# Brain and behaviour ontogenesis of the cuttlefish Sepia officinalis: impact of environmental pollution by pharmaceutical residues.

C. Di Poi, F.Bidel, A-S Darmaillacq, C. Jozet, L.Dickel and C.Bellanger*
Normandie Université, GMPc (EA4259), F-14032 Caen, France
* Presenting author Contact: cecile.bellanger@unicaen.fr

Recent ecotoxicological studies highlight the increasing presence of pharmaceutical residues discharged in the aquatic environment. Such pollutants are released continuously and at low doses in the environment, leading to potential chronic poisoning. Early life stages of the cuttlefish Sepia officinalis occur in coastal marine waters, chronically contaminated, and often used in laboratories breeding tanks. This period is a critical window for development during which animals experience behavioural and neural maturation. They need to cope autonomously with ecological demands such as foraging and predator avoidance. The presence of pharmaceuticals such as psychotropics in the marine environment has the potential to generate neural disrupting effects, yet their impact on behaviour and cognitive development. The present research project aims to evaluate the effects of subchronic exposure to waterborne antidepressants on ecologically relevant behaviours in newly hatched cuttlefish. Cuttlefish eggs or hatchlings were exposed during a maximum of 1 month at several drug concentrations. The efficiency of their predatory behaviour and that of their antipredator behaviour as well as some of their learning abilities were tested at different ages. This study provides discussion on how breeding conditions (here, water quality) in laboratories or in the field may impact the animals' development and our research studies.

COST FA1301 –
**CephsInAction**

# Brain and behaviour ontogenesis of the cuttlefish *Sepia officinalis*: impact of environmental pollution by pharmaceutical residues.

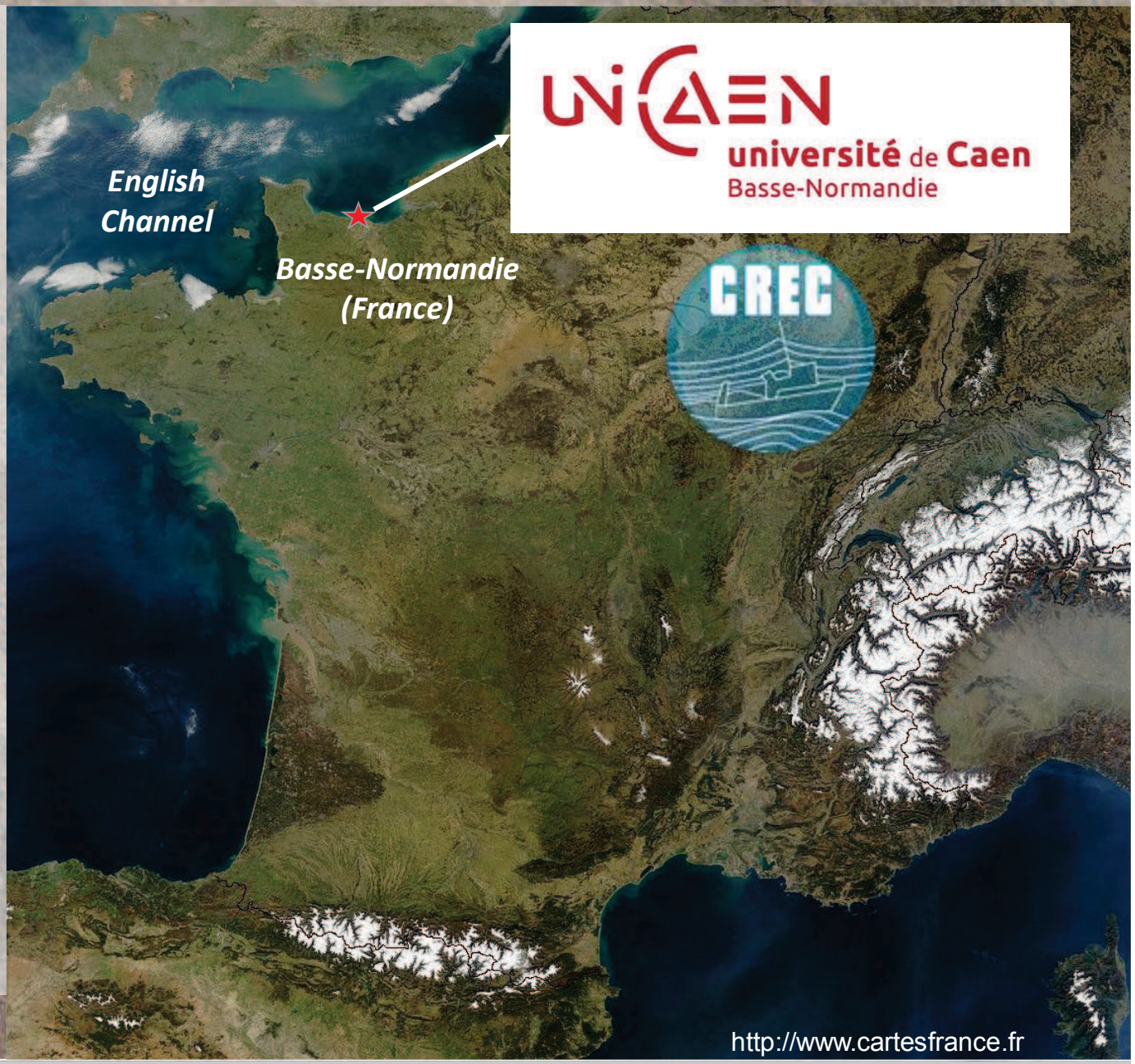

C. Di Poi, F.Bidel, A-S Darmaillacq, C. Jozet, L.Dickel and **C.Bellanger**



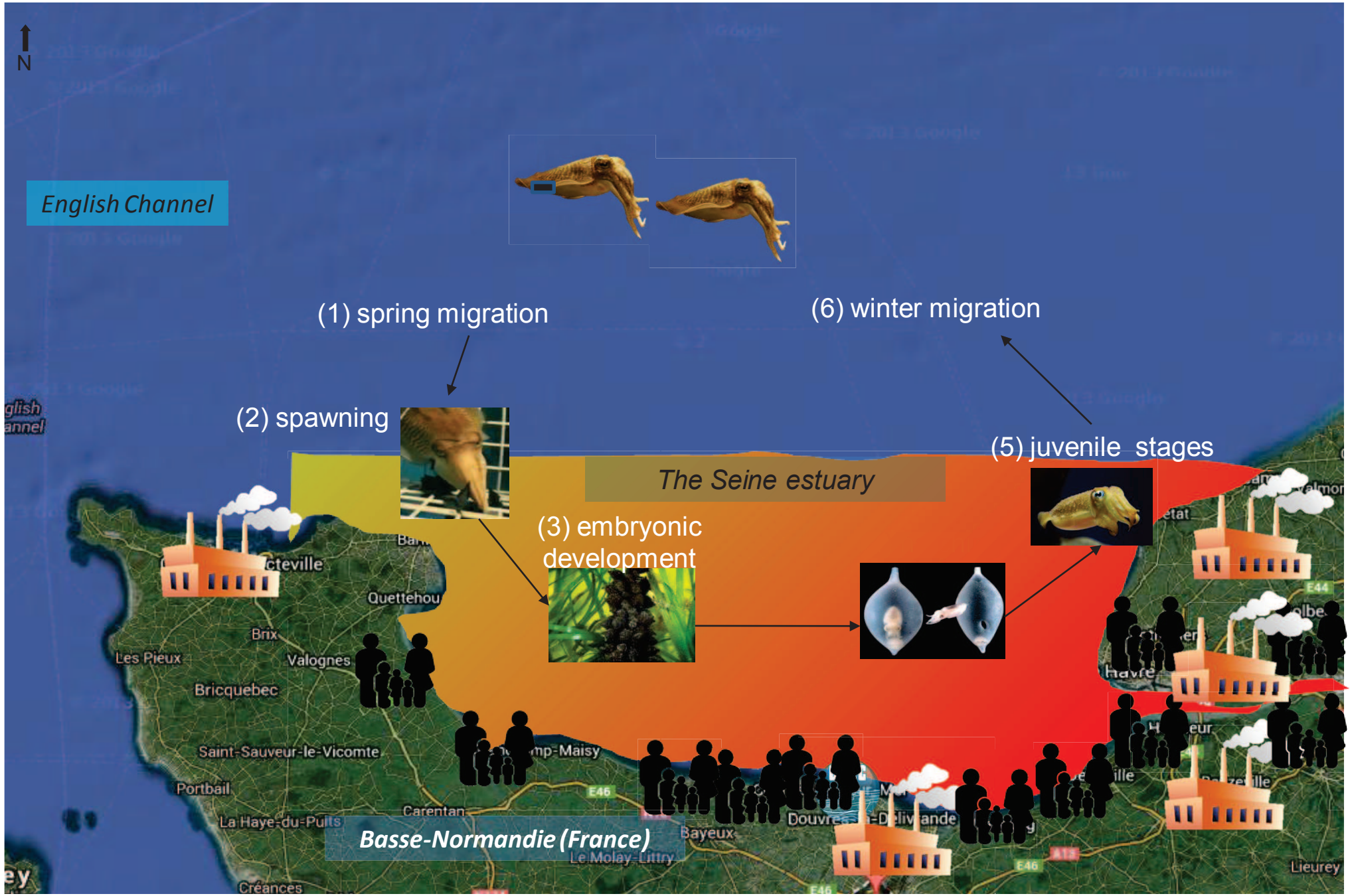
**Barcelona, 14-15 March 2014**

GMPc

# Memory and behavioral Plasticity Group



# The common cuttlefish *Sepia officinalis*

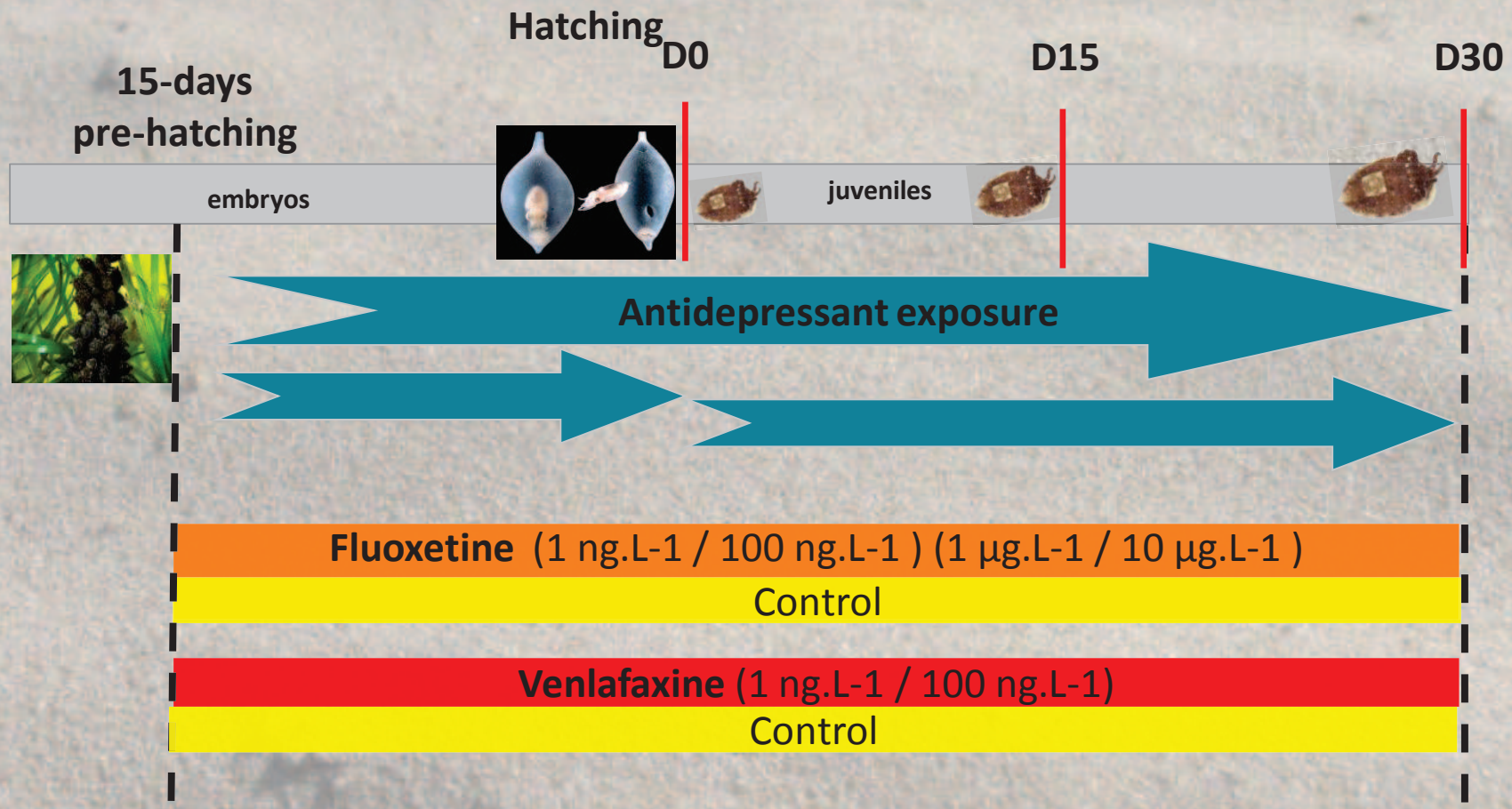



(Carpentier et al. 2002; AESN 2003)

# Emergent pollutants : pharmaceutical residues

## Psychoactive drugs


# Waterborne antidepressant exposure procedures




15°C
32 P.S.U.

photoperiod
(16:8 light:dark)

Flow through
system

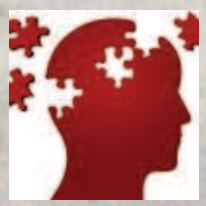
2-3 days water
change (60%)

Water
Quality

# Results : exposure to Fluoxetine

**Behavior**

**Cognitives abilities**



**Impairment in camouflage efficiency (sand digging ; body pattern)**
DiPoi et al, 2014

**Learning and memory impairment**
DiPoi et al, 2013

**Physiology (digestive system)**

**Neurobiology**

N. Koueta, BOREA

**Maturation of the digestive gland delayed (trypsine and phosphatases activities)**

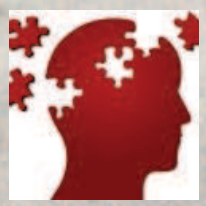
**Maturation of the brain modifyed (decrease in cell proliferation in the vertical and optic lobes, increase in dopaminergic activity)**

# Results : exposure to Venlafaxine (ongoing analysis)

**Behavior**

Impairment in predatory behavior (motivation, capture sucess); increase camouflage efficiency (disruptive pattern)

**Cognitives abilities**



**Physiology (digestive system)**

N. Koueta, BOREA

**Neurobiology**

Modification in noradrenergic activity

# Antidepressant quantification in samples



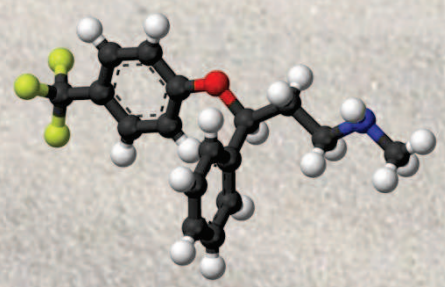

**Dr. Hélène Budzinski**

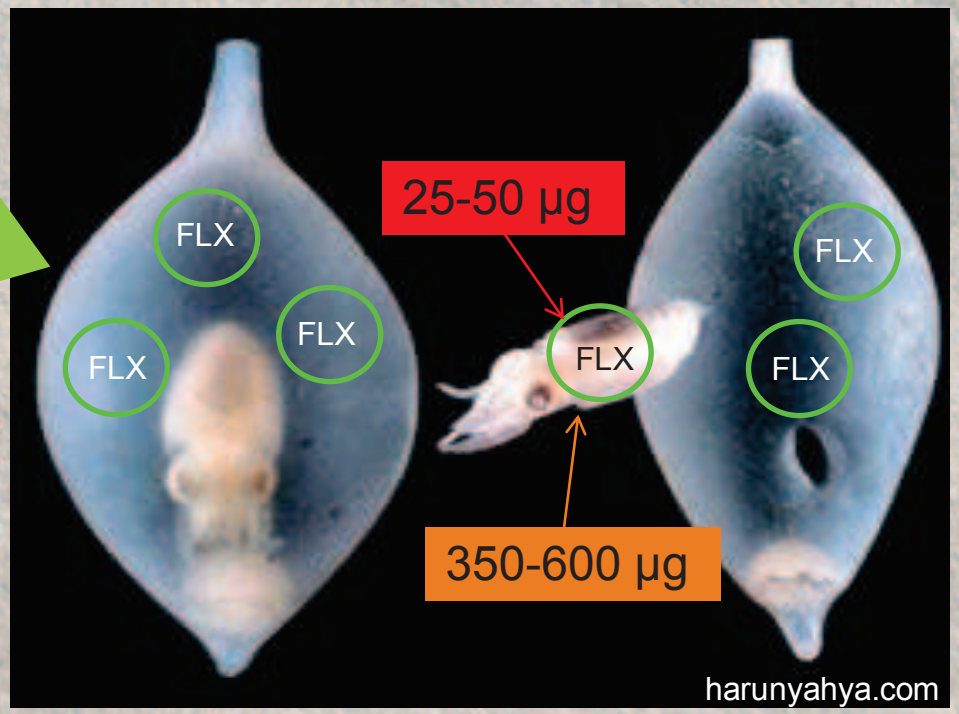
EPOC cnrs université de BORDEAUX

Idder, Ley, Mazellier and Budzinski, 2013, Analytica Chimica Acta, 805, 107-115

# Fluoxetine quantification in samples

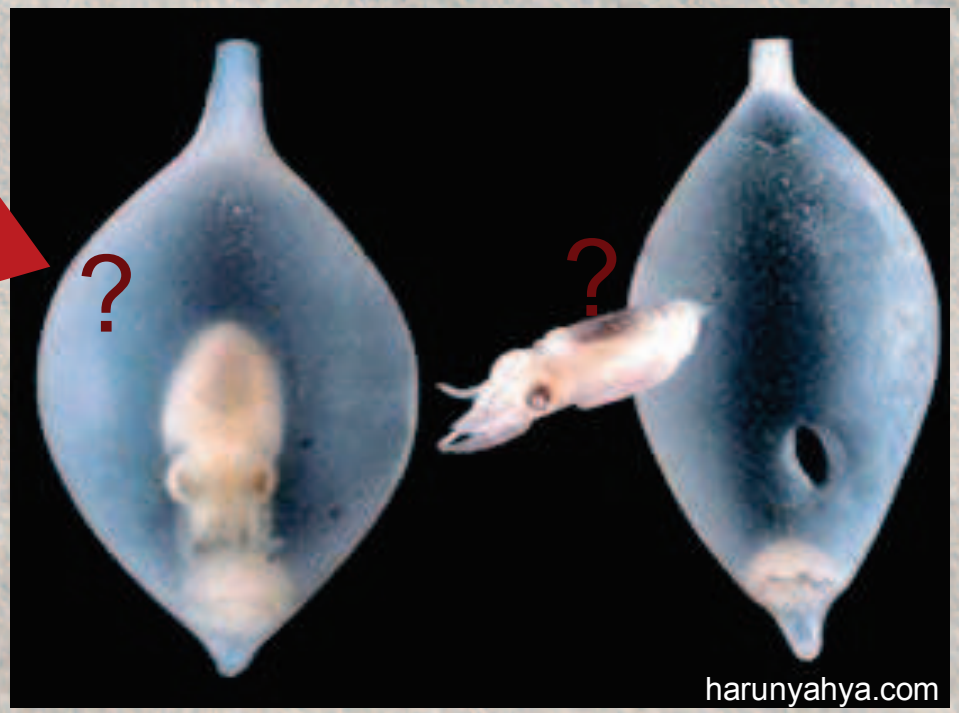

Not detected in sea water samples



# Venlafaxine quantification in samples


**Detected in sea water samples (ng.L$^{-1}$)**

# Conclusion


**Their metabolites? (norfluoxetine)**
**Effect when combined with other pollutants?**

**Regional variability**

# Funding

## Pharm@Ecotox project

Main Investigator: **M-P Halm-Lemeille**
(Centre d'Etude du Médicament de Normandie, Caen)

# The team


**Carole DiPoi**
**Post-doc**

**Flavie Bidel**
**PhD student**