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Preliminary results of *in situ* target strength estimates on Baltic herring and sprat.

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Background

Target strength of Sprat and Herring is estimated from the following regression Manual of BIAS, 2000):

$$TS = 20\log L + B_{20}$$

$$TS = 20\log L - 71.2$$

Assumption:

The same TS-length regression can be used for sprat and herring.

From 1983 a number of publications on sprat-herring TS regressions are known

Before 2001

B20 =-71.9 dB (Foote, 1987)
B20 = -72.1 dB (Foote, 1986)
B20= -69.9 dB (Rudstrum, 1988)
B20 =-70.8 dB (Lassen, Stahr 1985)

After 2001

B20= from -68.9 to -63.6 dB (Ona et al, 2001)
B20 = -67.3 dB (Ona, 2003)
B20 = -67.8 dB (Didrikas and Hansson, 2004)
B20 = -63.9 dB (Peltonen and Balk, 2005)

TS experiments were mainly conducted on Herring or Sprat - Herring mix. But sprat was not dominant in any case.

TS regressions are mainly not accompanied by statistical characteristics of **B20**

B20 is estimated from mean or modes values of TS and fish length

Objectives

1. **Test the assumption on ability of estimating sprat TS and herring TS from the same TS-length regression**

- *Estimate TS-length regression from herring single-target echo detections*
- *Estimate TS-length regression from sprat single-target echo detections*

2 Apply up-to-date techniques for collection and processing fish single-target echo detections

- **SonarData Echoview software:**
  - **split-beam method for single-target echo detections**
  - **split-beam echo target tracking**
  - **multiple-frequency method for measuring *in situ* TS (Demer, 2005)**

- **Techniques for estimating parameters of TS regression by mapping observed TS-frequency data into fish length frequency:**
  - **Bootstrap method (Demer, 2004; Kasatkina, Gasyukov, 2004)**
  - **Bayesian Maximum Entropy method (Brierley et al, 2005, 2006)**

Material and Methods

Data from Russian acoustic survey in Subdivision 26:

May 2005 – estimating sprat TS ,

October 2005 –estimating herring TS

Acoustic sampling with :

Echosounder EK500 (38 kHz, split-beam transducer),

SonarData Echoview using split-beam method for single-target echo detections ; split-beam echo target tracking .

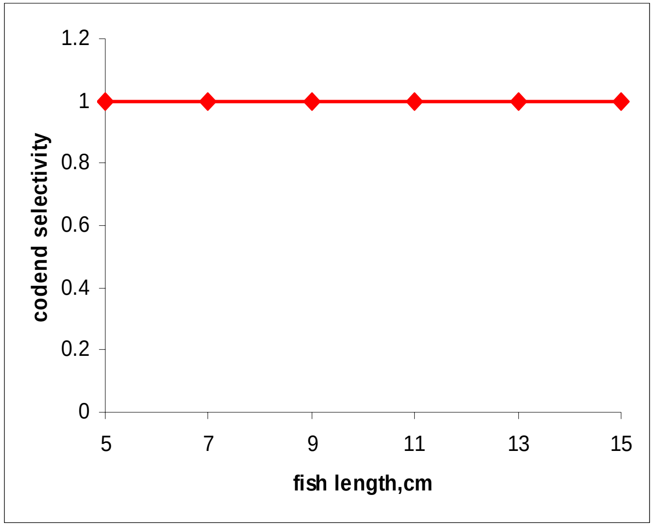
Trawl sampling

Midwater trawl RT/TM 70/300

Vertical opening -34m

Speed 3.9-4.0 kn

Codend mesh size- 6.5mm



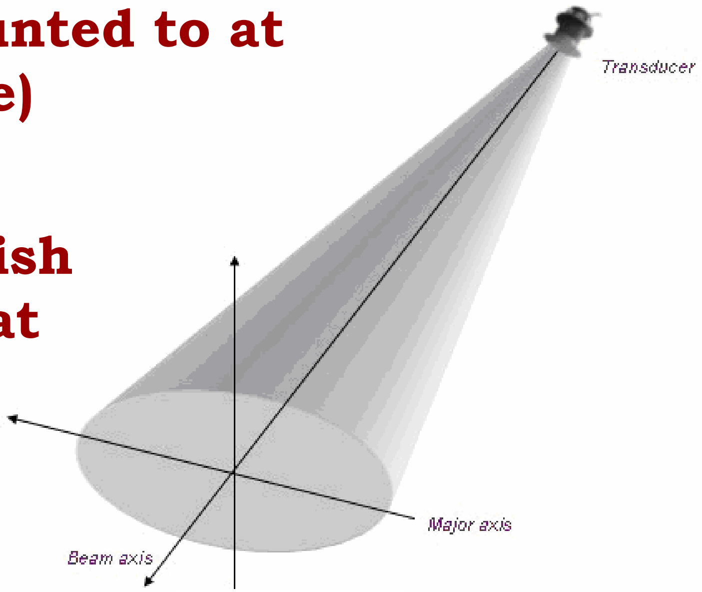
All length classes of sprat and herring under 15cm in length are completely retained in the trawl codend (Ivanova et al, 2002).

Estimating parameters of TS regression from :

in situ TS detections

the fish size distribution from catches } observed simultaneously

The studied fish species were amounted to at least 90% of the catch (in abundance)



Single-target echo detections from fish were filtered to retain only those that were from targets:

- less than 3° off the beam axis
- and within fished depth range.

Bootstrap method – for estimating parameters of TS regression and its statistical characteristics

RESULTS

Estimating TS- length regression for sprat (38 kHz):

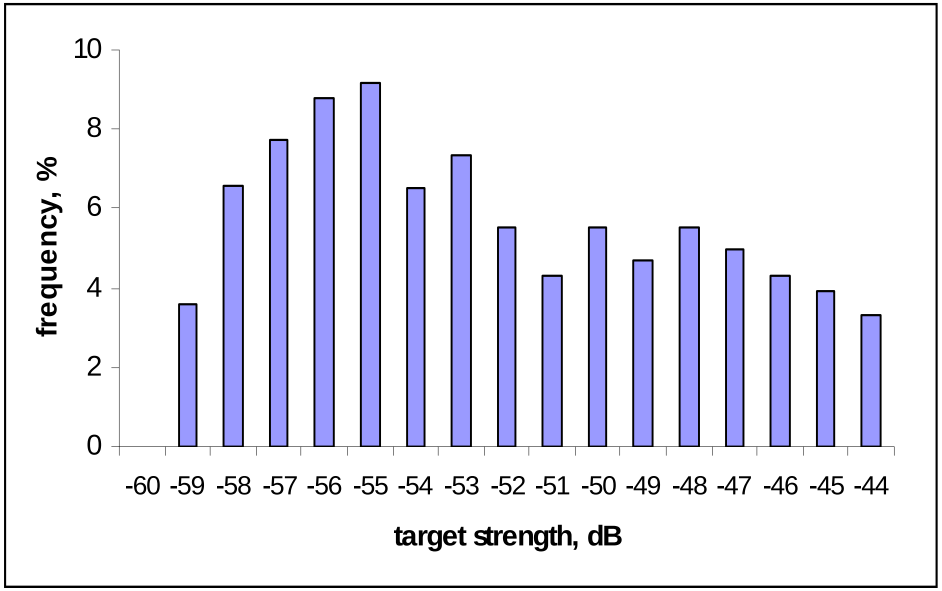
data set 1 - paired samples of TS detections vs fish length distribution obtained from 6 trawl tows during acoustic survey

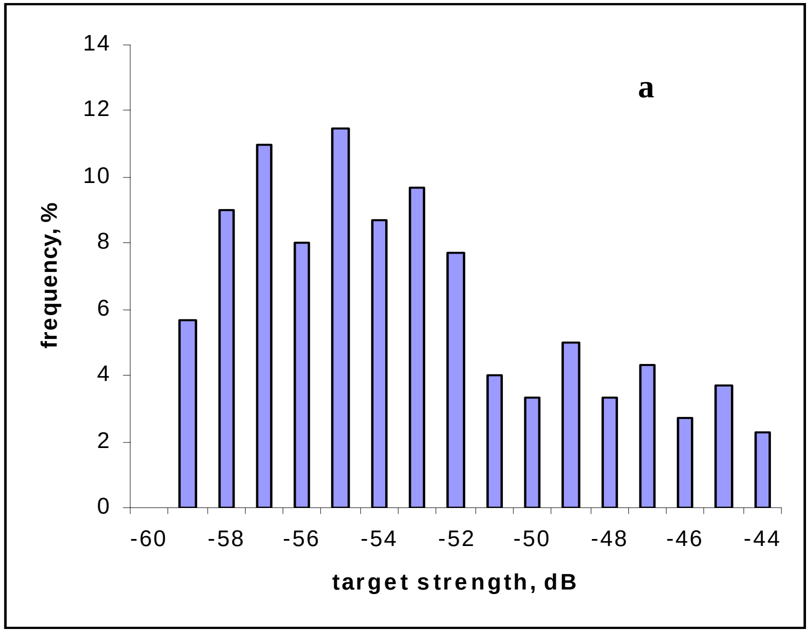
$$TS = 20 \log L - 73.33, \quad sd(B_{20}) = 0.20 \text{ dB}$$

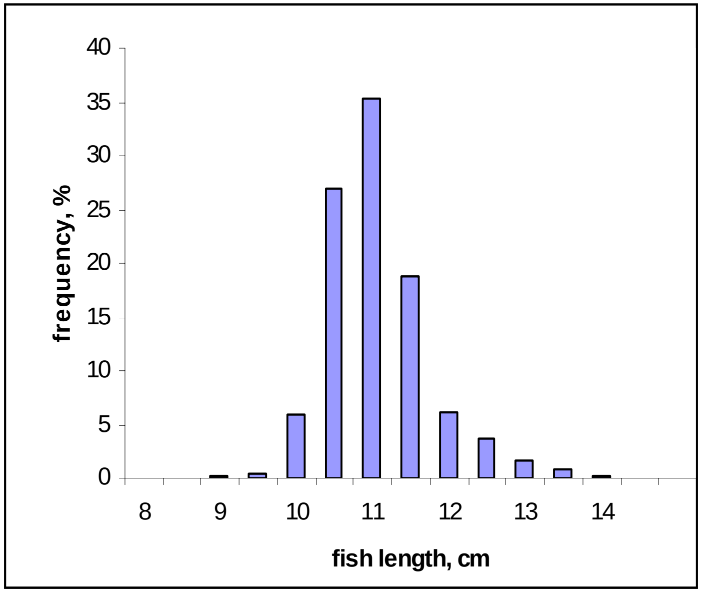
data set 2 - paired samples of TS detections vs fish length distributions obtained from 6 trawl tows during daily station

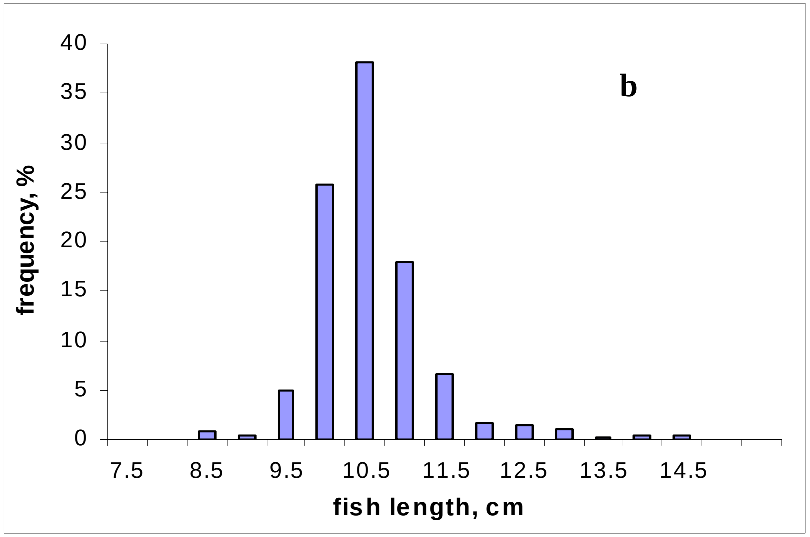
$$TS = 20 \log L - 73.66, \quad sd(B_{20}) = 0.24 \text{ dB}$$

TS *in situ* and length distributions obtained for sprat







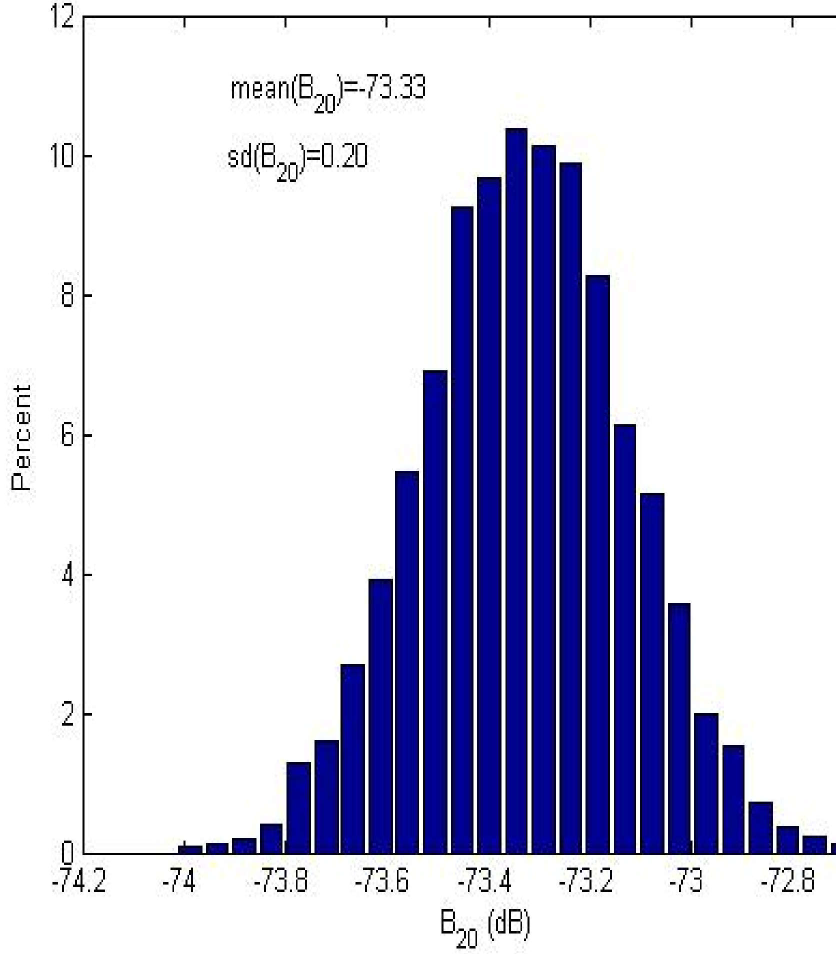


Data set 1

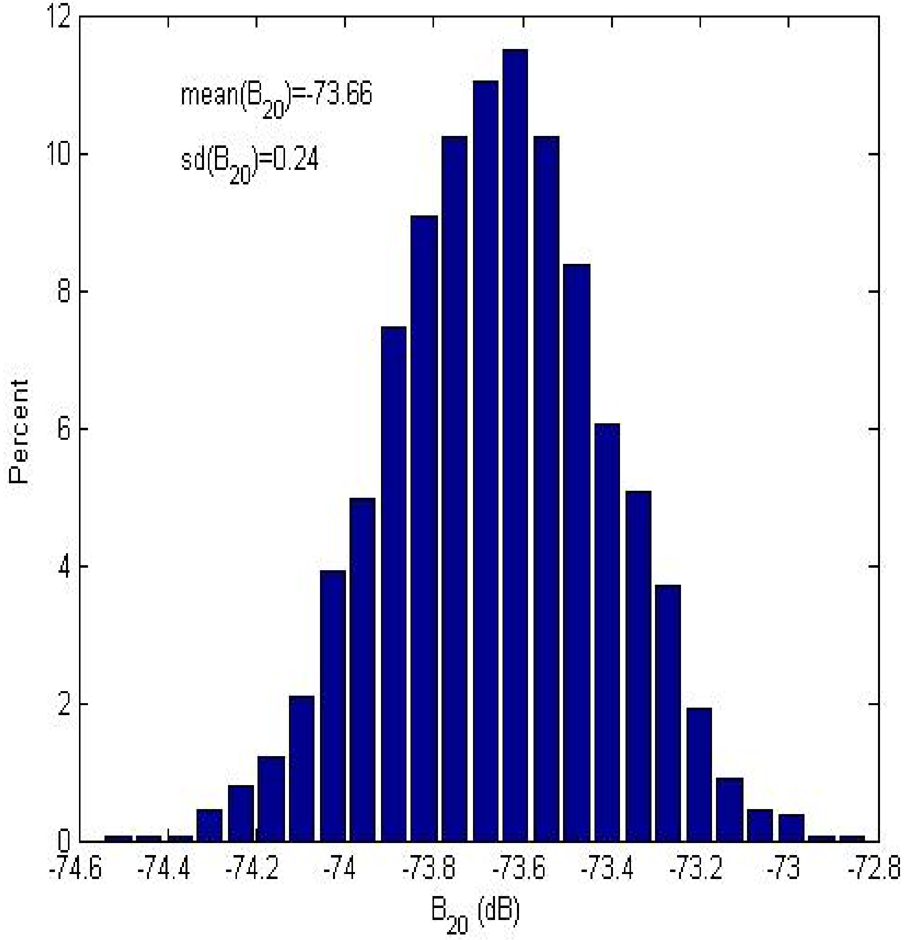
Data set 2

Frequency distribution of mean B20 (from 1000 replications)

Data set 1



Data set 2



TS= 20 log L - 73.33 ,

sd(B20)= 0.20 dB

TS= 20 log L - 73.66,

sd(B20)= 0.24 dB

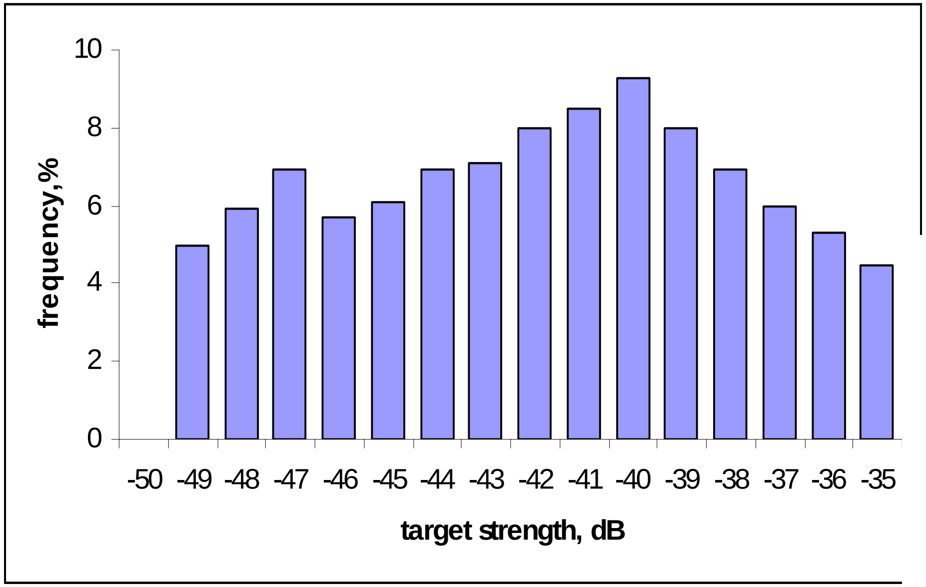
Estimating TS- length regression for herring:

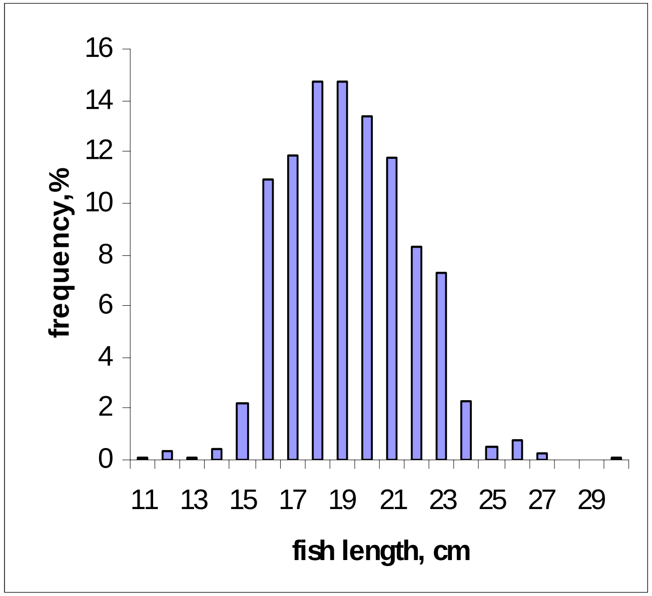
data set - 8 paired samples of TS detections vs fish length distribution obtained during acoustic survey

$$TS = 20 \log L - -67.55,$$ sd(B20)= 0.26 dB

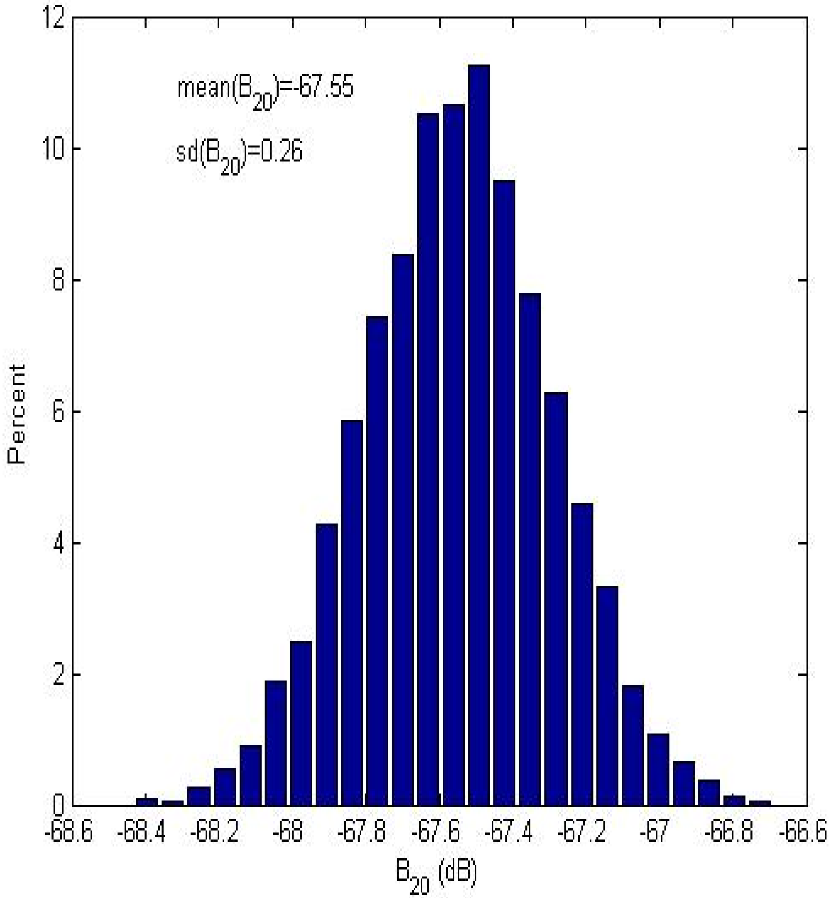
B_{20} = -67.3 dB (Bergen IMR, Ona, 2003)

TS *in situ* and length distribution obtained for herring





Frequency distribution of mean B20



Conclusion

1. **Different TS regressions for sprat and herring were revealed. It is coincident with known fact that for some fish species it is necessary to use different regression equations for different length ranges .**

2. **It is necessary to continue estimating TS regressions for sprat and herring. Incorporation of the SonarData Echoview software into the practice of the BIAS surveys allows to collect TS *in situ* data by vessels – participants of BIAS and create the TS database.**

3. **TS investigations should be addressed to a wide range of length-biological compositions of fish and application of the up-to-date techniques . The latter is key for accuracy and precision in TS estimates in compliance with the recommendations being developed by ICES and other Scientific organizations.**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АТЛАНТНИРО
Thank you for attention