

# Macrophytes as a part of Restoration Measurements in Lake Durowskie and an Indicator for water quality



## Offered by :

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# Introduction .... location!

Located in Wągrowiec in the western part of Poland



# Introduction ... attractive lake

**Wągrowiec the  
gift of Lake  
Durowskie**



Most of the  
city activity  
depending on  
the lake

Tourism and recreation activities



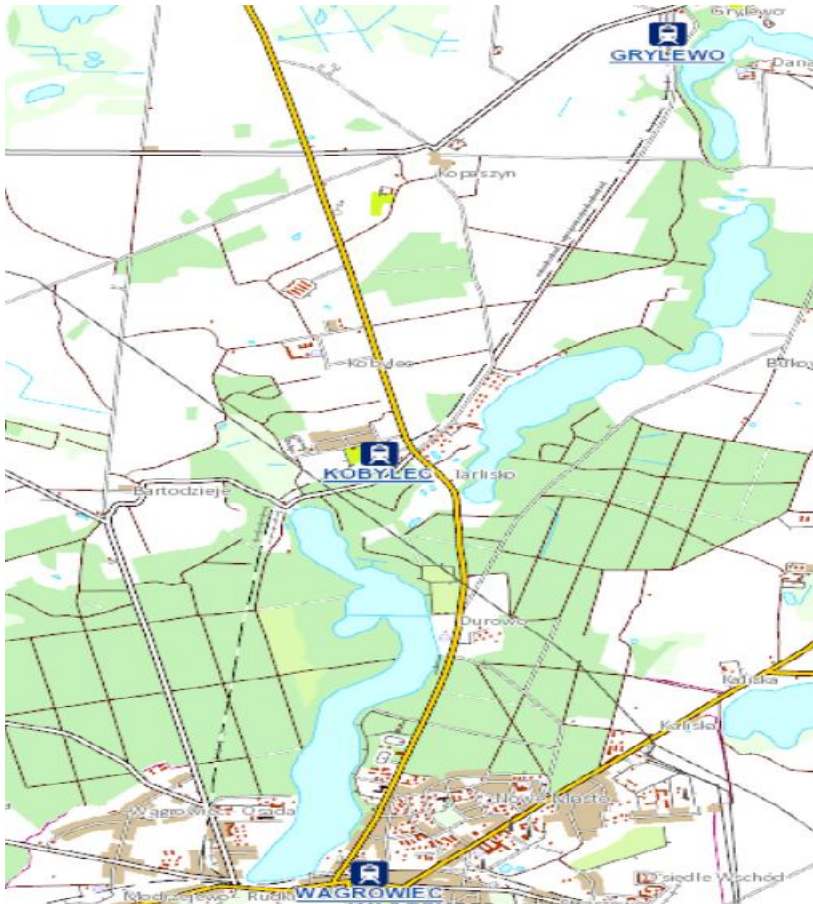
# Introduction .... Human Impact



***So , What is the human  
Impact in the lake ?***

# Introduction... Water quality suffer !

Location , human activities, storm and rain water discharge and erosion



# Introduction...Restoration Program .

Aerator , iron treatment and pike and pikeperch fish introducing







# Macrophytes , the guardian of Lake Durowskie





## Macrophytes and Lake management

- Natural buffer against wind and pollution
- Increase sedimentation and prevent erosion
- Prevent resuspension
- Limit phytoplankton distribution by competition for the nutrients
- Biodiversity
- Oxygen production



A photograph of a pond or lake. The foreground and middle ground are dominated by a dense layer of green lily pads floating on the water. In the background, there are tall, green reeds or grasses growing from the water. The water is dark and reflects the surrounding greenery. The overall scene is a natural, aquatic environment.

## Purpose of our macrophytes study ?

1. What is the present trophic state in the lake and its tributaries?
2. What is the trophic state trend from 2009 to now?  
And comparison of results with Summer School data from 2009 – 2014.

As an indicator for the Ecological state of the lake

# Material and Method

- Rowing boats, anchor, rope for the depth and GPS





# Material and Methods !

- One week of field work on the lake (macrophyte survey)
- Second week of work in mapping and analysis



# Material and Methods

- **ESMI index:** classification of the ecological state of deep stratified lakes
- **MIR index:** declare ecological state of outflow river

| Ecological statue | Range of values of ESMI | Range of values of MIR |
|-------------------|-------------------------|------------------------|
|                   | Deep lakes              | Organic buttom         |
| very good         | 0,680-1,000             | $\geq 44,5$            |
| good              | 0,340-0,679             | 44,5-35,0              |
| moderate          | 0,170-0,339             | 35,0-25,4              |
| weak              | 0,090-0,169             | 25,4-15,8              |
| bad               | $< 0,090$               | $< 15,8$               |



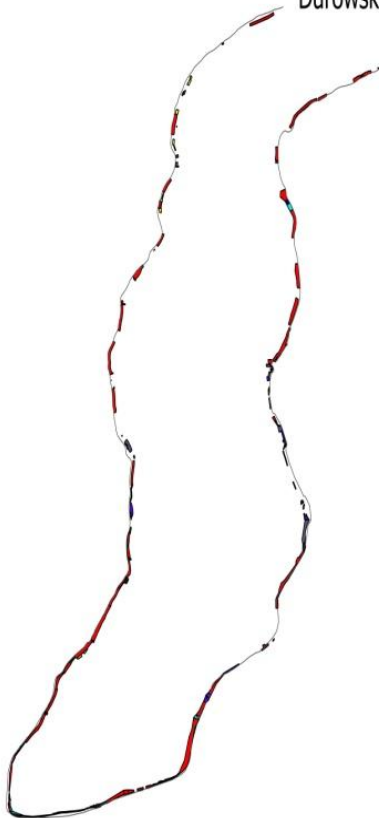
# Results !

Southern Part of Lake  
Durowskie in scale 1:5000

## Legend

### Association of macrophytes

- Acoretum calami*
- Butometum umbelati*
- Caricetum acutiformis*
- Cicuto-Caricetum pseudocyperii*
- Caricetum riapariae*
- Charetum tomentosae*
- Eleocharidetum palustris*
- Fontinaletum antipyreticae*
- Glycerietum maximae*
- Iridetum pseudacori*
- Myriophylletum spicati*
- Nupharo-Nymphaeetum*
- Phragmitetum communis*
- Potametum lucentis*
- Potametum pectinati*
- Potametum perfoliati*
- Scirpetum lacustris*
- Sparganietum erecti*
- Thelypteridi-Phragmitetum*
- Typhetum angustifoliae*
- Typhetum latifoliae*

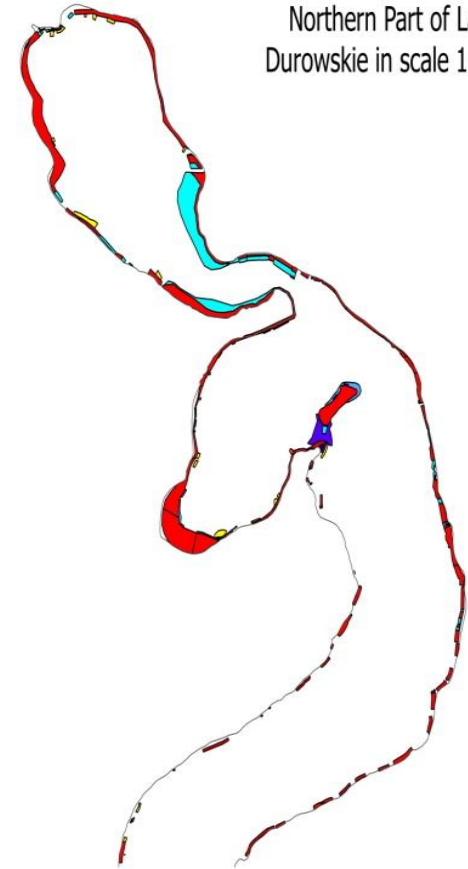


## Legend

### Association of macrophytes

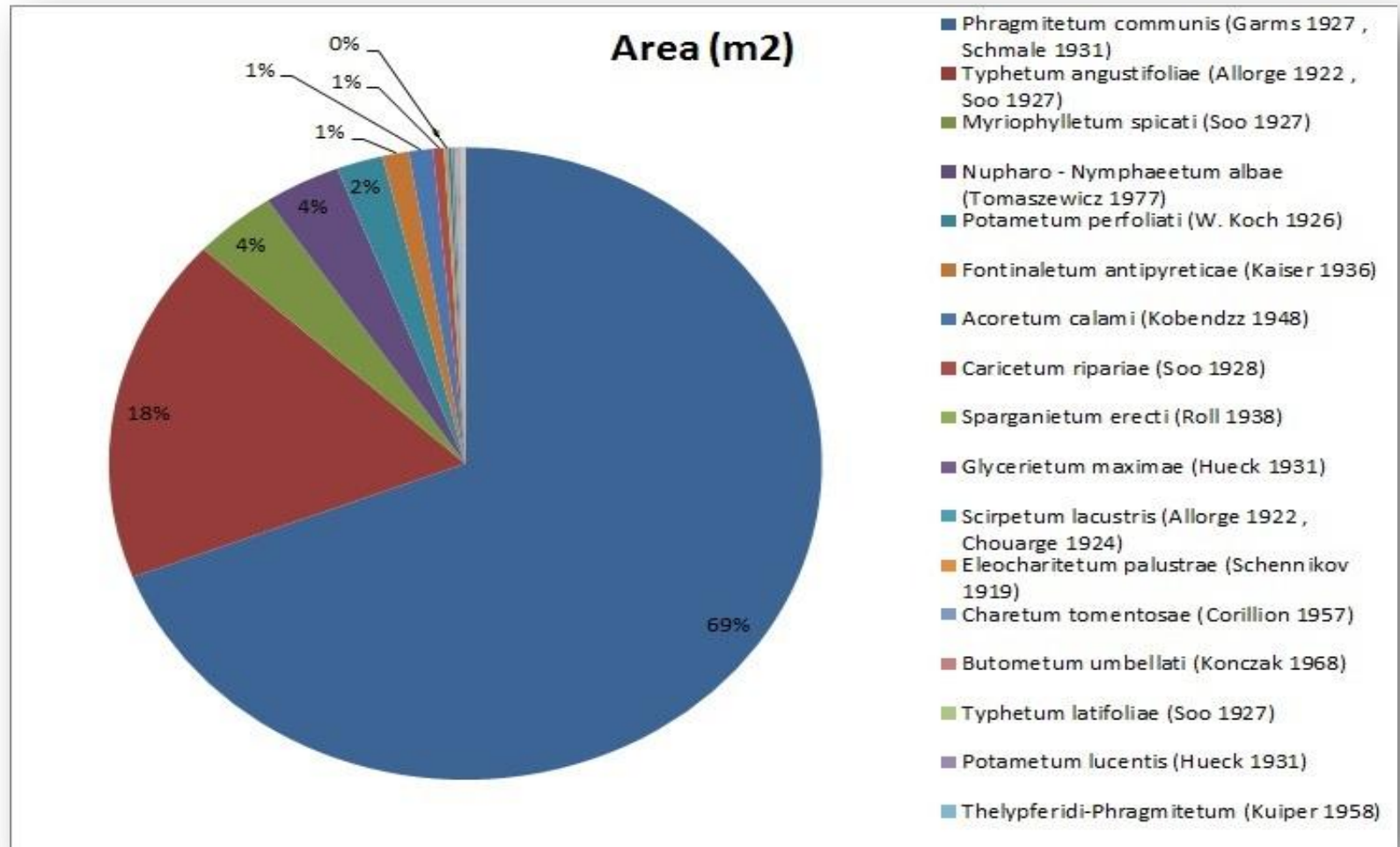
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Northern Part of Lake  
Durowskie in scale 1:5000



**Maps of macrophytes associations in the lake . Maps show more coverage in the northern part than the southern part .**

# Results ... Macrophytes distribution (%)

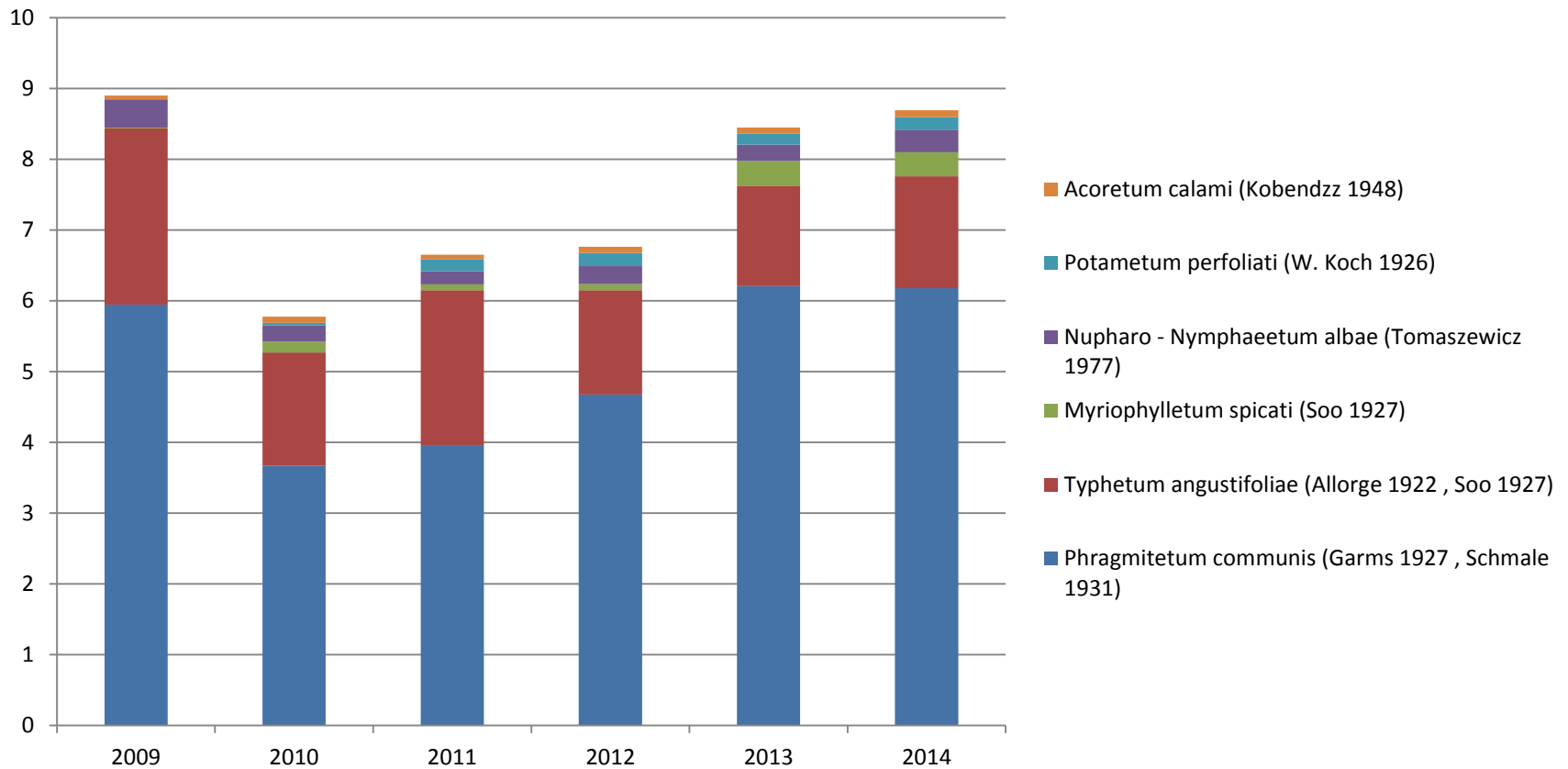


Pie chart for the coverage area expressed in percentage (%).



# Results.... Macrophytes associations

Area (ha) of dominant macrophytes

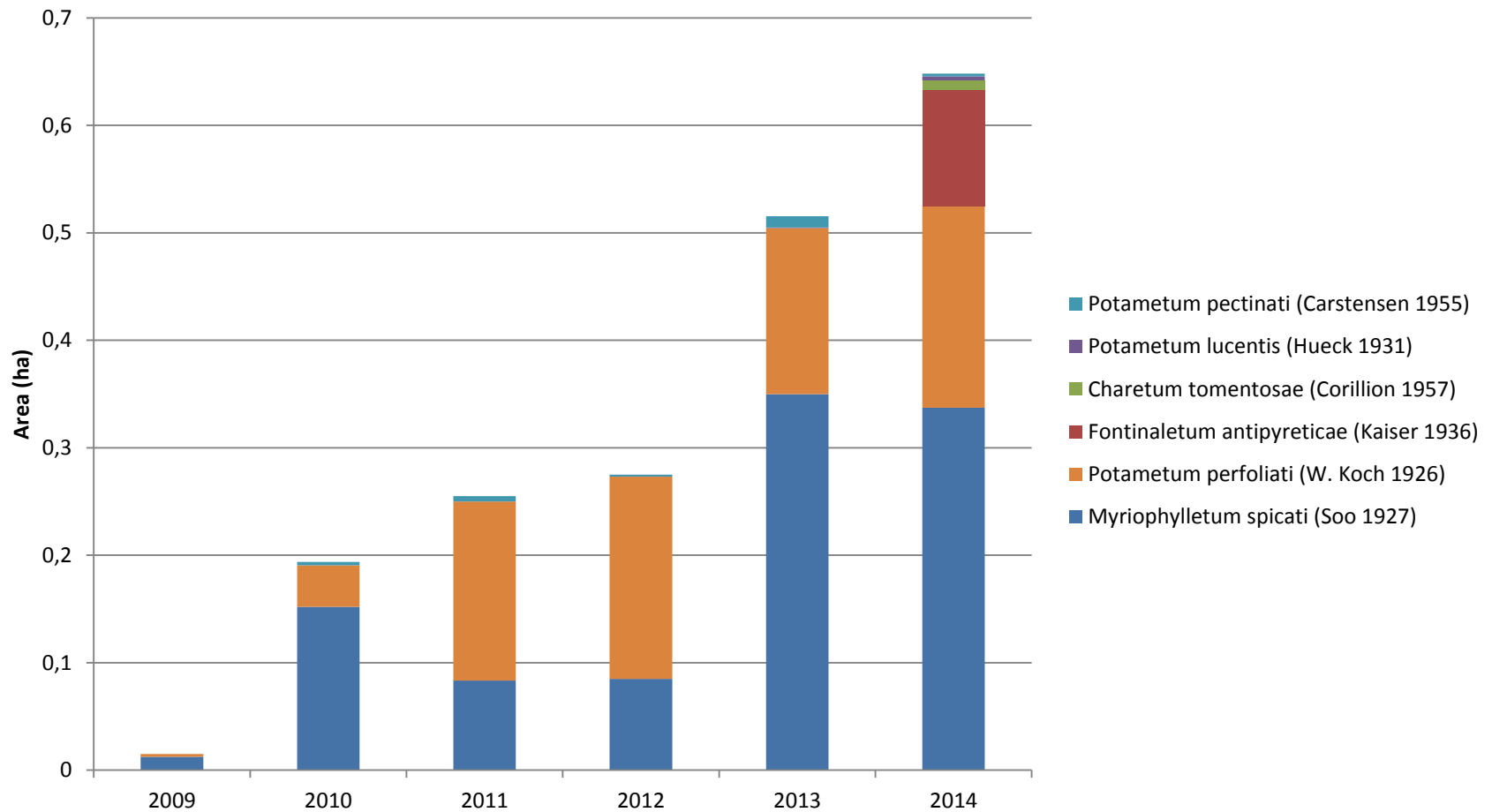






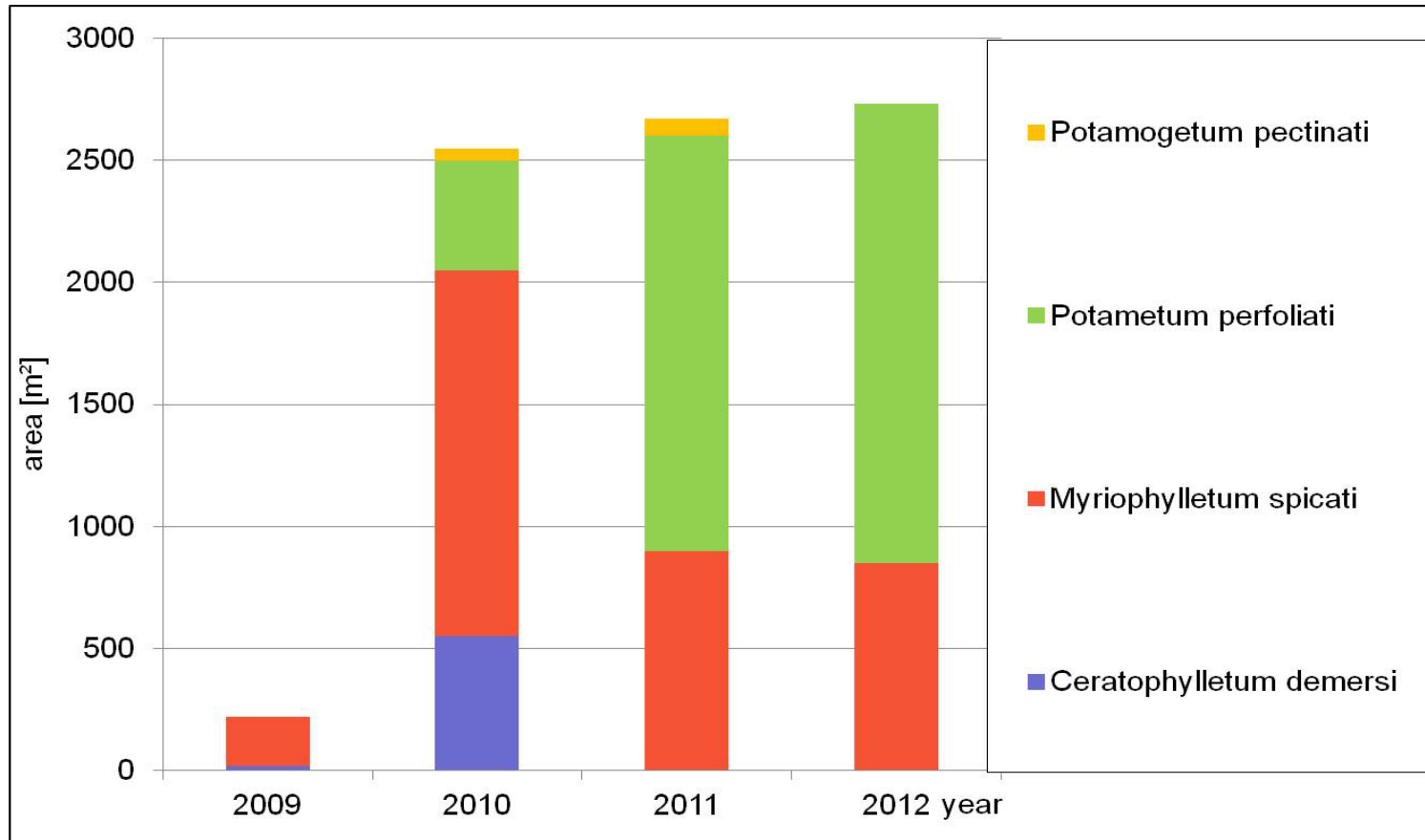
# Results... Macrophytes associations

## Composition of submerged associations



# Results.... Macrophytes associations

Comparing our result with result of 2012 group work . Graph show also composition of submerged association

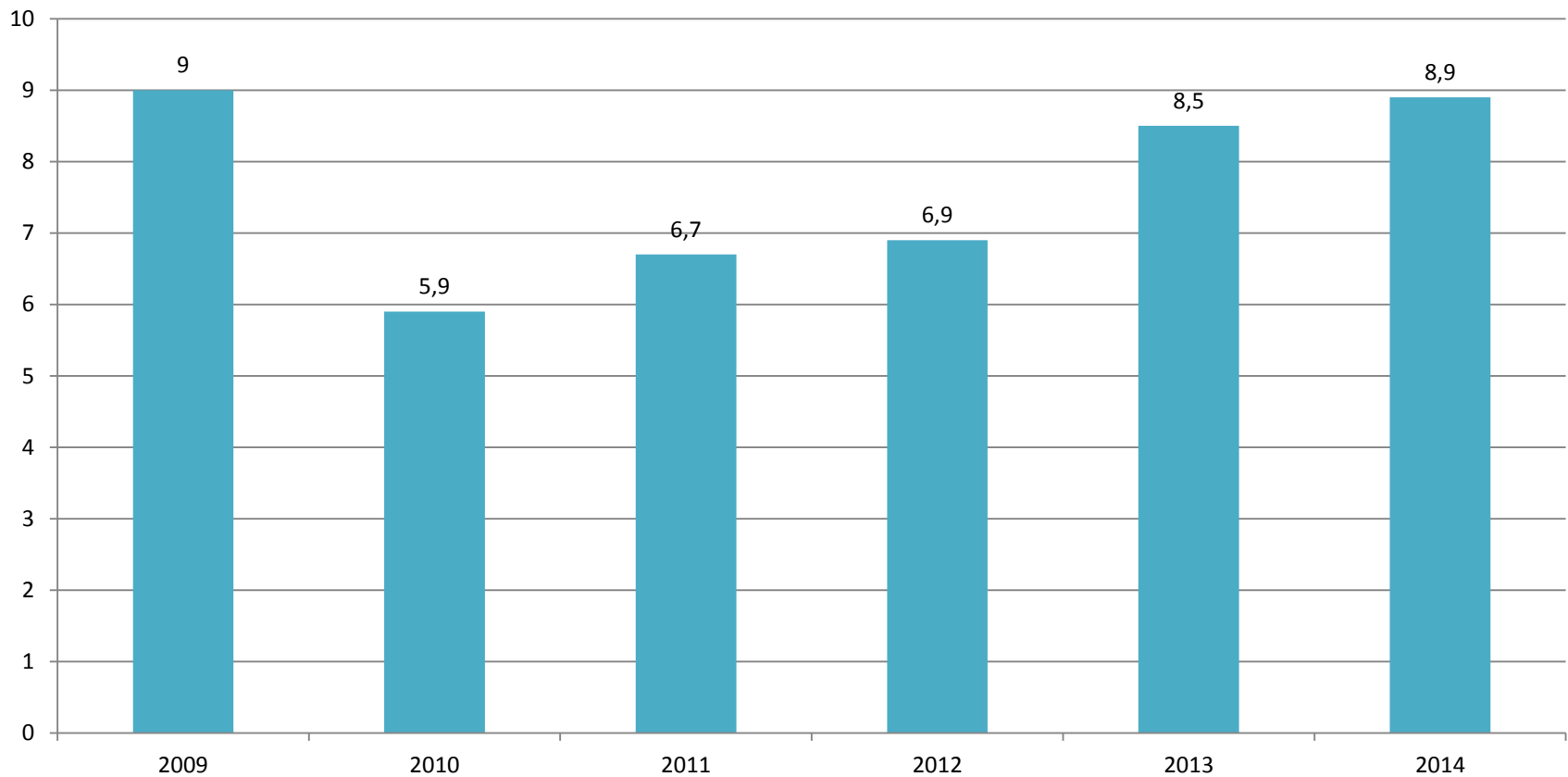




# Results.... Macrophytes associations

Changes in the total area coverage from 2009 until 2014

## Total area (ha) of macrophytes



# Results ... ESMI & MIR

Range of values for ESMI and MIR

| Ecological statue | Range of values of ESMI | Range of values of MIR |
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Values of ESMI and MIR indices 2009 – 2014

|             | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  |
|-------------|-------|-------|-------|-------|-------|-------|
| <b>ESMI</b> | 0.109 | 0.103 | 0.118 | 0.12  | 0.136 | 0.149 |
| <b>MIR</b>  | 30.6  | 31.7  | 29.8  | 33.41 | 26.05 | 28.95 |

# Conclusion



Lake Durowskie still in the poor level of water quality evaluation (ESMI) **BUT** there's Tangible Improvement



Positive results,  
new submerged associations appearance.  
Increase of the total area (0,4 hectare)



Increase the tourism but never forget the nature (awareness)



Restoration process share a lot of this improvement



Thank you for your attention 😊