Vrije Universiteit Brussel

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**PHD SUBMISSION**

# TITLE: EVALUATION OF *Posidonia oceanica* AS A BIOMONITORING ORGANISM TO ASSESS OIL POLLUTION

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**Abstract**

The overall objective of this work is to monitor the distribution and sources of organic contaminants in *Posidonia oceanica* meadows. To achieve this goal, we collected sediments, plants, and water samples along the Alexandroupolis Gulf (AG) located in the northeast Aegean Sea, from 2007 to 2011. The AG hosts extensive *P. oceanica* meadows but it is subject to intensive shipping activity because of the proximity of the ports of Alexandroupolis and Kavala, and the Bosporus and the Dardanelles straits. The latter represents the only cargo route for oil products between the Black and Mediterranean seas. Furthermore, a major industrial project in the region is under deliberation (the Burgas–Alexandroupolis oil pipeline), which would transport crude Russian and Caspian oil from the Black Sea port of Burgas (Bulgaria) to the port of Alexandroupolis. The increase in oil tanker traffic and the construction of the oil pipeline raise the risk of oil spillages.

In this study, we focussed on PAHs and *n*-alkanes, because these are abundant and ubiquitous environmental pollutants (Blumer and Youngblood, 1975; LaFlamme and Hites, 1978; Volkman *et al*., 1992; Fu *et al*., 2011). PAHs are described as relatively toxic and some aromatics are potentially carcinogenic (Irwin *et al*., 1997).

When oil contaminants in the environment are monitored, PAHs are the major group that is analysed, while little attention is given to alkanes, even though they are part of most petroleum products. However, both are valuable for fingerprinting oil sources.

This study examined the concentrations of PAHs and alkanes in the tissues of *P. oceanica* to determine realistic exposure concentrations, and evaluated the potential of *P. oceanica* as a bioindicator of oil pollution. Few studies have reported on the concentrations of organic contaminants in seagrasses (e.g., Viso *et al.*, 1993; Lewis and Devereux, 2009, Pergent *et al*., 2011).

Initially, we investigated the spatial distribution of *P. oceanica* meadows. Even though remote sensing techniques have been commonly used for mapping *P. oceanica* in the Mediterranean Sea (Pasqualini *et al*., 1998, 2005; Fornes *et al*., 2006; Vela *et al*., 2008), few studies have used such techniques for investigating their extent in the Aegean Sea. Mapping *P. oceanica* in the Aegean Sea not only extends our knowledge but it also fulfils an urgent need, as highlighted by Natura 2000 (Panayotidis and Drakopoulou, 2010). The Natura 2000 network is the centrepiece of the EU's nature and biodiversity policy aimed to assure the long-term survival of Europe's most valuable and threatened species and habitats. Satellite images can obtain background information of the spatial extent of seagrass with high overall accuracy, enabling us to take action to preserve and manage them (Yang and Yang, 2009). The high-resolution images obtained for this study were analysed in conjunction with georeferenced information from satellites using Geographical Information Systems (GIS).

Subsequently, we established a baseline inventory of the aliphatic compounds, PAHs, and isoprenoid hydrocarbons (pristane and phytane) in the coastal seagrasses and sediments. More precisely, we examined their concentrations from 2007 to 2011

in terrestrial, marine, and river ecosystems. The results of this research establish the levels of organic contaminants within the AG.

Finally, we examined the use of silicone rubber passive samplers as a tool for investigating organic contamination in *P. oceanica* meadows. The use of passive sampling is introduced to provide further insight into the monitoring of oil pollution in the Mediterranean Sea.

Our results may be compared with future evaluations of pollution levels, and our data might contribute to greater understanding of the *P. oceanica* ecosystem and its decline. In addition, this work could provide a basis for further toxicological and phytoremediative research.