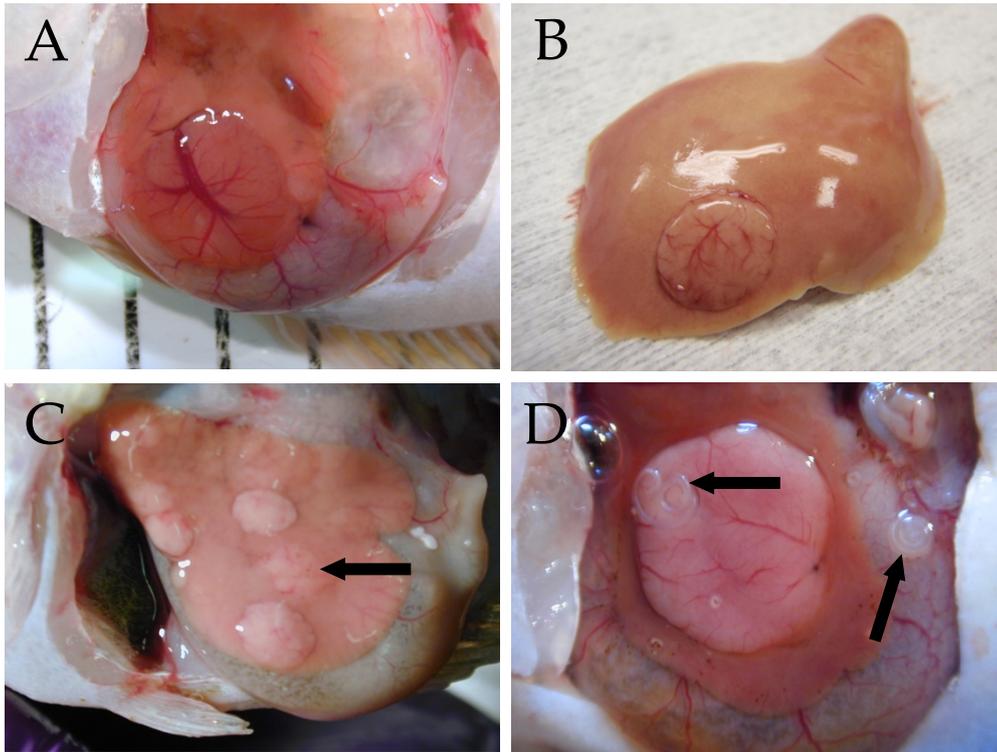
Diagnostic methods

Methods for sampling, macroscopic examination, histological processing and evaluation are provided by Feist *et al.* (2004). Guidelines for quality assurance for the diagnosis and reporting of data on liver pathology are provided under the Biological Effects Quality Assurance in Monitoring (BEQUALM) programme (<http://www.bequalm.org/>).

Key references

- Bucke, D., Watermann, B., and Feist, S. W. 1984. Histological variations of hepatosplenic organs from the North Sea dab, *Limanda limanda* (L.). *Journal of Fish Diseases*, 7(4): 255–268.
- Bucke, D., Vethaak, A. D., Lang, T., and Møllergaard, S. 1996. Common diseases and parasites of fish in the North Atlantic: Training guide for identification. ICES Techniques in Marine Environmental Sciences. No. 19. 27 pp.
- Feist, S. W., Lang, T., Stentiford, G. D., and Köhler, A. 2004. The use of liver pathology of the European flatfish, dab (*Limanda limanda* L.) and flounder (*Platichthys flesus* L.) for monitoring biological effects of contaminants. ICES Techniques in Marine Environmental Science. No. 38. 42pp.
- Lang, T., Wosniok, W., Baršienė, J., Broeg, K., Kopecka, J., and Parkkonen, J. 2006. Liver histopathology in Baltic flounder (*Platichthys flesus*) as indicator of biological effects of contaminants. *Marine Pollution Bulletin*, 53: 488–496.
- Lyons, B. P., Thain, J. E., Stentiford, G. D., Hylland, K., Davies, I. M., and Vethaak, A. D. 2010. Using biological effects tools to define Good Environmental Status under

- the European Union Marine Strategy Framework Directive. *Marine Pollution Bulletin*, 60(10): 1647–1651.
- Moore, M. J., and Stegeman, J. J. 1994. Hepatic neoplasms in winter flounder (*Pleuronectes americanus*) from Boston Harbor, Massachusetts, USA. *Diseases of Aquatic Organisms*, 20: 33–48.
- Myers, M. S., Rhodes, L. D., and McCain, B. B. 1987. Pathologic anatomy and patterns of occurrence of hepatic neoplasms, putative preneoplastic lesions, and other idiopathic lesions in English sole (*Parophrys vetulus*) from Puget Sound, Washington. *Journal of the National Cancer Institute*, 78: 333–363.
- Myers, M. S., Landahl, J. T., Krahn, M. M., Johnson, L. L., and McCain, B. B. 1990. Overview of studies on liver carcinogenesis in English sole from Puget Sound; evidence for a xenobiotic chemical aetiology, 1, Pathology and epizootiology. *Science of the Total Environment*, 94: 33–50.
- Myers, M. S., Johnson, L. L., Hom, T., Collier, T. K., Stein, J. E., and Varanasi, U. 1998a. Toxicopathic lesions in sub-adult English sole (*Pleuronectes vetulus*) from Puget Sound, Washington, USA: Relationships with other biomarkers of contaminant exposure. *Marine Environmental Perspectives*, 45 (1), 47–67.
- Myers, M. S., Johnson, L. L., Olson, O. P., Stehr, C. M., Horness, B. H., Collier, T. K., and McCain, B. B. 1998b. Toxicopathic hepatic lesions as biomarkers of chemical contaminant exposure and effects in marine bottomfish species from the northeast and Pacific coasts, USA. *Marine Pollution Bulletin*, 37: 92–113.
- OSPAR. 1997. JAMP Guidelines for general biological effects monitoring. OSPAR Commission Ref. No. 1997–7.
- OSPAR. 2005. OSPAR Coordinated Environmental Monitoring Programme (CEMP). OSPAR Commission Ref. No. 2005–5.
- OSPAR. 2008. JAMP Guidelines for contaminant-specific biological effects monitoring. OSPAR Commission Ref. No. 2008–9.
- Stentiford, G. D., Longshaw, M., Lyons, B. P., Jones, G., Green, M., and Feist, S. W. 2003. Histopathological biomarkers in estuarine fish species for the assessment of biological effects of contaminants. *Marine Environmental Research*, 55: 137–159.
- Stentiford, G. D., Bignell, J. P., Lyons, B. P., Thain, J. E., and Feist, S. W. 2010. Age at onset of fish diseases: application to assessment of marine ecological health status. *Marine Ecology Progress Series*, 411: 215–230.
- Vethaak, A. D., and Wester, P. W. 1996. Diseases of flounder *Platichthys flesus* in Dutch coastal and estuarine waters, with particular reference to environmental stress factors. II. Liver histopathology. *Diseases of Aquatic Organisms*, 26: 99–116.
- Vethaak, A. D., Jol, J. G., Meijboom, A., Eggens, M. L., ap Reinhalt, T., Wester, P. W., van de Zande, T., *et al.* 1996. Skin and liver diseases induced in flounder (*Platichthys flesus*) after long-term exposure to contaminated sediments in large-scale mesocosms. *Environmental Health Perspectives*, 104(11): 1218–1229.
- Vethaak, A. D., Jol, J. G., and Pieters, J. P. F. 2009. Long-term trends in the prevalence of cancer and other major diseases among flatfish in the southeastern North Sea as indicators of changing ecosystem health. *Environmental Science and Technology*, 43: 2151–2158.



Figures A-D showing the macroscopic variability of liver tumours in dab. A: Discrete 'nodule' with relatively dark colouration compared to the rest of the liver and with characteristically prominent vascularisation. B: Single nodule protruding from the surface of a dissected liver, again showing increased and enlarged blood vessels. C: Multiple pale staining nodules protruding from the surface of the liver or with the majority of the lesion embedded in the liver (arrow). D: Large discrete 'nodule' of pale colouration compared to the rest of the liver. Note the presence of anisakid nematodes on the surface of the lesion and intestine (arrows).

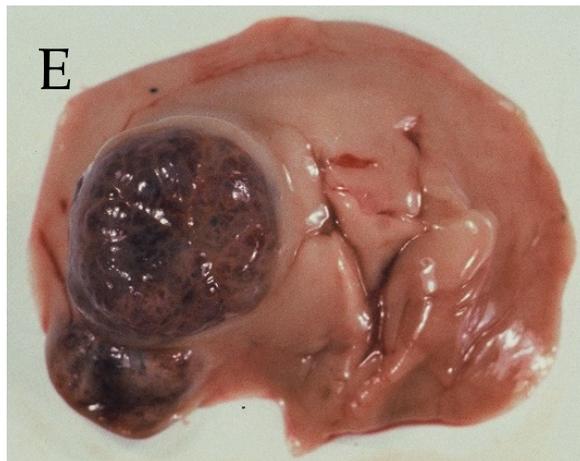


Figure E shows a large, rarely occurring dark variant of liver nodule with prominent protrusion of neoplastic tissue on the underside of the liver.

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