

# PROPOSALS

## for **BALTIC SEA REGIONAL PROJECT Phase 2**

### **Task (2) and Task (3)**

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## **Task (3) . Joint Baltic International Acoustic Survey**

**From the Recommendation  
of ICES WGBIFS 2005:**

**To improve specific methodical  
aspects of the Baltic  
International Acoustic Surveys  
(BIAS)**

**From the 2nd phase of the BSRP  
Project objectives:**

**To support ecosystem-based  
management of the Baltic Sea  
marine resources.**



## **Specific methodical aspects of BIAS survey which should be improved** (*Recommendation of ICES WGBIFS 2005*):

- ❖ **Evaluation of analytical methods used in Baltic acoustic survey data processing with special attention to the design of survey transects and the skewness of the distribution of acoustic data.**
- ❖ **Studies of sampling variance in biomass and abundance estimates of acoustic surveys based in simulations and recommendations of ICES WGFAS<sup>T</sup> and WGSAD. Uncertainty of the results of acoustic surveys will be studied.**
- ❖ **Modification of procedures for pooling acoustic survey data obtained by different vessels in overlapped rectangles taking into consideration the statistical characteristics of acoustic and biological data.**
- ❖ **Development of proposals for improving the acoustic database by means of Sonar Data EchoView software.**

# The current state of BIAS surveys

The BIAS surveys are only addressed to herring and sprat abundance indices and biomass assessments.

New developments of Fisheries Acoustics provided a efficient tool for studding pelagic ecosystem are not incorporated in BIAS surveys

Evaluation of analytical methods used in acoustic survey data processing should be performed.

It is necessary to improve Post Survey Analysis that could improve precision and accuracy of BIAS surveys (ICES WKSAD,2004; ICES WGBFAS, 2005)

Biomass and abundance indices values are not accompanied with the uncertainty estimates

Uncertainty estimates being a critically important information for modern stock assessment and managements methods are not used (ICES WGFAS, 2003-2006; ICES WKSAD, 2004; Acoustic survey North Sea herring - FRS Marine Lab Aberdeen Scotland ).

The BIAS survey are accompanied by acoustic databases BAD1 and BADII addressed to storage highly aggregated data only.

This precludes to improve the Baltic surveys methodology using new recommendations and developments of *ICES FTC and ICES WGs*, including data analysis techniques for studying aquatic ecosystem (Special Session of ICES ASC, 2004, 2005. Report of ICES WGFAS, 2003-2006)

## The Objectives for tack (3)

1

**To improve the BITS survey data collection and analysis with special attention to:**

- ❖ Evaluation of analytical methods used in acoustic survey data processing;
- ❖ develop efficient methods for biomass and abundance uncertainty estimation ;
- ❖ improve target strength estimations .



- ❖ The improvements in precision and accuracy of biomass and abundance indices from BIAS surveys.
- ❖ The incorporation of uncertainty estimates of abundance indices into statistical analyses of Interannual pelagic species stock dynamics and stock assessment method (*ICES WGFAS* ,2003-2006, *ICES ASC*,2003-2004).
- ❖ Advanced standardization of acoustic data collection, storage and processing.

## The Objectives for tack (3)

**To modify the BIAS survey into the Baltic International Ecosystem Survey with special attention to**

**incorporation of the modern Acoustics technologies for remote Species Identification into BIAS survey methodology (*SIMFAMI project of EU; ICES WGFASST 2003-2005; CCAMLR WGEMM, 2000-2005*)**



- ❖ **Application of acoustic survey data for studying of different trophic levels (plankton, fish) of Baltic pelagic ecosystems (*SIMFAMI project of EU; Antarctic International Acoustic survey 2000-2005; Acoustic survey of FRS Marine Lab Aberdeen Scotland 2002-2005*).**
- ❖ **The improved understanding of the relation between the environmental characteristics and the organisms of different trophic levels.**
- ❖ **The development of effective methodology to support ecosystem-based approach to marine resource monitoring**

# METHOD

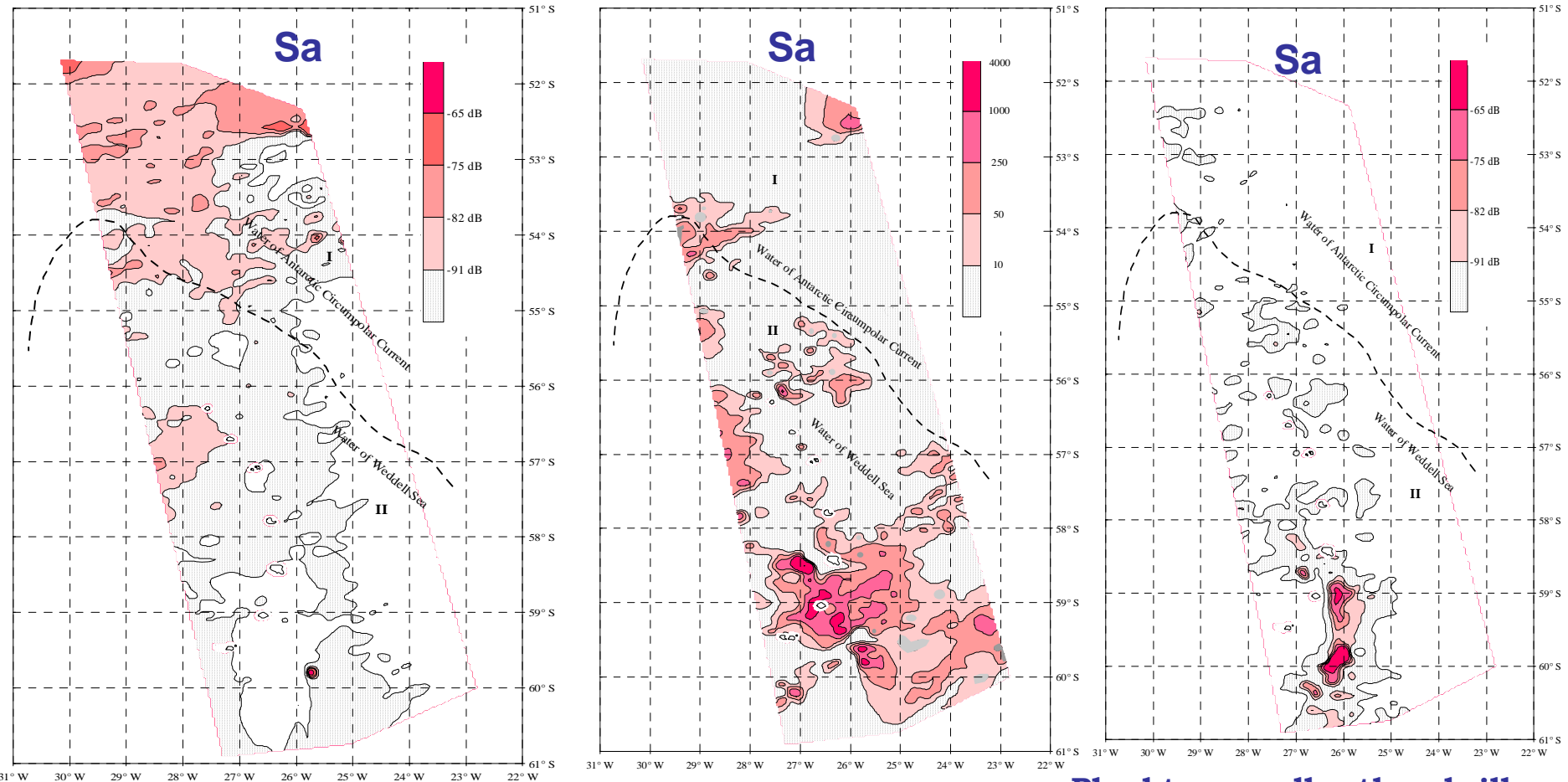
## Data sampling:

- Simrad EK-500 , EK-60 echosounder for Multi-frequency acoustic sampling (e.g. 38, 120, 200 kHz) applying SonarData Echoview software;
- EY 60 echosounder;
- Pelagic trawl sampling;
- CTD stations;
- Satellite altimetry.

## Data processing:

- SonarData Echoview software;
- **The methods of collection, analysis and use of multi-frequency acoustic survey data (e.g. 38, 120, 200 kHz) specifically for the purpose of species identification (fish, plankton) (SIMFAMI project of EU; Antarctic International Acoustic survey 2000-2005; Acoustic survey of FRS Marine Lab Aberdeen Scotland 2002-2005; Special Sections of ICES ASC 2003-2005).**
- Simulation with Monte Carlo method (Rivoirard et al, 2000);
- Bootstrap resampling methods (Smith, 1997)
- Geostatistical procedures (Petitgas, 1999), (Rivoirard et al, 2000).

# Example of multi-frequency acoustic survey data processing: Acoustic estimates of different fractions of pelagic ecosystem in South Sandwich Islands Subarea (48.4)

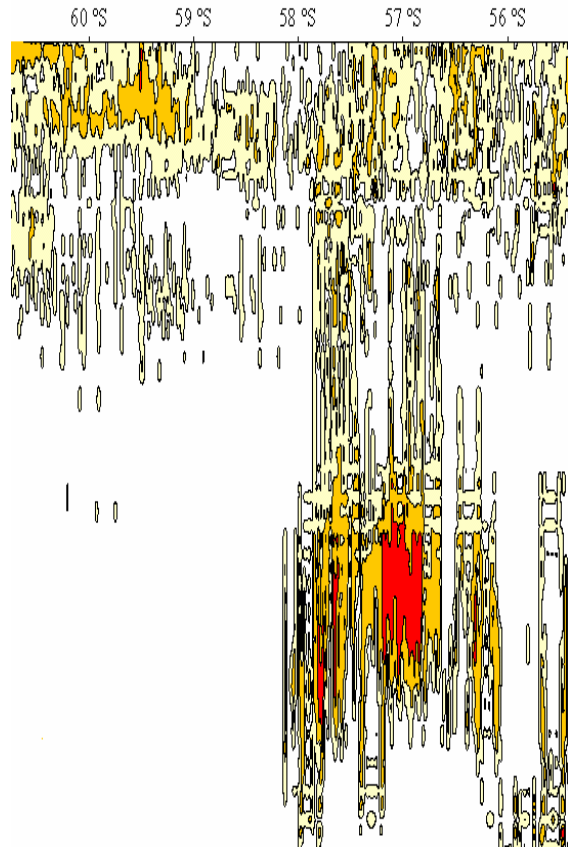


**Mictophid fish**  
(*E.antarctica*, *E.carlsbergi*,  
*G.bolini*, *G.nicholsi*)

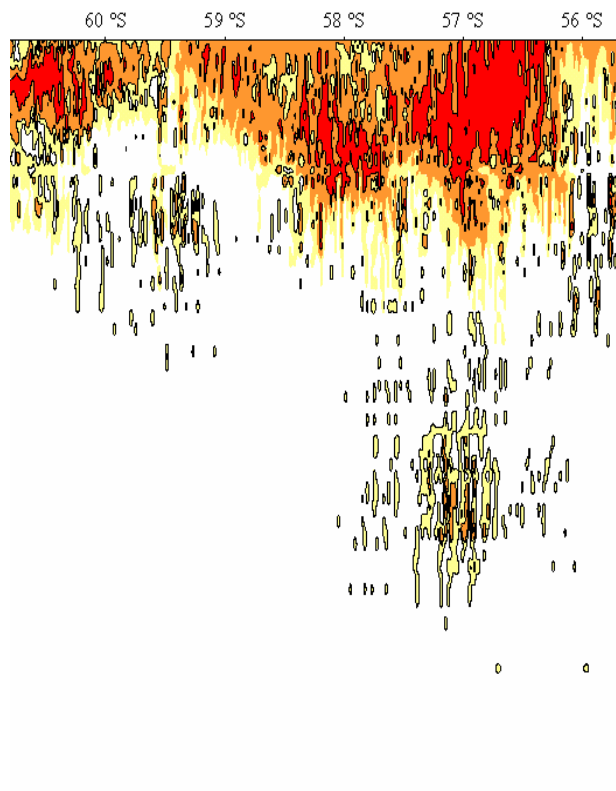
**Krill (*Euphausia superba*)**

**Plankton smaller than krill**  
(*Thysanoessa*, *E.macrura*,  
*E.valentini*, *E.frigida*),  
amphipods

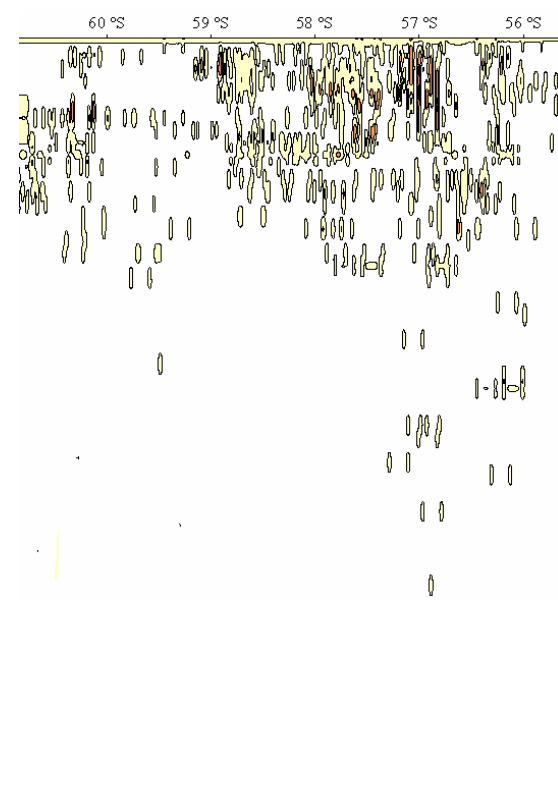
# Density vertical distribution of different fractions of pelagic ecosystem in South Sandwich Islands Subarea (from multi-frequency method)



**Mictophid fish**



**Krill (*Euphausia superba*)**



**Plankton smaller than krill**

**Example of Sa vertical distributions along the same transect for different categories of pelagic organisms based on acoustic multi-frequency identification method ( Kasatkina, 2002).**

# Improvement of BIAS surveys acoustic database is the integral part of Tack (3) performance.

## Current state of BIAS surveys acoustic databases

### BAD 1

Integrated data over  
ICES rectangles

### BAD 2

Integrated data over  
1 mile

Incorporation of acoustic data collection and processing by means of Sonar Data Echoview into the practice of the BIAS survey allows *to create the multifunctional and multi-level acoustic database for:*

- ❖ *storage of comprehensive survey data including primary and aggregated data( including BAD1 and BAD2)*
- ❖ *performance of survey improvements in compliance with the recommendations and new approaches being developed by ICES and other Scientific Committee*

# **EXPECTED RESULTS**

## **Task (2). The Joint Baltic International Bottom trawl Surveys**

**Recommendation of ICES WGBIFS 2005:**

**“studying the vertical and horizontal distribution of cod based on acoustic and trawl methods should be performed”**



# 1. Background

Bottom trawl surveys are the traditional method for cod abundances indices assessment. These surveys only provide point data, which is then processed to form the abundance indices as a base for stock assessment.

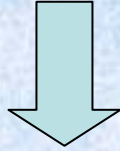
The traditional near-bottom fish distribution can change due to environment factors (e.g. cod migration from the near-bottom layer with depleted oxygen).

## Problems:

- **Horizontal or vertical migration of cod?**
- **To derive wider perspective on horizontal fish distribution data in near bottom layer for improvement of cod abundances indices estimates from the bottom trawl survey. *It will be required data collection along both trawl track and track between trawl stations.***
- **The acoustic observations and midwater trawl samplings shown: the part of cod biomass can be distributed in pelagic zones in untrawlable area. Pelagic biomass becomes unavailable to the bottom survey that will be resulted in underestimated cod abundances indices.**

## 2. The objectivities of Task (2) are :

**to design efficient demersal fish survey integrating both trawl and acoustic methodologies.**



**modification of the bottom trawl survey into the trawl-acoustic survey of demersal fish in the context of current recommendation and developments of ICES WG**

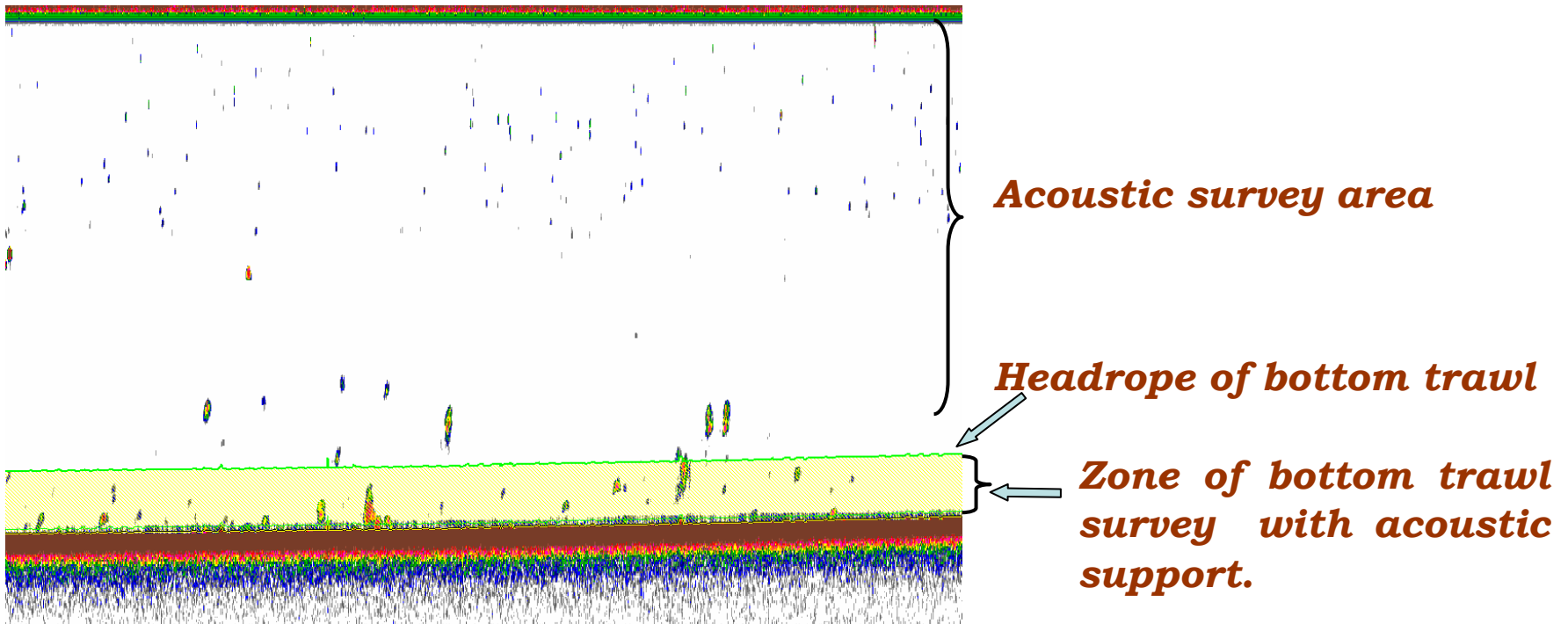
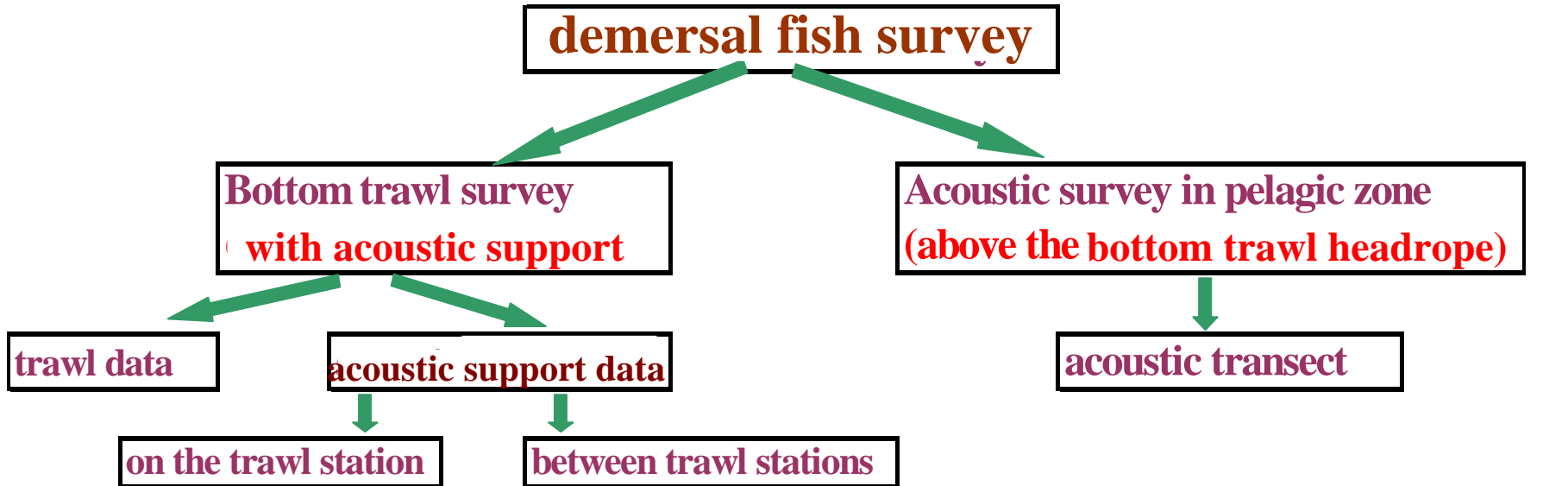
*Special Session of ICES ASC, 1999, 2003, 2004. Report of ICES WGFAS, 2003-2005; Report of ICES WKSAD, 2004, 2005.*



**❖improvement in survey sampling strategy and design taking into account the effect of environments and fish spatial distribution patterns ;**

**❖the use of combined acoustic and trawl indices in the stock assessment process.**

### 3. METHOD



### 3. METHOD

#### Data sampling:

- *Simrad EK-500 , EK-60, EY 60 echosounders;*
- *SonarData Echoview software;*
- *Bottom trawl sampling (BITS survey);*
- *Pelagic trawl sampling (acoustic survey in the pelagic area);*
- *CTD stations.*

#### Data processing:

- *SonarData Echoview software;*
- *Methods for pooling trawl and acoustic indices (ICES CATEFA project, Special Session of ICES ASC, 1999, 2003, 2004; Kasatkina et al, 2003,2004).*
- *Simulation with Monte Carlo method (Rivoirard et al, 2000;*
- *Bootstrap resampling methods (Smith, 1997)*
- *Geostatistical procedures (Petitgas, 1999), (Rivoirard et al, 2000).*

# To develop integrated DATABASE or DATABASE system for storage demersal fish survey data

**BITS/DATRAS database**

**Multilevel Acoustic database  
applying Echoview software for  
data collection and processing**

**Bottom trawl  
survey acoustic  
support data**

**Acoustic survey  
data (above  
bottom trawl  
active zone )**

**This DATABASE system will allow :**

- ❖ to storage of comprehensive survey data including primary and aggregated data;**
- ❖ to conduct a range of survey improvements in compliance with the recommendations and new approaches being developed by ICES**

# EXPECTED RESULTS

- ❖ **Improvements of International demersal fish survey, especially Sampling strategy and design;**
- ❖ **Improvement of cod abundance indices assessment, especially taking into account fish spatial distribution pattern and pelagic biomass inaccessible to bottom survey;**
- ❖ **Improved survey database;**
- ❖ **Working documents on data collection, storage and processing;**
- ❖ **Workshop on methodologies problems of data collection, storage and processing.**