



## Integrating spatial processes into ecosystem models for sustainable utilization of fish resources

### INSPIRE

Deliverable No: 1.1		Workpackage number and leader: WP1, SLU	
Date:	31.03.2015	Contract delivery due date	March, 2015
Title:	Database from first surveys to initiate habitat modelling and spatial distribution analyses		
Lead Partner for Deliverable:	Swedish University of Agricultural Sciences (SLU)		
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Dissemination level (PU=public, PP=Restricted to other programme participants, including the BONUS Secretariat, CO=confidential)			PU
Nature of the Deliverable (RE, RE/SP, RE/PP, RE/PR, RE/FR, SP, PP, ER, MO, PT, DE, TE, OT)			DB
Report Status (DR = Draft, FI = FINAL)			FI

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## INSPIRE Overview

Process-based understanding of changes in commercial fish spatial distributions, and to disentangle the role of natural drivers and various anthropogenic impacts, is a challenging research topic with high relevance to resource management. The very recently started four-years BONUS INSPIRE project will fill in the most persistent gaps in knowledge of the spatial ecology of the major commercial fish and thereby support the effectiveness of the relevant policies and ecosystem-based management of the Baltic Sea. The project would serve as a „*framework axis project*“ which other Baltic Sea research could be related to.

INSPIRE is designed to substantially advance our knowledge on the major commercial fish species – cod, herring, sprat and flounder, which represent key elements of the Baltic Sea ecosystems. The specific objectives of INSPIRE are to:

- i. Quantify processes generating heterogeneity in spatial distributions of fish;
- ii. Quantify and map potential hazards to the connectivity between identified key habitats, and assess the impact of anthropogenic and climatic environmental changes on habitat connectivity;
- iii. Quantify the population dynamics and interactions of the fish species in a spatially explicit context;
- iv. Develop spatially explicit advice for ecosystem-based fisheries management.

INSPIRE proposes pilot ecosystem integrated surveys to resolve the habitat requirements of different life-stages of fish species by combined use of traditional methods and application of modern advanced analysis techniques. The surveys are conducted in close collaboration with local fishermen.

[www.bonus-inspire.org](http://www.bonus-inspire.org)

## Executive Summary

Gillnet fish survey are used to monitor the distribution of the main life stages of cod and flounder during spring and autumn on selected transects covering all possible habitat types and supposed nursery areas at pan-Baltic scale. Beach seine surveys are performed in several locations around the Baltic to detect the timing and frequency of larvae arrival and abundance of 1-group, and to characterize the habitat of the nursery areas.

Deliverable 1.1 is a database that comprises the first data from the spring gillnet and beach seine surveys that can be used to initiate habitat and species distribution modelling. The database holds at this stage data from 11 gillnet transects and 3 beach seine surveys, amounting to 5 281 records of in total 8 506 fishes in the gillnets and 777 records from the beach seine.

The database constitutes the physical location of the data collected during the gillnet and beach seine surveys. The database is constituted by three sections: "Environmental data", "Fish catch data" and "Fish individual data".

The data included in the database will be used within WP1 to address D1.3 (Manuscript on simulating spatial distributions of key exploited stocks), D1.5 (Manuscript on habitat preferences of different life-stages of fish), D1.7 (Design protocol for future surveys for flatfish and juvenile cod), and will also be used for WP4.

## Introduction

Work-package 1 encompasses a comprehensive data collection programme, and statistical as well as process-oriented analyses on the spatial distributions of the focal species at different spatial scales. Focus here is put on the distributions and their properties at different points in time, including environmental (habitat) impact factors, trophic interactions and fisheries.

In the Task 1.1 (Data collection and assembly in common databases), gillnet fish surveys are used to monitor the distribution of the main life stages of cod and flounder during spring and autumn on selected transects covering all possible habitat types and supposed nursery areas at pan-Baltic scale. Collection of relevant habitat data are also undertaken along the same transects. Inventory of settling flounder and 1-group flounder using beach seine are performed in several locations around the Baltic to detect the timing and frequency of larvae arrival and abundance of 1-group, and characterize flounder nursery areas. National hydro-acoustic surveys are used for the identification of the main nursery grounds of sprat through ichthyoplankton sampling and application of molecular/biochemical analysis methods. Hydro-acoustic and experimental trawling surveys are used to achieve additional information on distribution and abundance of herring and sprat and their feeding habits.

The collected data will be used for habitat mapping and analyses of the spatial distribution of the focal species. The data collected during the surveys will be specifically used to address D1.2 (Report on distribution maps for different life-stages), D1.3 (Manuscript on simulating spatial distributions of key exploited stocks), D1.5 (Manuscript on habitat preferences of different life-stages of fish) and D1.7 (Design protocol for future surveys for flatfish and juvenile cod) within WP1. Moreover, the abundance indices from the gillnet samplings will be used to design a

reliable recruitment index for cod (integrating BITS data) and flounder, applicable in stock assessment (WP4).

The first surveys carried out within the WP1 were gillnet and the beach seine sampling in spring 2014. The data from most of these surveys (plus some spring surveys 2015) are presently included in the database to initiate the spatial distribution analysis (D.1.1). The database will be continuously updated with data from the rest of the gillnet surveys as well as the beach seine surveys.

## Core Activity

### i) Scientific Highlights

The data base currently holds data from 11 gillnet transects and 3 beach seine surveys, amounting to 5 281 records of in total 8 506 fishes in the gillnets and 777 records from the beach seine. Individual data (length, weight, sex, maturity, etc) are available for 995 cod and 1602 flounders. The data base currently holds also environmental variables (238 records) and video recording (122 records).

### ii) Progress

Data base from first surveys completed

### iii) Deviations from the work-plan

Oxygen measurements and habitat video recording are missing from 3 transects in the spring 2014 survey due to delayed delivery or malfunction of equipment.

### iv) Methods and results

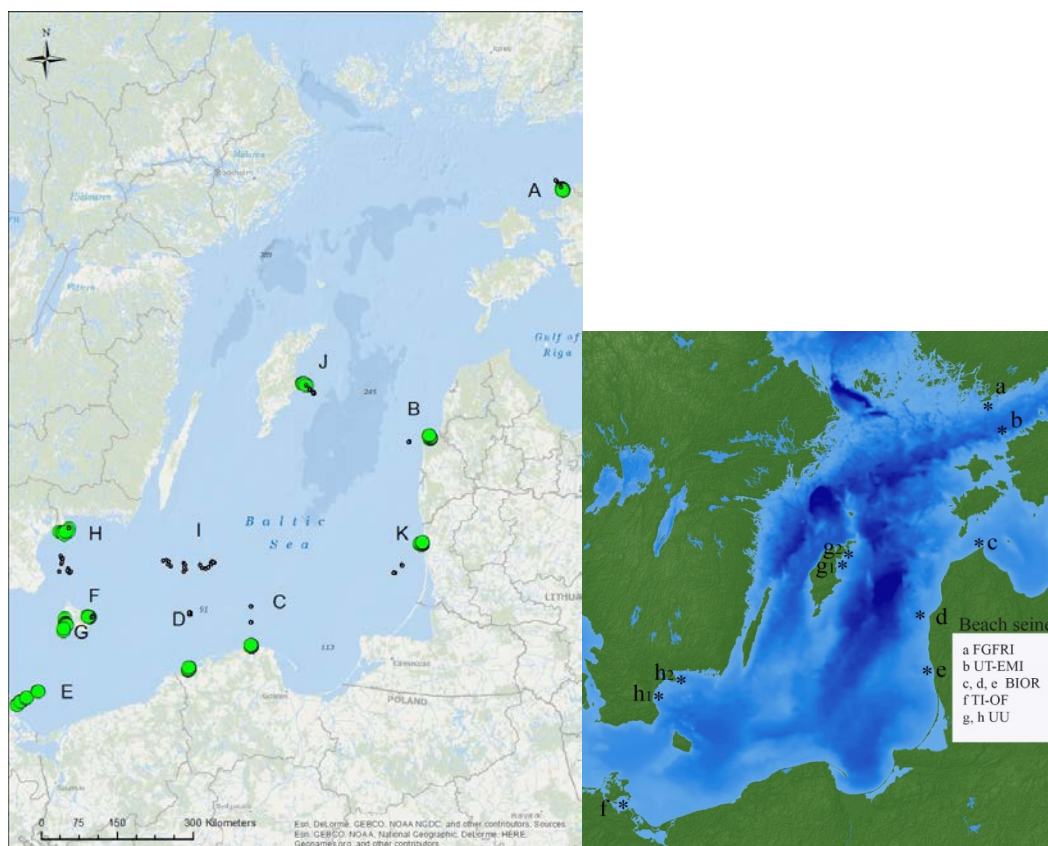
#### *Surveys*

The gillnet survey consists of 11 transects distributed over the entire Baltic Sea and are fished twice a year, in spring and autumn, in 2014 and 2015. The surveys are designed as transects along a gradient from near-shore shallow depths towards the deepest area in the vicinity. Each of the 11 transects is handled by the same project participant throughout the BONUS-INSPIRE project, with the number of transects distributed among participants as follows: Denmark 2, Sweden 4, Germany 1, Poland 2, Latvia 1 and Estonia 1. A map of the sampling locations is shown in Fig. 1, left panel.

For the INSPIRE gillnet surveys, Nordic coastal multi-mesh gillnets extended with two extra mesh sizes and strengthened lead line to allow for machine hauling are used. The Nordic Coastal Multi-mesh net is a 1,8m deep, 45m long gillnet with 5m long panels of different mesh sizes stringed together 0, 12, 15, 19, 24, 30, 38, 48 and 60 mm, knot to knot. In addition: to the 19mm end of this multi-mesh gillnet, a 5m panel with mesh size 6.25 mm (or 6.5mm) is added followed by a 50m panel with mesh size 75 mm.

Beach seine sampling is performed at fixed locations (Fig. 1, right panel) in three depths (0.2, 0.6 and 1 m) parallel to the coast line. Area of sampling should be at least 120 m<sup>2</sup>. Time of sampling was set from July to middle of September, but the

timing can be modified according to local expertise about flounder settling in particular areas.



**Figure 1. Gillnet (left panel) and beach seine (right panel) stations. Green circles in the left panel represent stations fished both in spring and autumn 2014, while black dots represent the deeper stations only fished in spring. In D1.1 data from some spring 2014 and 2015 surveys are collated.**

### *Database (D 1.1)*

Data from surveys are both stored at the partner Institutes responsible for fieldwork and in a common project database at DTU Aqua and UT-EMI. The common database format was decided to be Excel spreadsheets in three different categories: environmental data, catch data and individual data (Appendix). In addition the CTD casts and video films will be stored in the same place.

The current database (D.1.1) contains the first data from the gillnet surveys in spring 2014 and 2015, and from beach seines 2014. The data base currently holds data from 11 gillnet transects and 3 beach seine surveys, amounting to 5 281 records of in total 8 506 fishes in the gillnets, and 777 records from the beach seine. Individual data (length, weight, sex, maturity, etc) are available for 995 cod and 1602 flounders. The data base currently holds also environmental variables (238 records) and video recording (122 records).

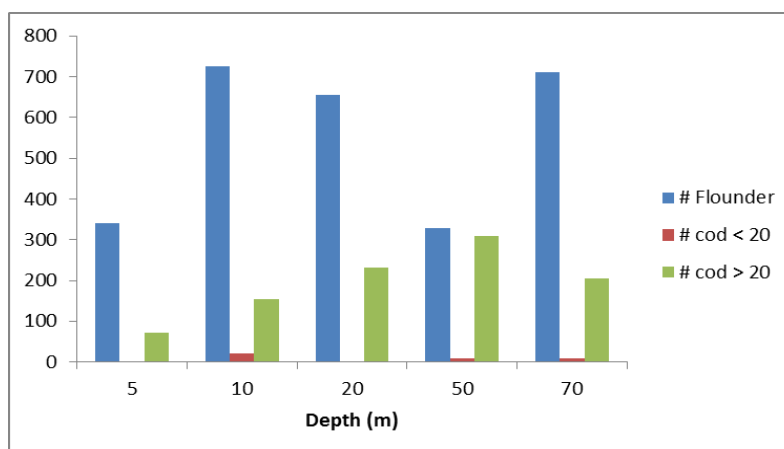
Tables 1-2 give an overview of the data currently stored in the database, while Figures 2-3 show the overall depth-distribution of cod and flounder and the transect-specific length-distributions of cod and flounder.

**Table 1. Environmental variables recorded so far in the database for spring gillnet surveys; numbers refer to number of data points, or in the case of CTD and film the number of the data files. Temperature, salinity and oxygen can be extracted from the CTD files.**

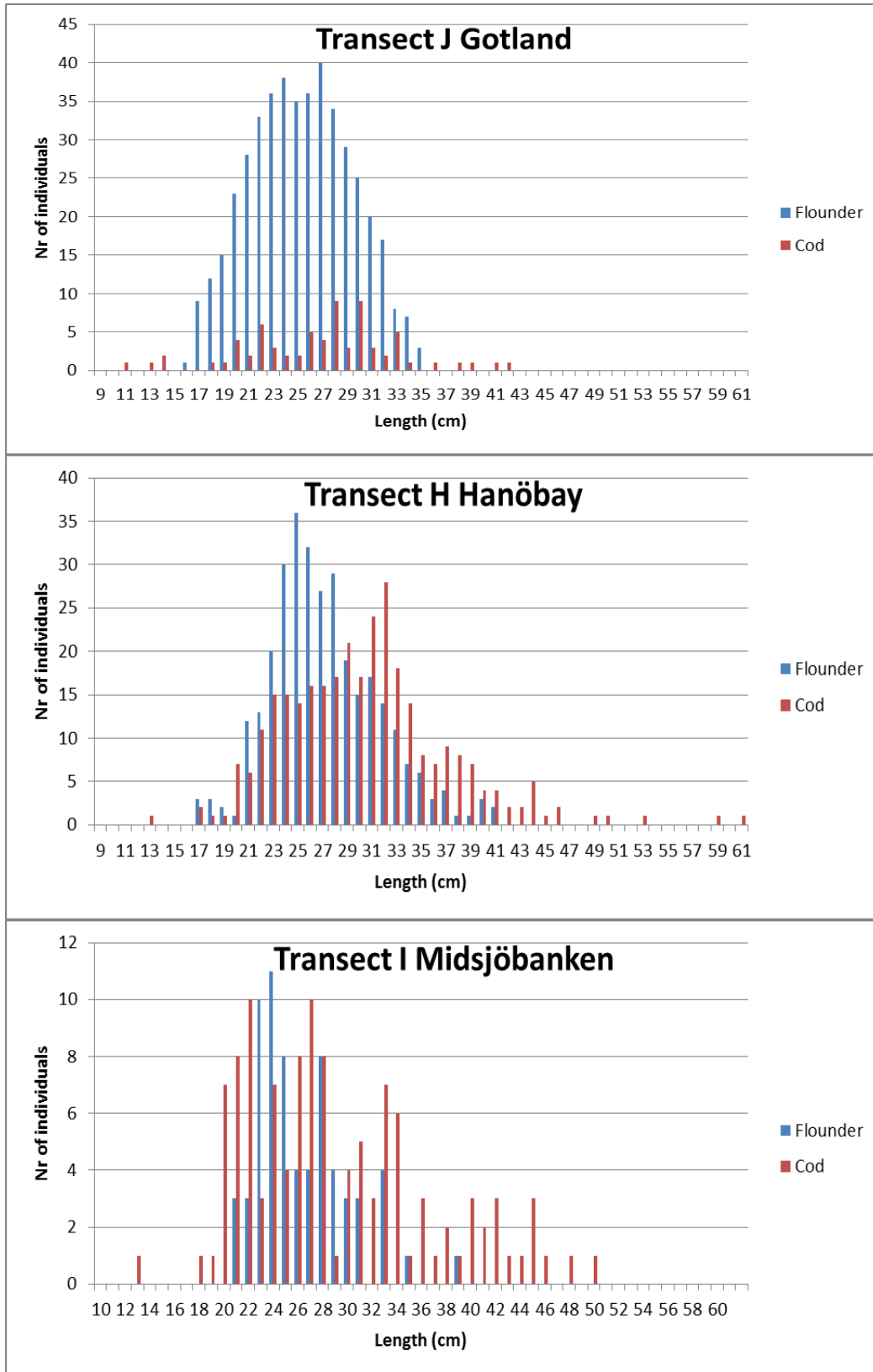
Transect	Total	Wind		CTD	TEMP	PSU	O2	Secchi	Habitat film
		dir	speed						
A	25	25	25	25	25			25	25
B	21	4	4		4	4		4	
C	25	25	25	10					
D	25	25	25	10				-	
E	20	20	20	8	8	8	8	8	6
F	15	15	15	13	13	13	13	15	12
G	12	12	12	11	11	11	11	12	9
H	25	25	25	22	22			25	18
I	20	20	20	14	14			20	10
J	25	25	25	25	25			25	17
K	25	25	25		25	25	25	25	25
Total	238	221	221	138	147	61	57	159	122

**Table 2. Catch (number) of the focus species, flounder and cod, per transect from the spring gillnet surveys recorded so far in the database.**

Transect	# flounder	# cod >20 cm	# cod < 20 cm
A	103	2	1
B	162	46	6
C	117	108	4
D	203	138	13
E	428	28	0
F	341	108	0
G	96	63	0
H	614	265	5
I	67	115	4
J	633	60	6
K	113	91	4



**Fig.2. Depth distribution from spring gillnet surveys of the focus species, flounder and cod.**



**Fig 3. Length distribution of cod and flounder in three transects, from the spring gillnet surveys included so far in the database.**



## v) Appendices

List of variables in the database for gillnet and beach seine surveys within the INSPIRE project.

### Environmental datasheet

Stationdata	Transect or location Station or Site LAT DD ( WGS84) LONG DD (WGS84) Year Month Day (setting) Day (lifting) CTD file (name) Video file (name) Camera position (Vertical or Horizontal filming)
Physical & Chemical	Depth (0.1 m) Temp at surface dg C Temp at bottom dg C Salinity at surface PSU Salinity at bottom PSU Oxygen mg/l at bottom Wind dir Degree Wind speed m/s Secchi depth (m) Turbidity
Substrate	Silt & Clay (<0.06mm) % coverage Sand (0.06-2mm) % coverage Gravel (2-60mm) % coverage cobble 60-200mm % coverage Boulders 200-600mm % coverage Large boulder > 600 mm % coverage Bedrock % Coverage
Vegetation	Fucus % coverage Fucurella % coverage Vascular plants % coverage Filamentous algae % coverage Drifting Algal mats / % coverage
Other	Mytilus % coverage Dreissena % Coverage

## Catch datasheet

Stationdata	Transect or Location Year Month Day setting Day lifting hours Time (local) setting first net Time (local) lifting last net Station or site Haul nr (for beach seine) Depthinterval
Fishing data	Gear Area covered ( for beach seine) Meshsize (mm) Disturbance code
Biological data	Species ( WORMS name) Total weight per species/meshsize/sample Weight of subsample if not all fish measured Number of ind, in subsample Length (cm) Number of individuals

## Individual datasheet

Stationdata	Transect or location
	Year
	Month
	Day (setting)
	Day (lifting)
	Station or Site
	Haul nr
	Depthinterval
	Meshsize
Biological data	Species
	ID
	Preservation method
	Totallength (mm)
	Total weight (g)
	Somatic weight (g) ( intestines & gonads & liver removed)
	Gutted weight (only intestines and liver removed)(g)
	Sex (F,M)
	Maturitystatus (1-6)
	Sidedness (flounder) (L, R)
	Otoliths removed (yes/no)
	Genetic sample (ID)
	Stomach sample (ID)
	Disease/parasites code
	Remarks
	Age
Ageing method (1=slice&stained, 2= crack & burn)	



## BONUS metadata database descriptors

No	Descriptor	Information
1	Title of dataset	Gillnet and beach seine dataset
2	General description of the dataset	Environmental, catch and fish individual data from the gillnet and beach seine surveys
3	Keywords	Gillnets, beach seines, cod, flounder, habitat modeling
4	Parameters in the dataset	The data include environmental, catch and fish individual data
5	Area covered	Whole Baltic Proper
6	Spatial resolution	Transects and stations at specific predefined positions
7	Time span covered	2014 and 2015
8	Temporal resolution	Spring and autumn 2014 and 2015
9	Data quality	Computerized data from paper protocols
10	Date created	31 March 2015
11	Last update	31 March 2015
12	Availability	Project limited, upon request
13	Originator/Contact	Ann-Britt Florin, <a href="mailto:ann-britt.florin@slu.se">ann-britt.florin@slu.se</a> Michele Casini, <a href="mailto:michele.casini@slu.se">michele.casini@slu.se</a>
14	Location of dataset	SLU, DTU AQUA, UT-EMI
15	Reference to sources other datasets	
16	BONUS Project	INSPIRE
17	WP	1