ICES BIOLOGICAL EFFECTS MONITORING IN PELAGIC ECOSYSTEMS (BECPELAG) WORKSHOP: *in-situ* TECHNIQUES

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Introduction

There is a lack of agreed methods to assess the impact of contaminants in pelagic ecosystems. Earlier workshops arranged under the auspices of ICES and IOC have successfully stimulated research into the use of biological effects methods to monitor contaminant impacts in benthic ecosystems. Many of the techniques developed have now been incorporated in national and international monitoring programmes. There has been increasing interest throughout the past years to commence co-ordinated studies on effects in pelagic organisms as a basis for future monitoring programmes. *in-situ* techniques is one of three components of the workshop. The *in-situ* methods consist of caged cod, sticklebacks and mussels. In April 2001, cages were deployed at four stations on a contaminant gradient in the German Bight and at three stations in the vicinity of an oil field in the North Sea plus a reference area. In June, approximately six weeks later, the cages and organisms were retrieved and samples taken for a range of biological effects techniques.

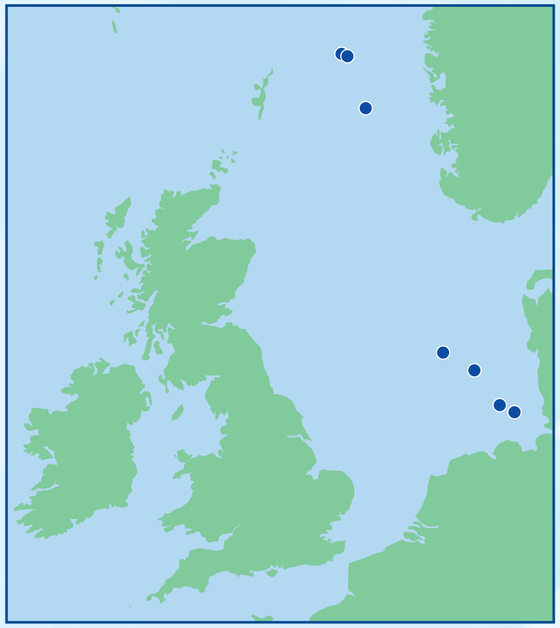

Figure 1: Positions of where cages were deployed.

Acknowledgements

RV support by:

Other support by:

in-situ deployments

Cage construction and dimensions are shown in Figure 2. The cages were designed and manufactured by Ocean Climate A.S., Bergen, Norway. A battery and light were attached to each cage; the light is used to attract food into the cage. Each cage (Figure 3) contained 50 hatchery-reared Atlantic cod (*Gadus morhua*).

200 blue mussels (*Mytilus edulis*) obtained from Norway and Ireland were deployed at each site. The mussels were placed in tubular mesh stockings, and bunched in groups of ten using plastic ties. The strings of mussels were suspended from the inside roof of the cage as shown in Figure 4.

200 3-spined sticklebacks (*Gasterosteus aculeatus*) obtained from Sweden and acclimated to full salinity seawater, were deployed in two cages (supplied by CEFAS UK) each suspended on the inside of the main fish cage as shown in Figure 5.

SPMD - semipermeable membrane device; used to estimate integrated accumulation of hydrophobic contaminants from water. These were suspended externally to the top of each cage as shown in Figure 6a and 6b.

DGT - diffuse gradient in thin films: used to estimate integrated accumulation of metals from water. These were suspended externally to the top of each cage as shown in Figure7a and 7b.

Figure 3: Fish cage at deployment.

Figure 4: Mussels being attached to cage.

Figure 5: Stickleback cages inside main cage.

Figure 6a: SPMD cage.

Figure 2: Diagrammatic representation and details of cage.

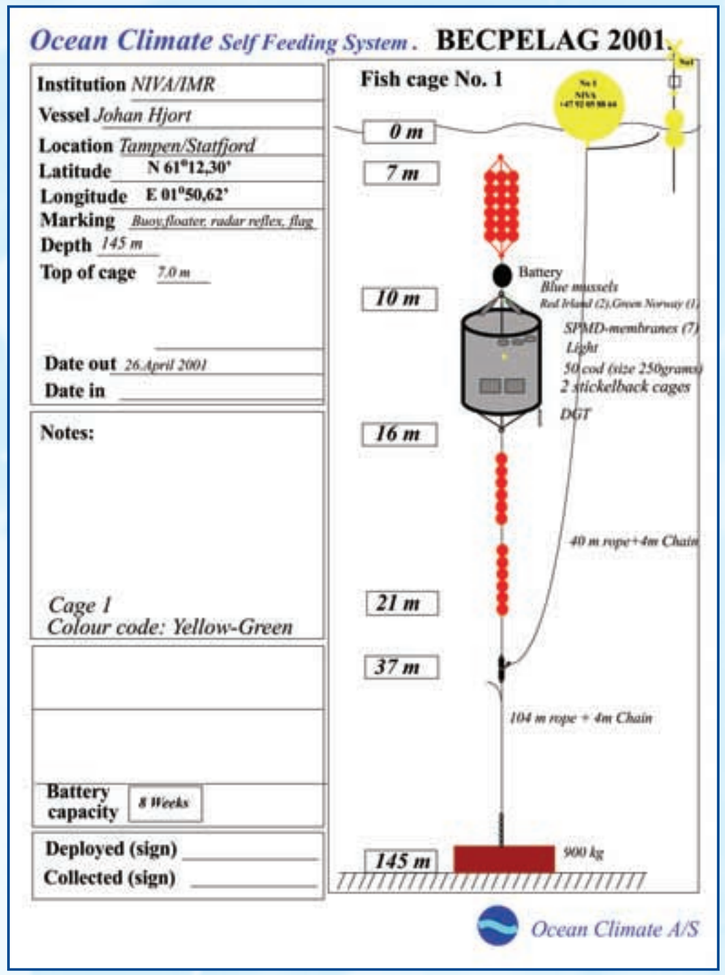

Figure 6b: SPMD device.

Figure 7a: DGT container.

Figure 7b: DGT device.

Figure 8: Cod in tanks after cage retrieval.

Figure 9: Sampling cod (note size).

Achievements

Cages were retrieved from all sites. Only one cage was lost (due to trawling activity) but later retrieved and this was a replicate 'control' cage deployed close to the Dogger Bank. Cod were taken from each cage, kept alive on-board prior to sampling (Figure 8 & 9). Mussels were also sampled on-board but for some techniques the animals were transported ashore e.g. Scope For Growth. No sticklebacks survived the exposure period. Samples processed onboard were placed in fixative or stored at -80°C as appropriate for each technique.

Table 1: Techniques with caged organisms. (Proposed techniques with sticklebacks were abandoned)

Organism	Tissue	Endpoint
Blue mussel (*Mytilus edulis*)	Gills	Mt induction
	Hepatopancreas	Mt induction, histochemistry, AChE, BPH, CYP, oxidative damage, antioxidant enzymes, TOSC, DNA damage
	Haemolymph	Immunotoxicity, lysosomal stability (platereader), immunocompetence
	Whole mussels, haemolymph	Lysosomal stability, genotoxicity, pathology
	Whole mussels	scope for growth
Atlantic cod (*Gadus morhua*)	Liver	Mt, EROD, DNA adducts, CYP (protein, mRNA), GST, histopathology
	Bile	PAH-metabolites
	Plasma	Vtg, zrp (protein, mRNA)
	Muscle	AChE
3-spined sticklebacks (*Gasterosteus aculeatus*)	Kidney	Spiggin
	Liver	EROD, Mt
	Bile	PAH-metabolites

A complimentary chemistry programme supported the biological effects techniques used above. SPMD and DGT samples were processed on-board for subsequent chemical analysis ashore. In addition, samples of liver and muscle from Atlantic cod and whole soft tissue of blue mussels were taken for targeted chemical analysis ashore e.g. polycyclic aromatic hydrocarbons, alkylated polycyclic aromatic hydrocarbons, alkylphenols, Hg, Cd, Pb,Cu,Ni, Zn and TBT.

in-situ techniques are important and unique; they offer a degree of realism that cannot be simulated with laboratory studies and an element of control that cannot be found in field observations.

A full evaluation of the techniques and results will take place at a wrap-up conference in Copenhagen on the 19th - 21st August 2002 and at the ICES Annual Science Conference, also in Copenhagen on the 1st - 5th October, 2002. More information can be found on www.niva.no/pelagic/web/.

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