

# ***The GIS method application for the stock assessment of walleye pollock and the Northeast Arctic cod***

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*Objective:*

- *to assess the fishable biomass of walleye pollock and NE Arctic cod in 1998 - 2007*

## VESSELS DAILY REPORT (VDR) INCLUDE FOLLOW INFORMATION:

- *DATE OF REPORT*
- *LATITUDE*
- *LONGITUDE*
- *TARGET SPECIES*
- *CATCH AMOUNT*
- *TYPE OF FISHING VESSEL*
- *TYPE OF FISHING GEAR*
- *TIME OF THE FISHING OPERATIN*

NUMBER OF VDRs SUBMITTED FOR THE SURVEYED AREA  
IN 1998-2007 (*walleye pollock*)

| YEAR         | The Sea of Okhotsk |
|--------------|--------------------|
| 1998         | 4,694              |
| 1999         | 3,527              |
| 2000         | 3,748              |
| 2001         | 3,294              |
| 2002         | 2,301              |
| 2003         | 3,517              |
| 2004         | 1,808              |
| 2005         | 3,192              |
| 2006         | 2,557              |
| 2007         | 2,809              |
| <b>Total</b> | <b>31,447</b>      |

# NUMBER OF VDRs SUBMITTED FOR THE SURVEYED AREA IN 2000-2007 (*NE Arctic cod, Barents Sea*)

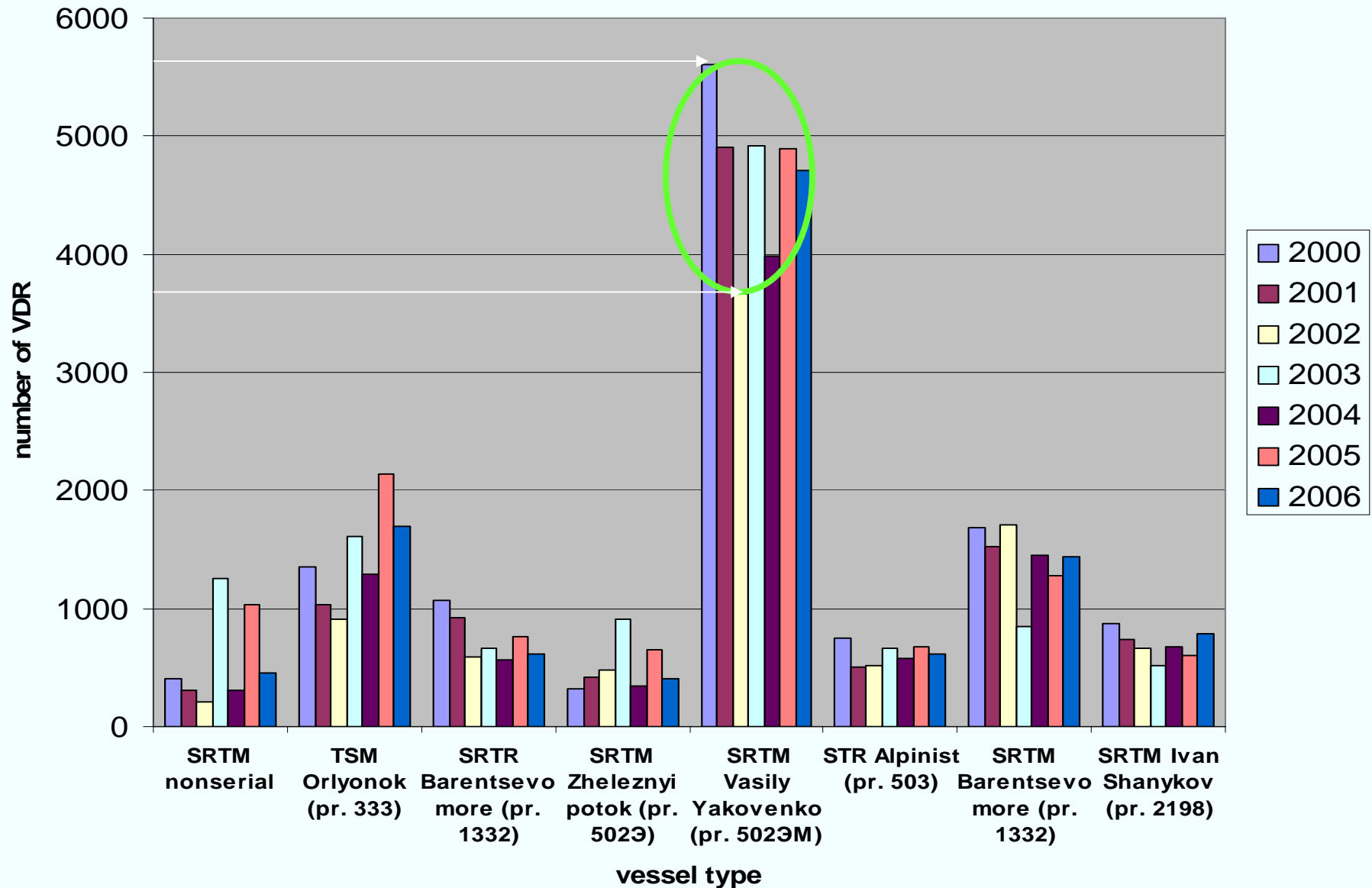
| Year \ Number of VDRs | Total number of VDRs | Number of VDRs with the known trawl type | Percentage of VDRs with the known trawl type (%) |
|-----------------------|----------------------|--|--|
| 2000                  | 36,797               | 14,458                                   | 39.3   |
| 2001                  | 31,118               | 13,220                                   | 42.5   |
| 2002                  | 23,716               | 11,236                                   | 47.4   |
| 2003                  | 20,095               | 11,052                                   | 55.0   |
| 2004                  | 22,111               | 13,712                                   | 62.1   |
| 2005                  | 21,746               | 10,969                                   | 50.5   |
| 2006                  | 25,485               | 14,381                                   | 56.5   |
| 2007 (IY-YIII)        | 15,647               | 10,766                                   | 68.8   |
| <b>Total</b>          | <b>196,715</b>       | <b>99,794</b>                            | <b>50,7</b>                                      |



# DIFFERENCES BETWEEN GIS 1.1 AND GIS 1.2 VERSIONS

|                             | GIS 1.1<br>VERSION<br>(POLLOCK)                     | GIS 1.2<br>VERSION<br>(COD)                        |
|-----------------------------|---|--|
| VESSEL<br>TYPE              | ALL LARGE<br>VESSELS                                | 8 TYPES OF MEDIUM<br>VESSELS<br>(SELECTED FROM 17) |
| TRAWL<br>TYPE               | 8 TYPES OF MIDWATER<br>TRAWLS<br>(SELECTED FROM 12) | 6 TYPES OF BOTTOM<br>TRAWLS<br>(SELECTED FROM 35)  |
| CATCHABILITY<br>COEFFICIENT | 0.4   | 0.3  |

# NUMBER OF VESSELS' DAILY REPORTS VS VESSEL TYPES (*NE Arctic cod*)

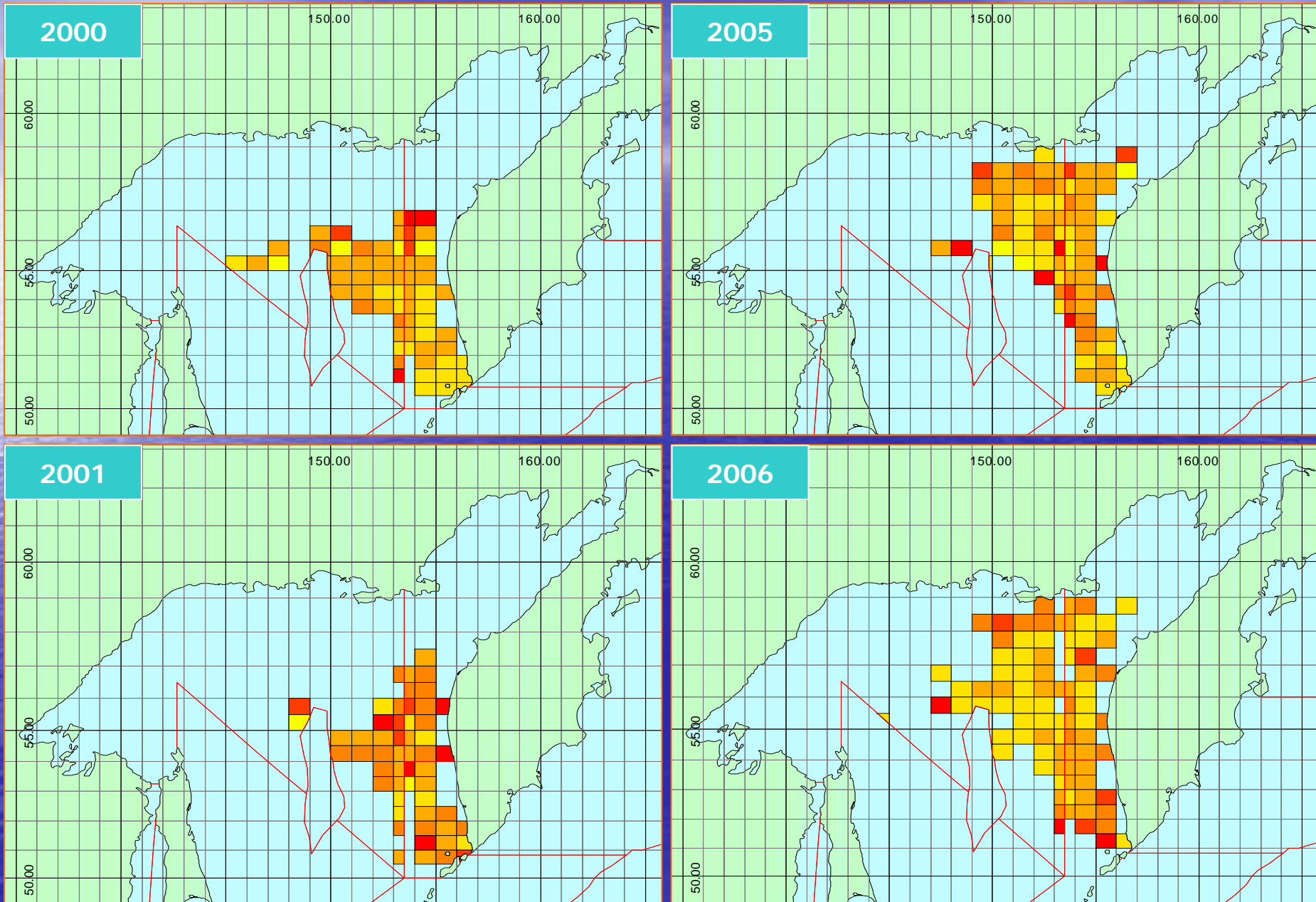


$$P = \sum_{i=1}^n \left( \frac{Q_i \times x_i}{q \times k} \right);$$

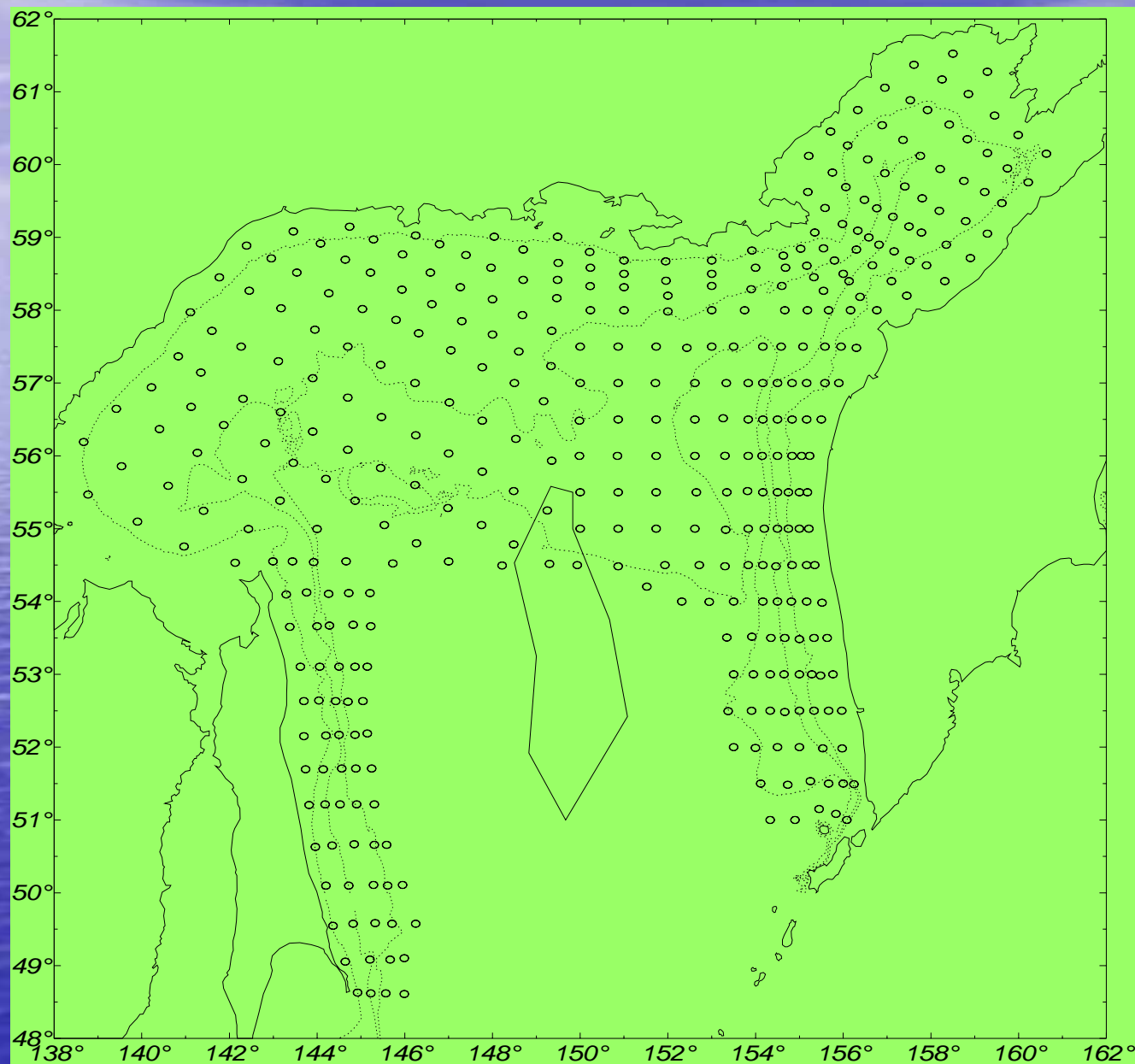
- *P* - is the fishable biomass, tons;
- *Q(i)* - is the area of each square (i), km<sup>2</sup>;
- *x(i)* - is the mean actual catch in each square (i), t/h of trawling;
- *q* - is the area of trawling (determined through multiplication of the trawl horizontal opening by the distance covered), km<sup>2</sup>
- *k* - is the catchability coefficient (which totaled for walleye pollock 0.4 (Shuntov et al., 1988) and for cod 0.3 (Serebrov, 1988).
  - Areas of polygons (each square) were determined with the GIS software ArcView 3.2 (ESRI)
  - The monthly biomass was found as the arithmetic mean biomass for 10-days periods (pollock) and 15-days period (cod)



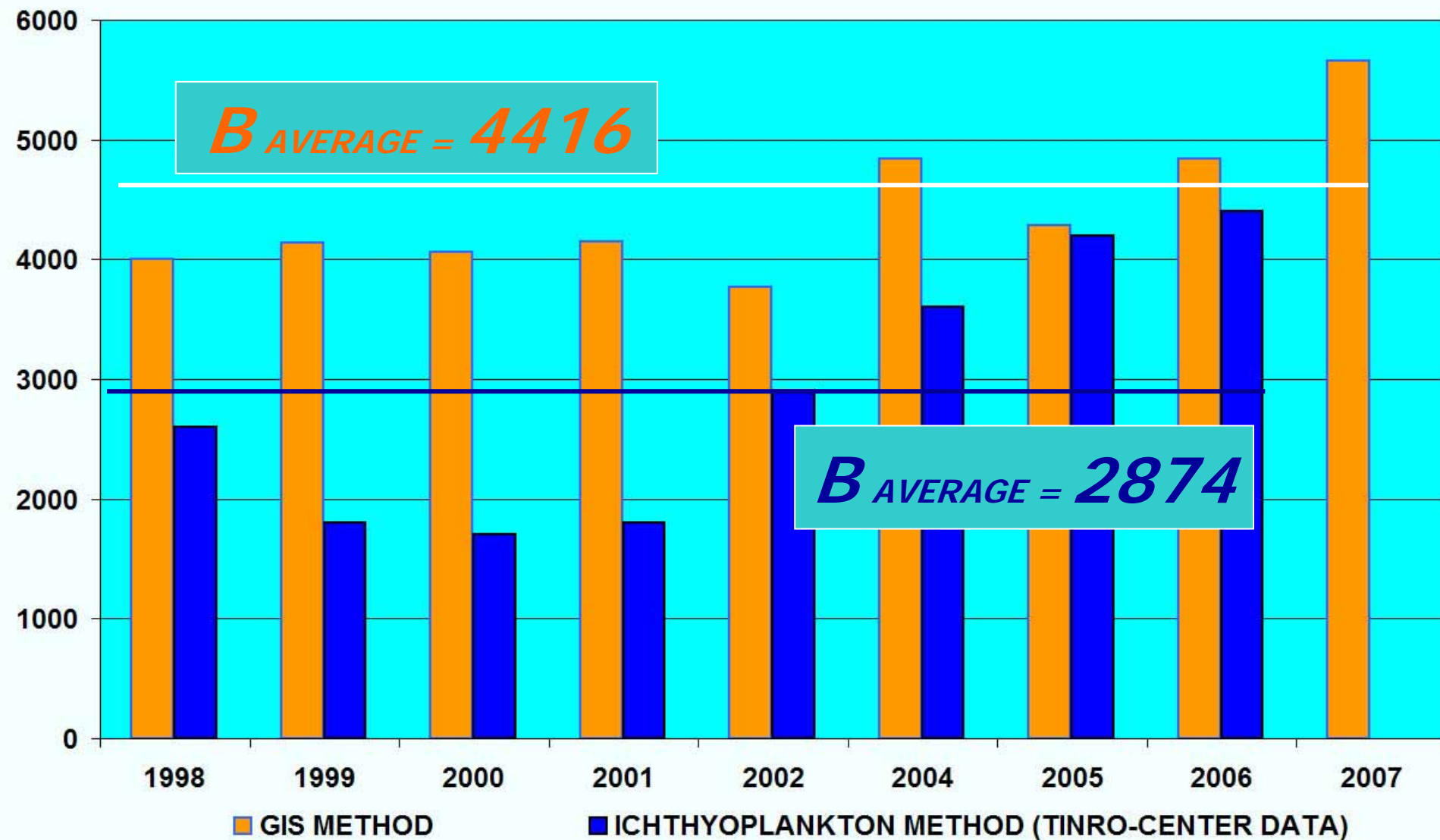
# DENSITY DISTRIBUTION (t/h) OF WALLEYE POLLOCK IN THE SEA OF OKHOTSK IN MARCH



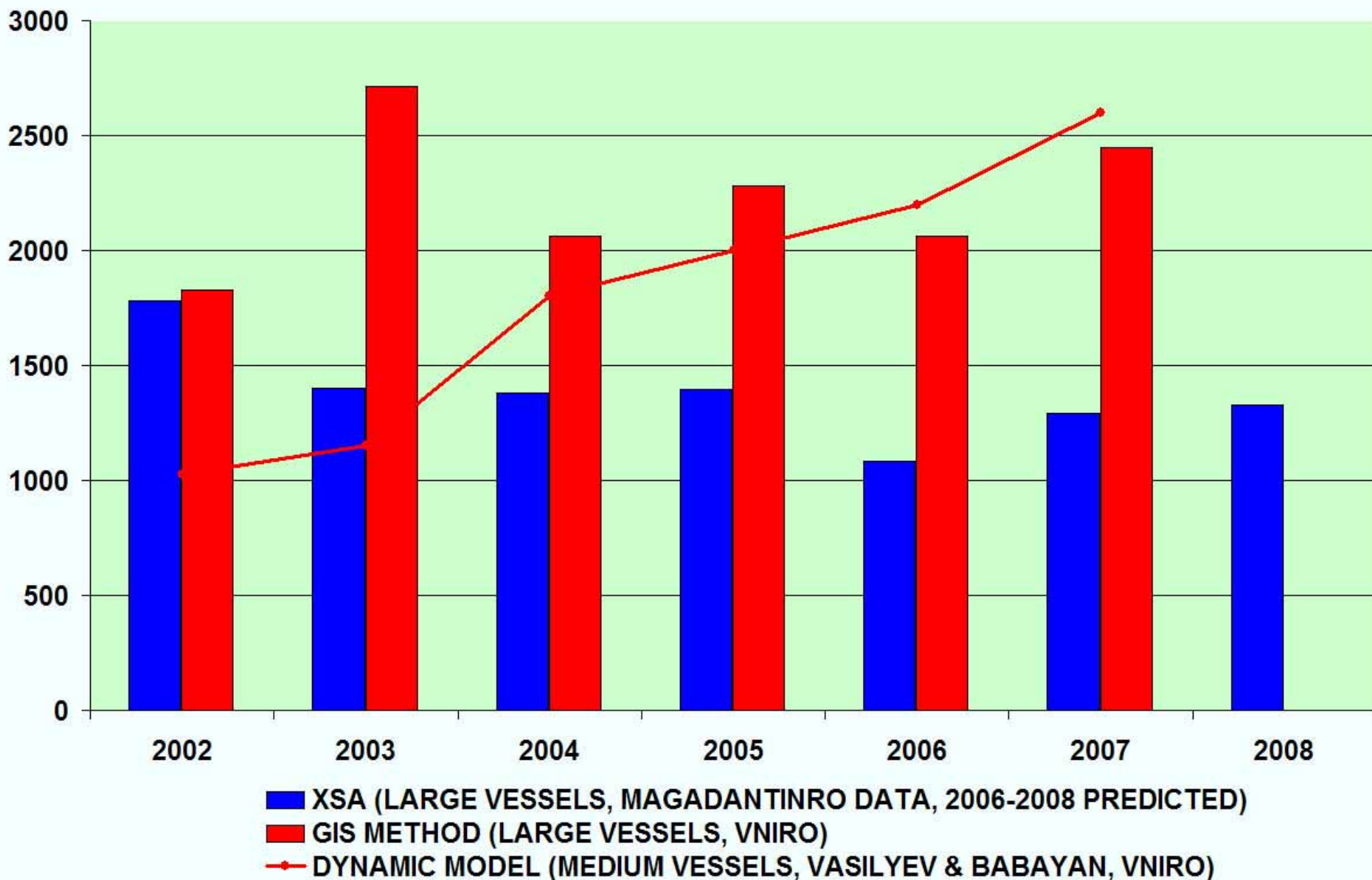
# The grid of ichthyoplankton stations in the Sea of Okhotsk (April-June)



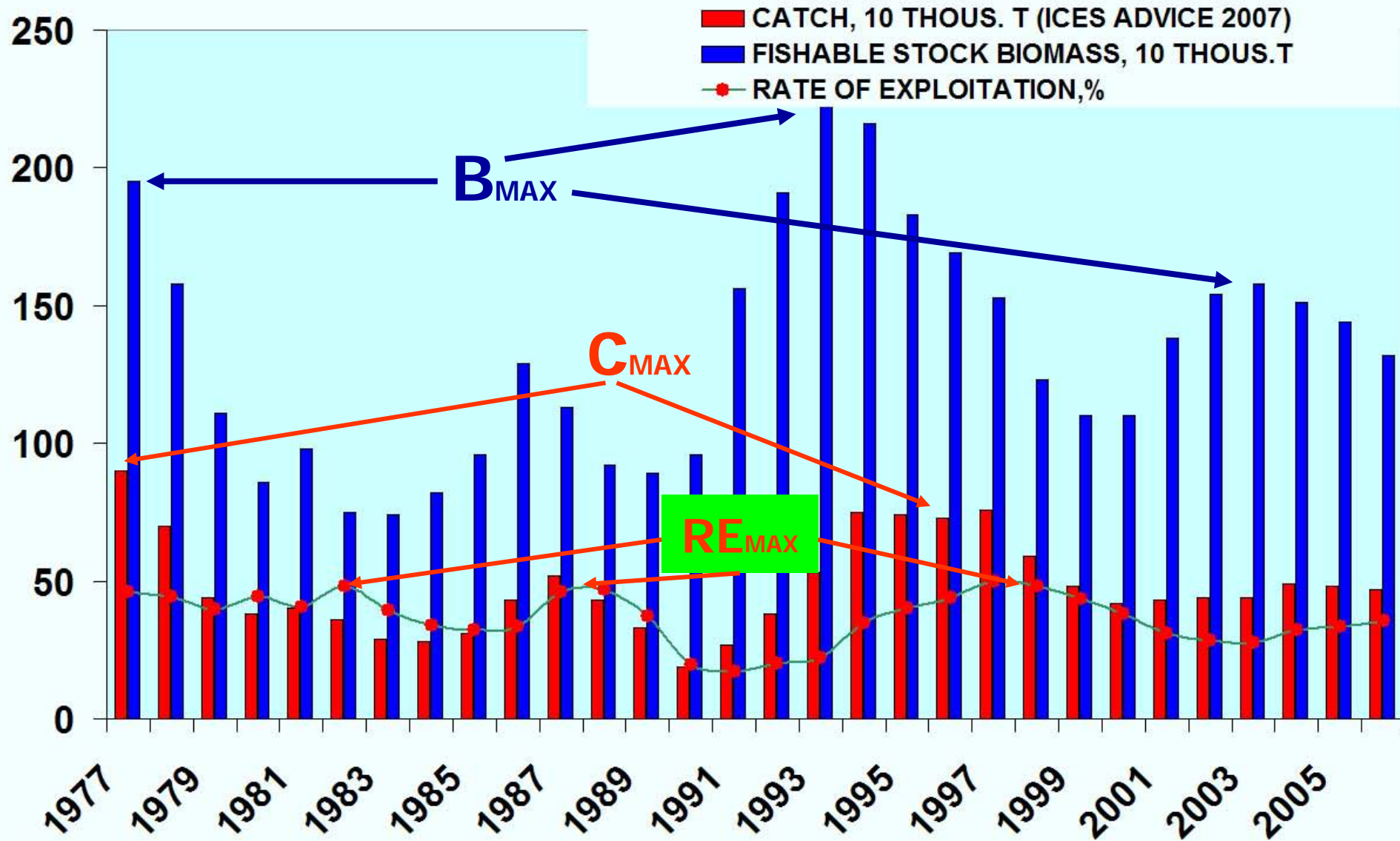
# ASSESSMENT OF FISHABLE BIOMASS BY GIS AND SPAWNING BIOMASS BY ICHTHYOPLANKTON METHODS (*walleye pollock, the Sea of Okhotsk, thousands ton*)



# ASSESSMENT OF FISHABLE BIOMASS OF WALLEYE POLLOCK IN THE NORTH OF OKHOTSK SEA BY DIFFERENT METHODS (thousands ton)

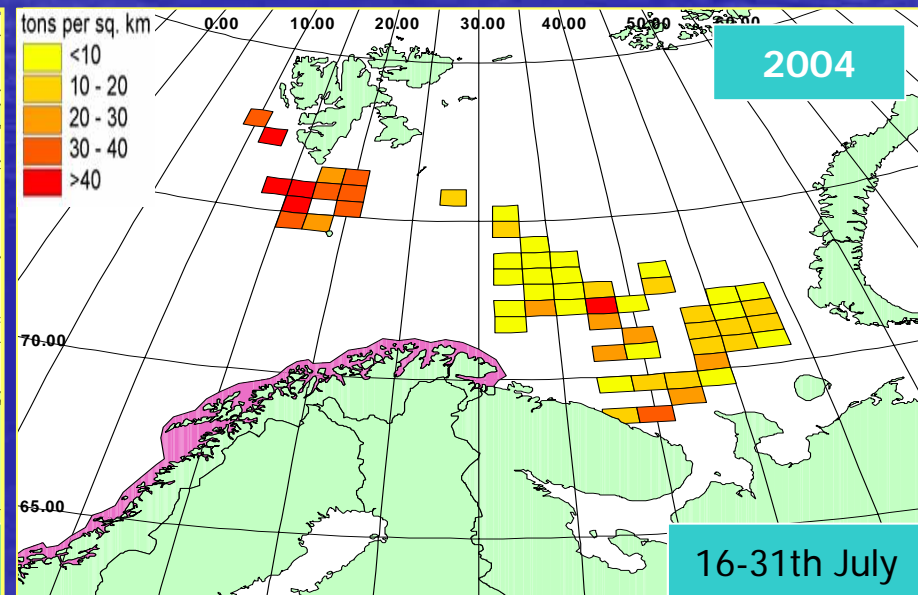
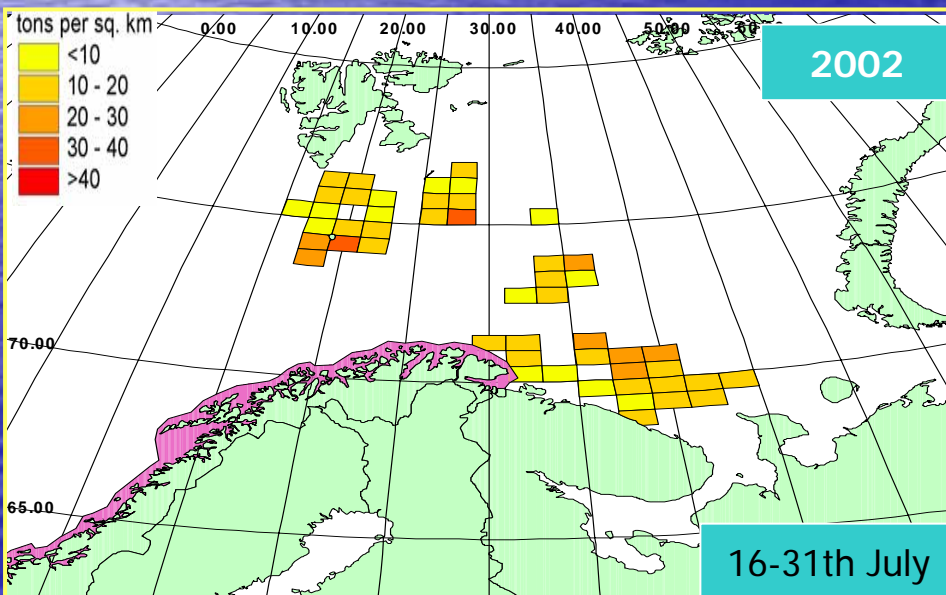
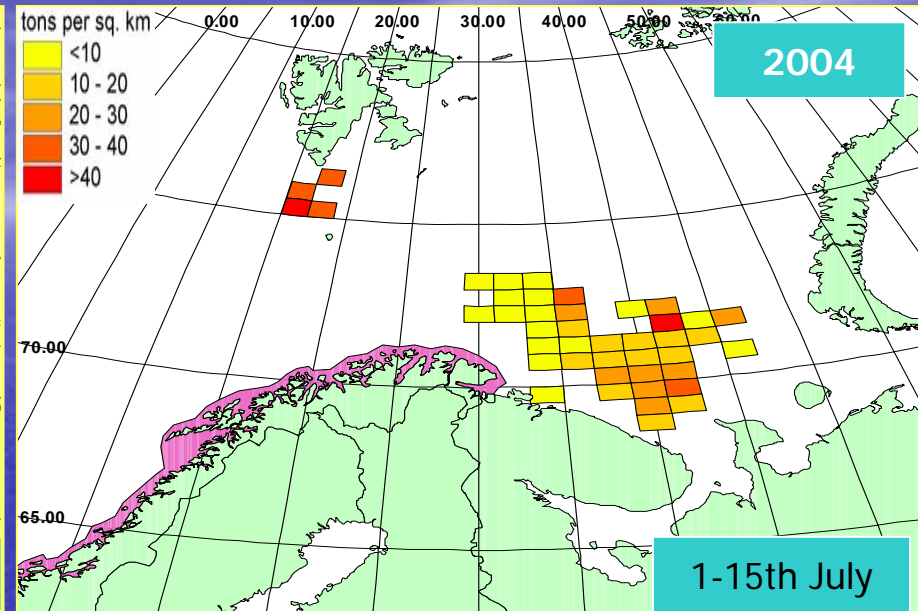
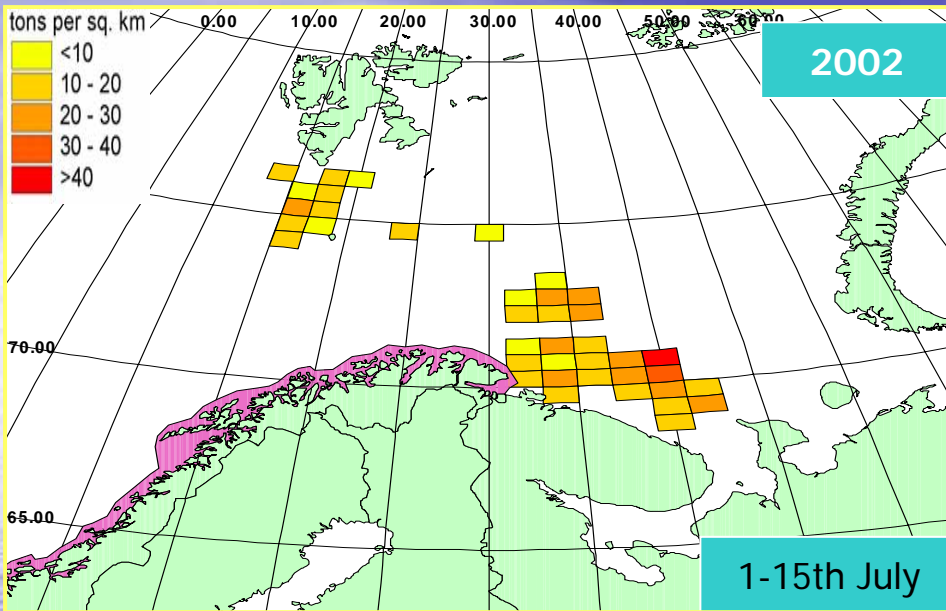


# FISHABLE BIOMASS AND CATCH OF NORTHEAST ARCTIC COD IN 1977-2006, thousands ton (data from AFWG Report 2007)



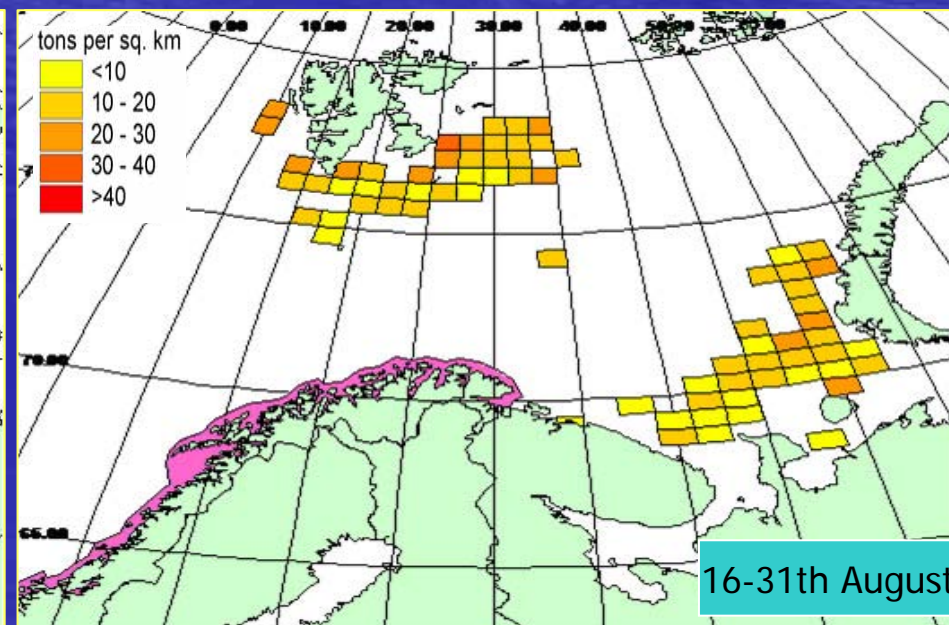
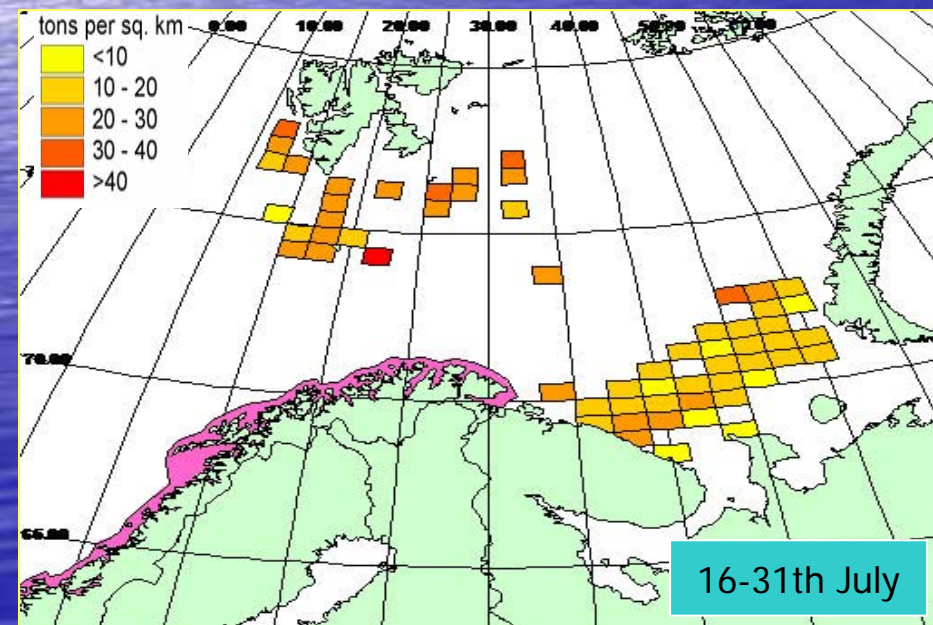
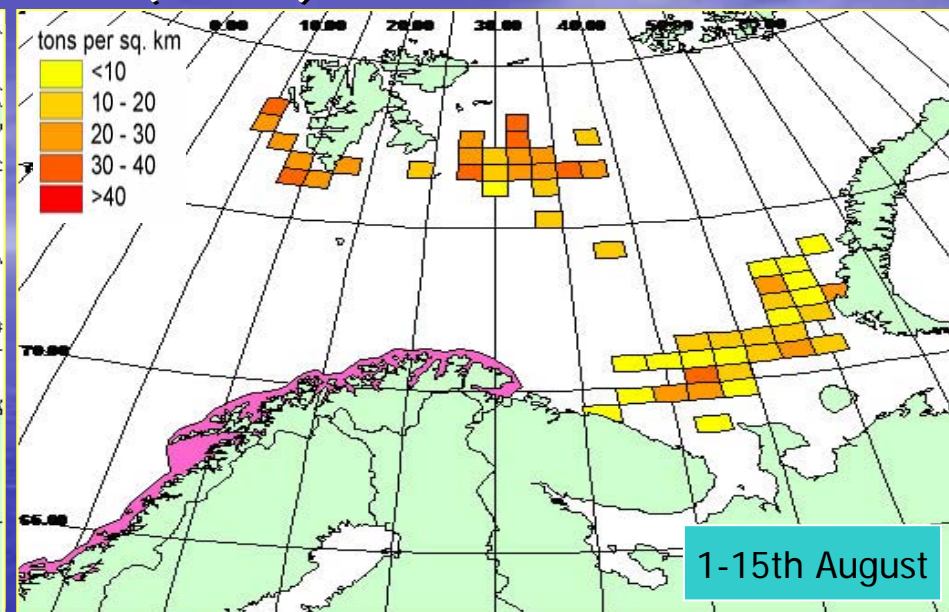
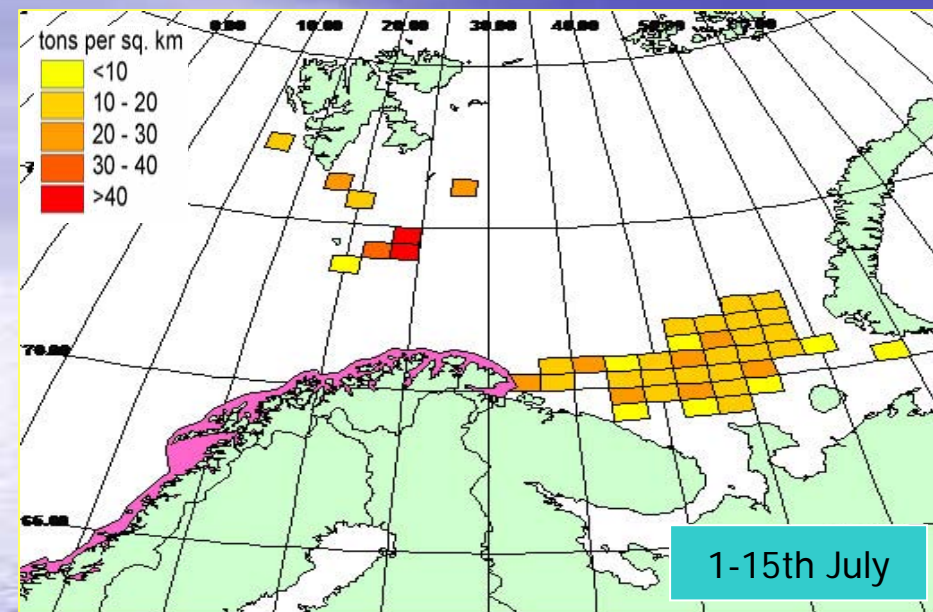


# DENSITY DISTRIBUTION OF NORTHEAST ARCTIC COD IN BARENTS SEA

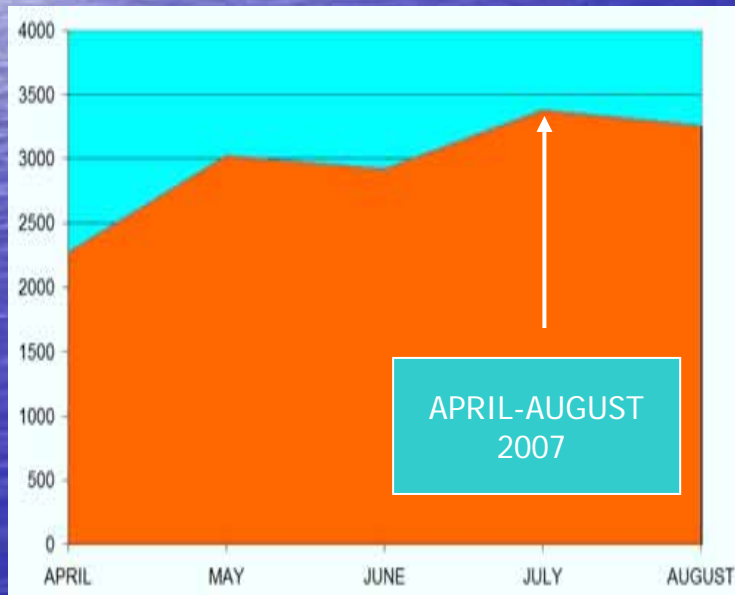
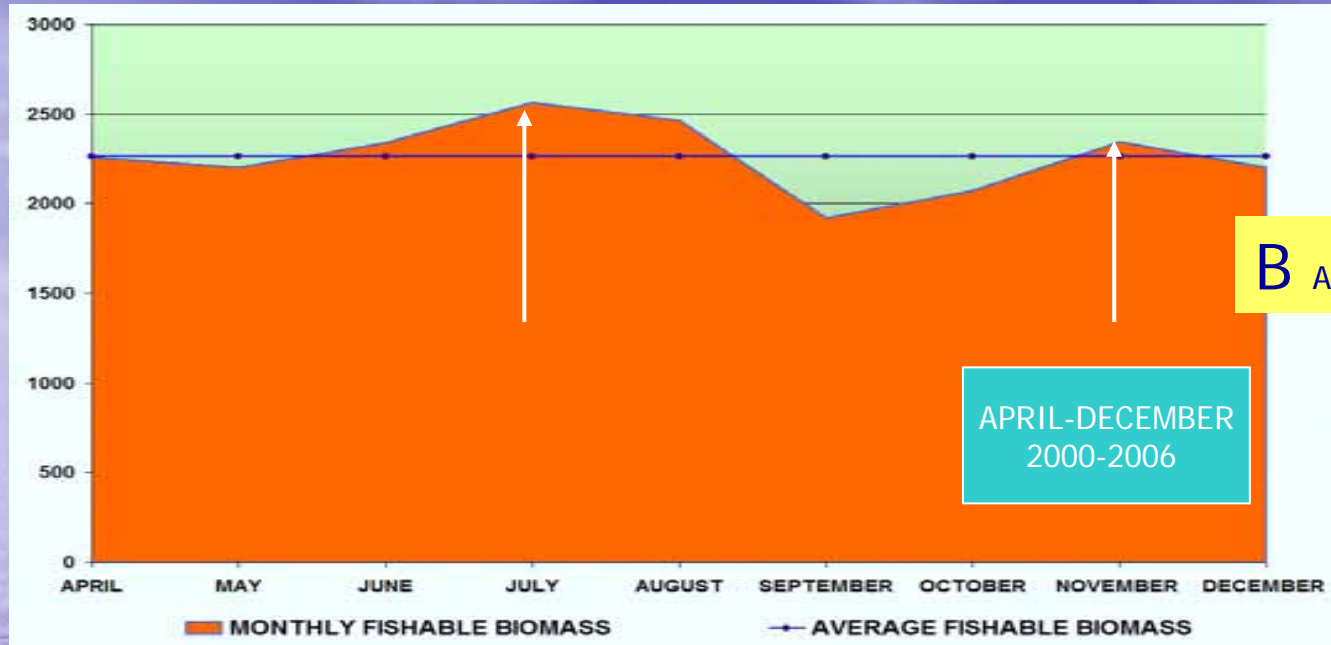




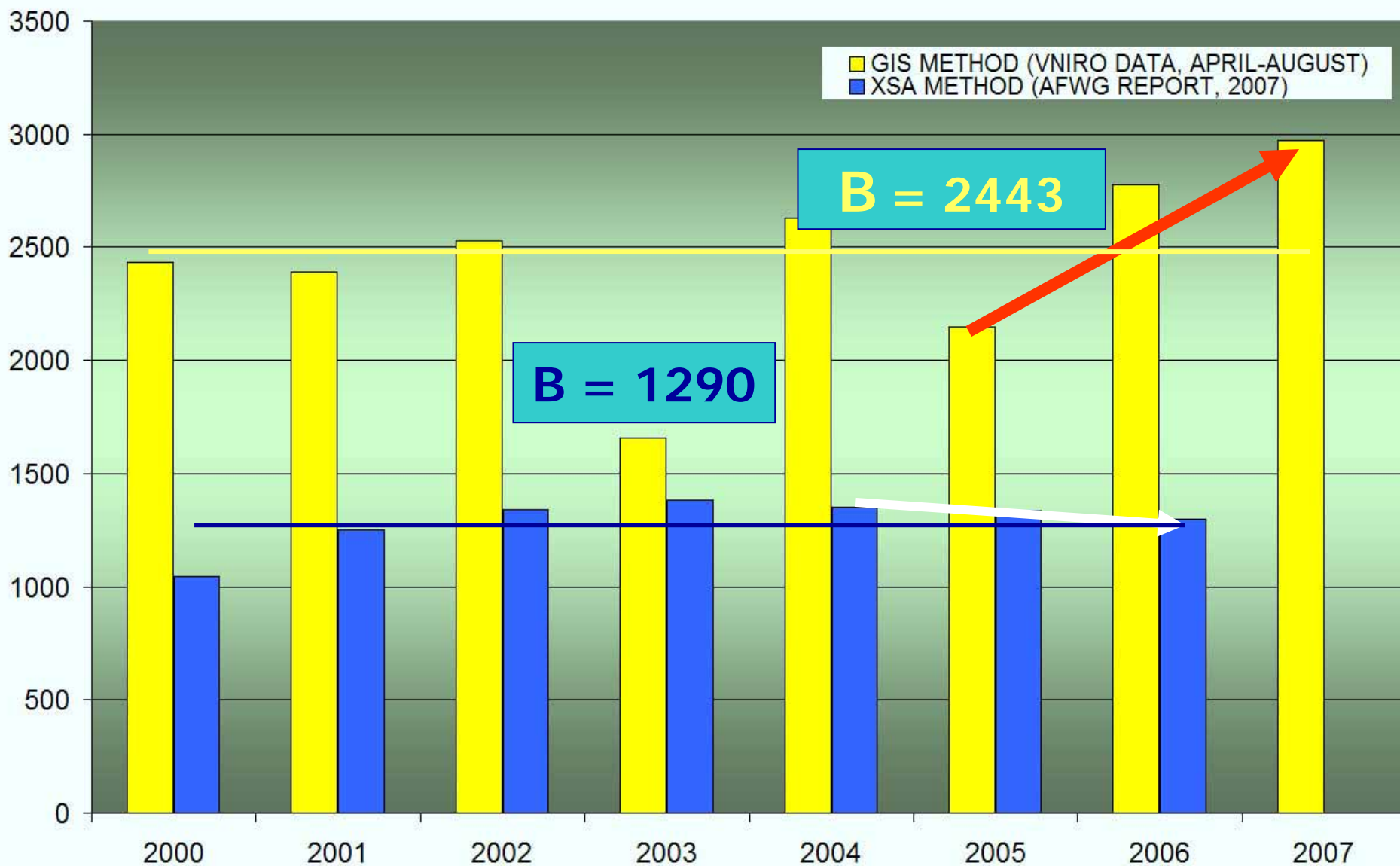
# DENSITY DISTRIBUTION OF NORTHEAST ARCTIC COD IN THE BARENTS SEA (2007)



# MONTHLY MEAN AND AVERAGE FISHABLE BIOMASS OF ARCTIC COD, '000 t

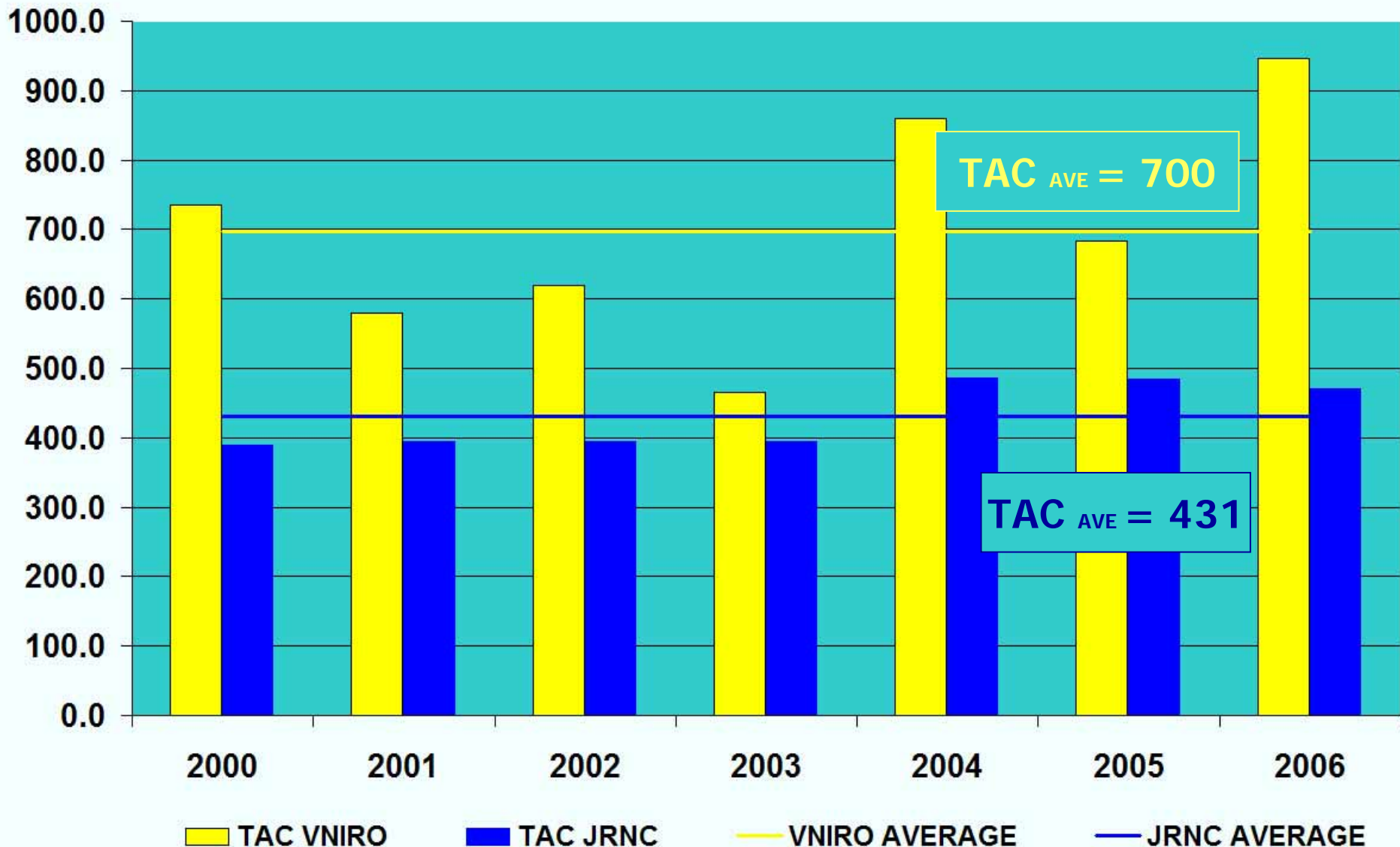


# ASSESSMENT OF THE FISHABLE BIOMASS OF NE ARCTIC COD IN 2000-2007 (April-August) BY GIS METHOD AND IN 2000-2006 BY XSA METHOD

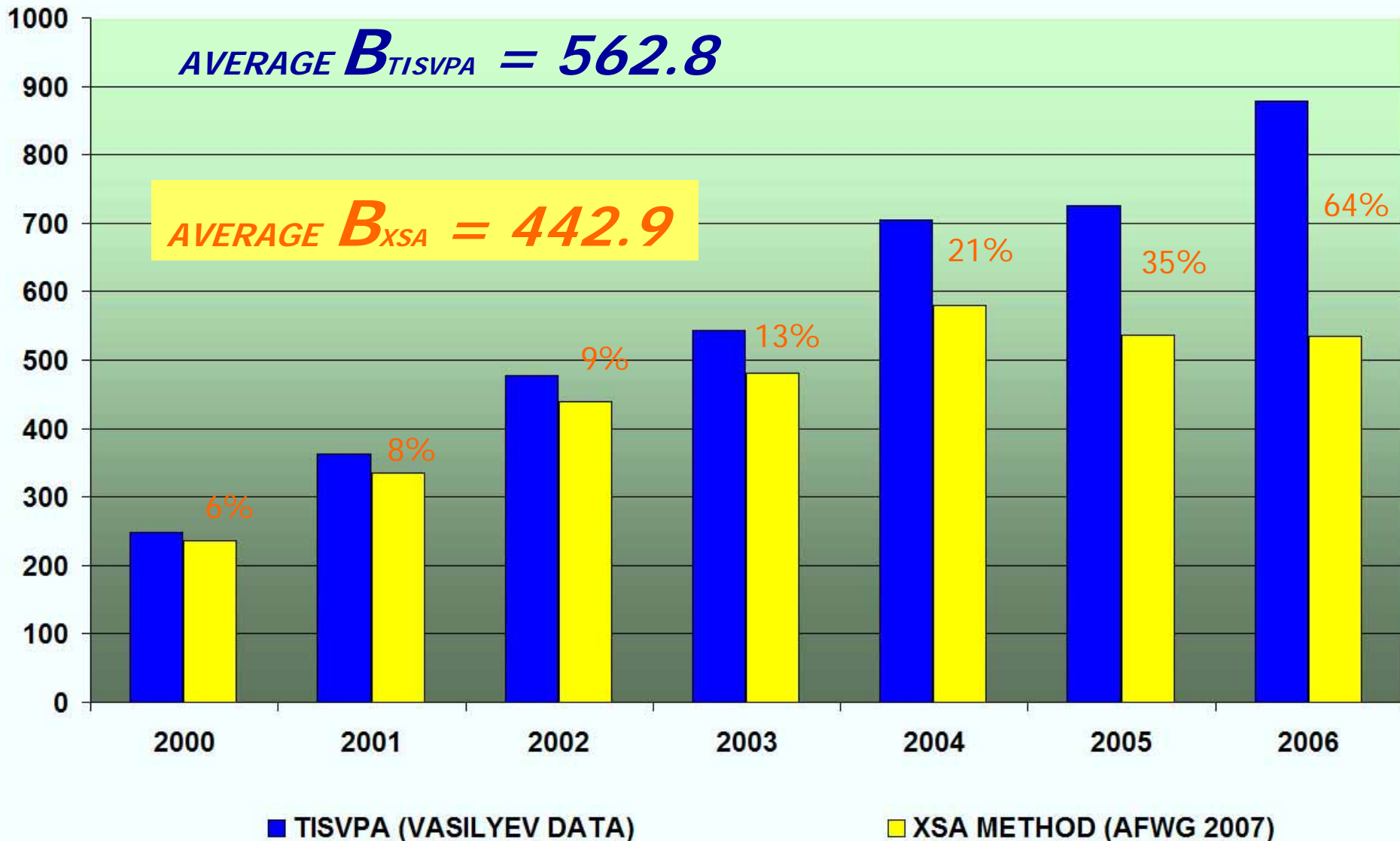




# ASSESSMENT OF TOTAL ALLOWABLE CATCH (TAC) OF NE ARCTIC COD IN THE BARENTS SEA, thousands ton



# ASSESSMENT OF SPAWNING BIOMASS OF ARCTIC COD BY TRIPLE ISVPA AND XSA METHODS IN 2000-2006 (thousands ton)



# The stock assessment of walleye pollock, thousands ton

| Method   | The North<br>Okhotsk Sea   |
|--|----------------------------|
| <b>GIS</b><br>(BULATOV, MOISEENKO, <i>IN PRESS</i> ) | <b>2233</b><br>(2002-2007) |
| <b>XSA</b><br>(SHERSHENKOV, MAGADANNIRO)             | <b>1407</b><br>(2002-2006) |
| <b>Dynamic model</b><br>(BABAYAN, VASILYEV, VNIRO)   | <b>1796</b><br>(2002-2007) |



The stock assessment of Northeast Arctic cod in the Barents Sea in 2000-2007, thousands ton

| Method                                       | Fishable biomass           | Spawning biomass          |
|--|----------------------------|---------------------------|
| <b>GIS</b><br>(BULATOV ET AL., 2007)         | <b>2443</b><br>(2000-2007) | -                         |
| <b>TISVPA</b><br>(VASILYEV, BULGAKOVA, 2007) | <b>1632</b><br>(2000-2006) | <b>563</b><br>(2000-2006) |
| <b>XSA</b><br>(ICES AFWG Rep., 2007)         | <b>1290</b><br>(2000-2006) | <b>443</b><br>(2000-2006) |

## ***Conclusions***

- In 2007 the fishable biomass of walleye **pollock** in the Okhotsk Sea and NE Arctic **cod** in Barents Sea according to the GIS method estimations exceeded **5.7** mln. t and **3.0** mln t, respectively.
- Based on the “new” **pollock** and **cod** biomass the TAC could reach **1.2** mln t and **1.0** mln t, respectively, in 2007.
- However, recommended TAC for walleye **pollock** based on ichthyoplankton method was **0.5** mln t. and for **cod** based on XSA method was **0.4** mln t.



THANK YOU

FOR YOUR

ATTENTION