# The Curonian Lagoon Ecosystem and its Ecosystem Services

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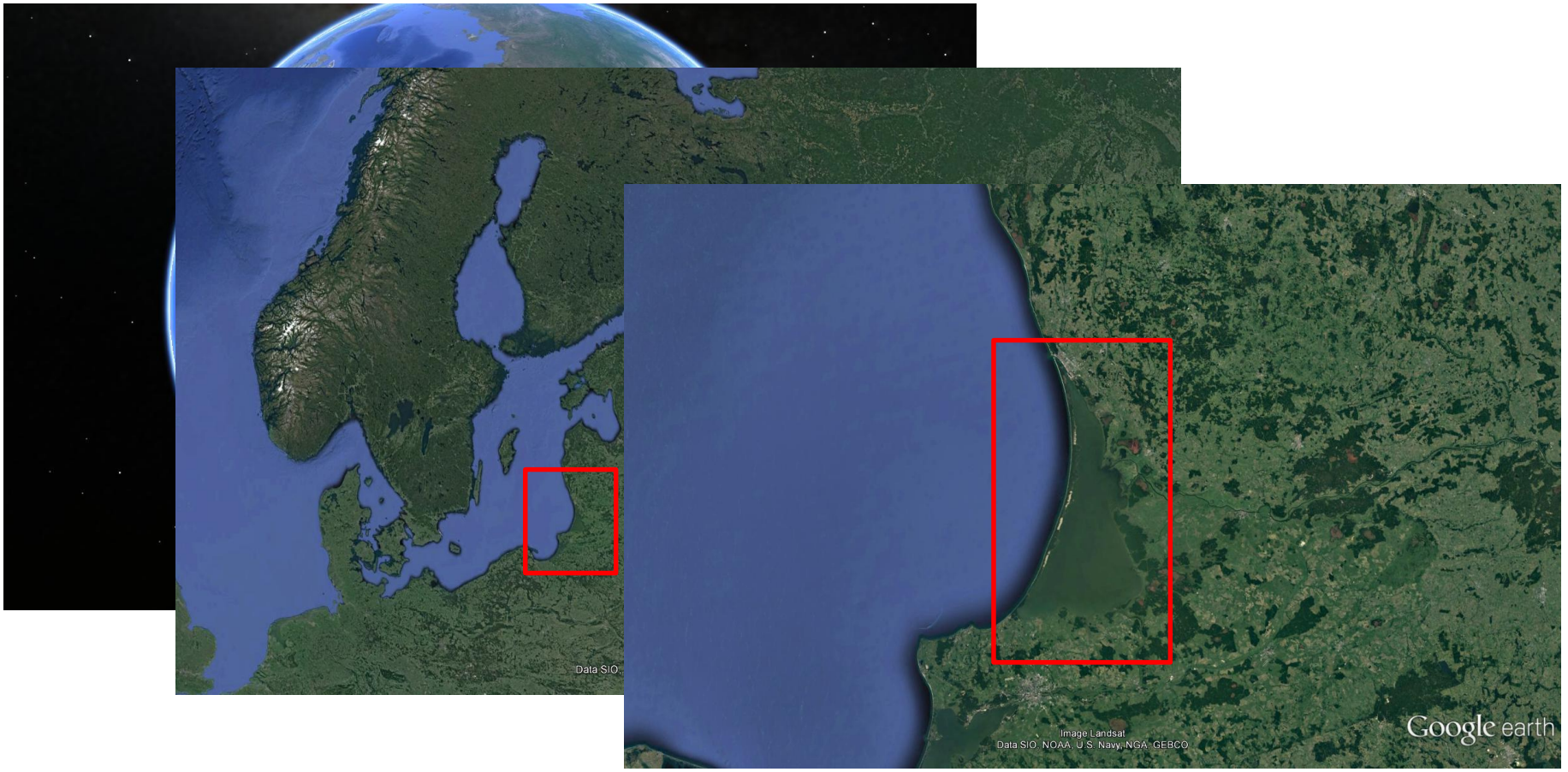
**A SYSTEM APPROACH FRAMEWORK FOR COASTAL RESEARCH & MANAGEMENT**

BONUS-BaltCoast received funding from BONUS (Art 185), funded jointly by the EU and Baltic Sea national funding institutions

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- The **Curonian Lagoon** is located in the **South-eastern** part of the **Baltic Sea**
- In Lithuanian Kuršių Marios, is the **biggest coastal lagoon** in Europe

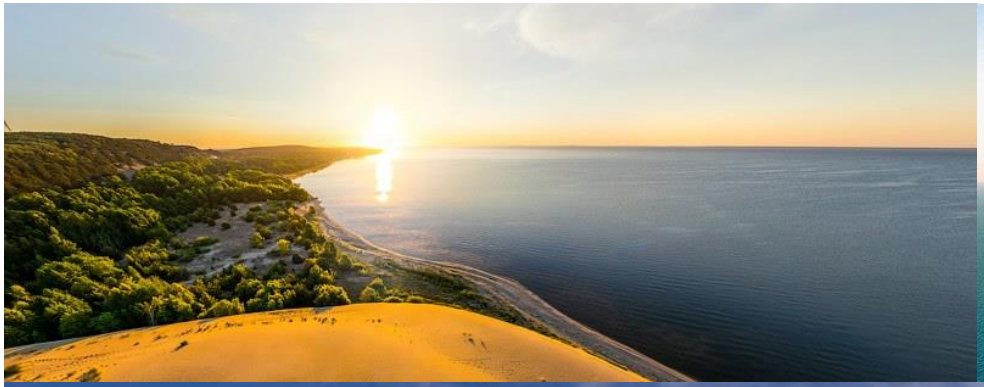


# The Curonian Lagoon Ecosystem and its Ecosystem Services


- This lagoon is shared by two countries:
  - the **central-northern** part of the lagoon belongs to **Lithuania**
  - the **central-southern** part belongs to **Kaliningrad District of Russia**

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- In the Lithuanian part the lagoon lies between the mainland and an dunar-sandy spit called Curonian Spit, which is nowadays a National Park and UNESCO Heritage Site.



© http://privateguide.lt/wp-content/uploads/2014/12/curonian-Spit.jpg

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- The main influencing river discharging freshwater is the Nemunas River

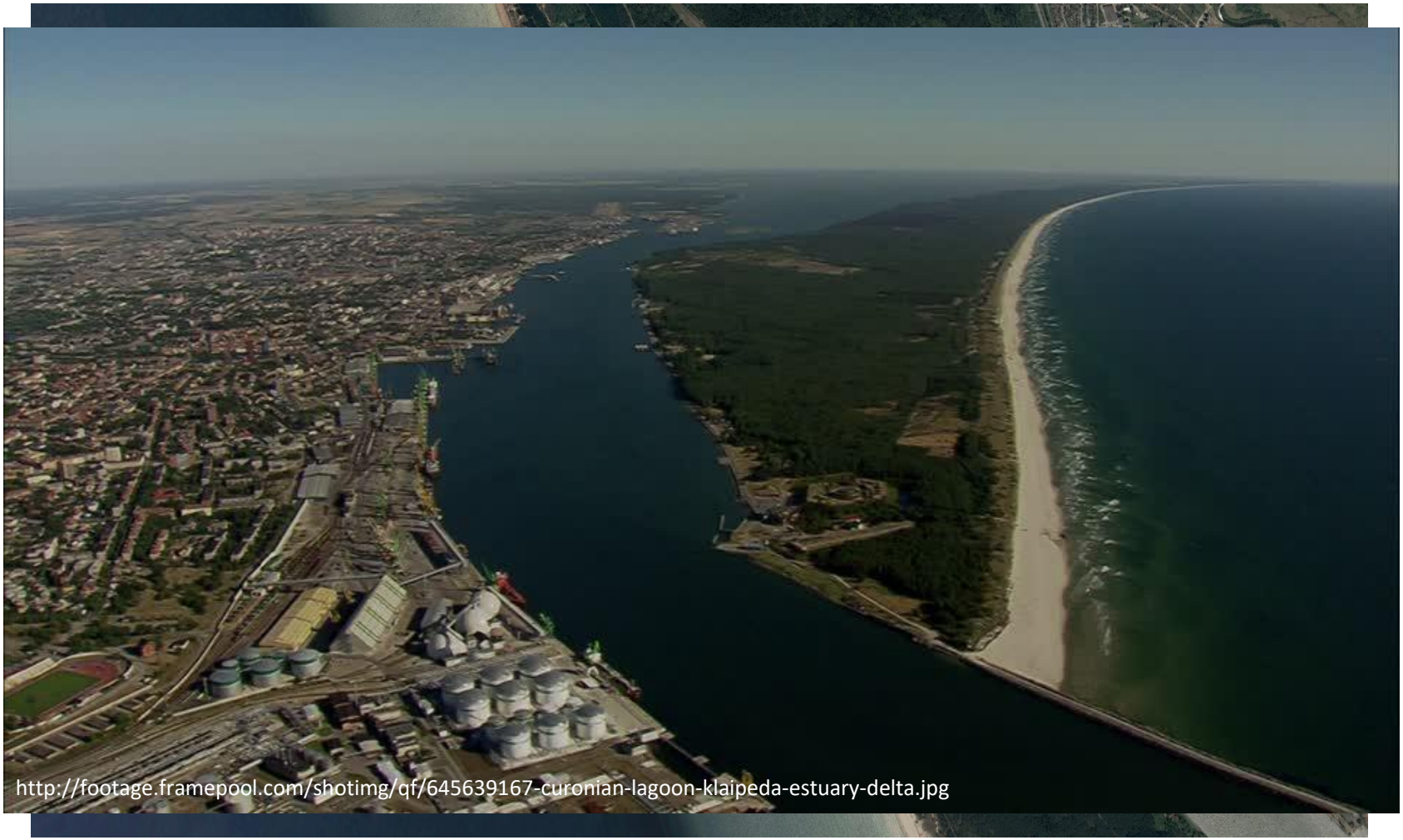
http://www.lithuania.travel/images/83/4/15_5/

http://www.baltic-info.com/userfiles/images/Litouwen/Nature/NemunoDeltas.jpg

scientific conference, 28-29 november, 2013, Akademija : proceedings. Akademija : Aleksandras Stulginskis University. ISSN 1822-3230. Vol. 6, b. 3 (2013), p. 239-244.

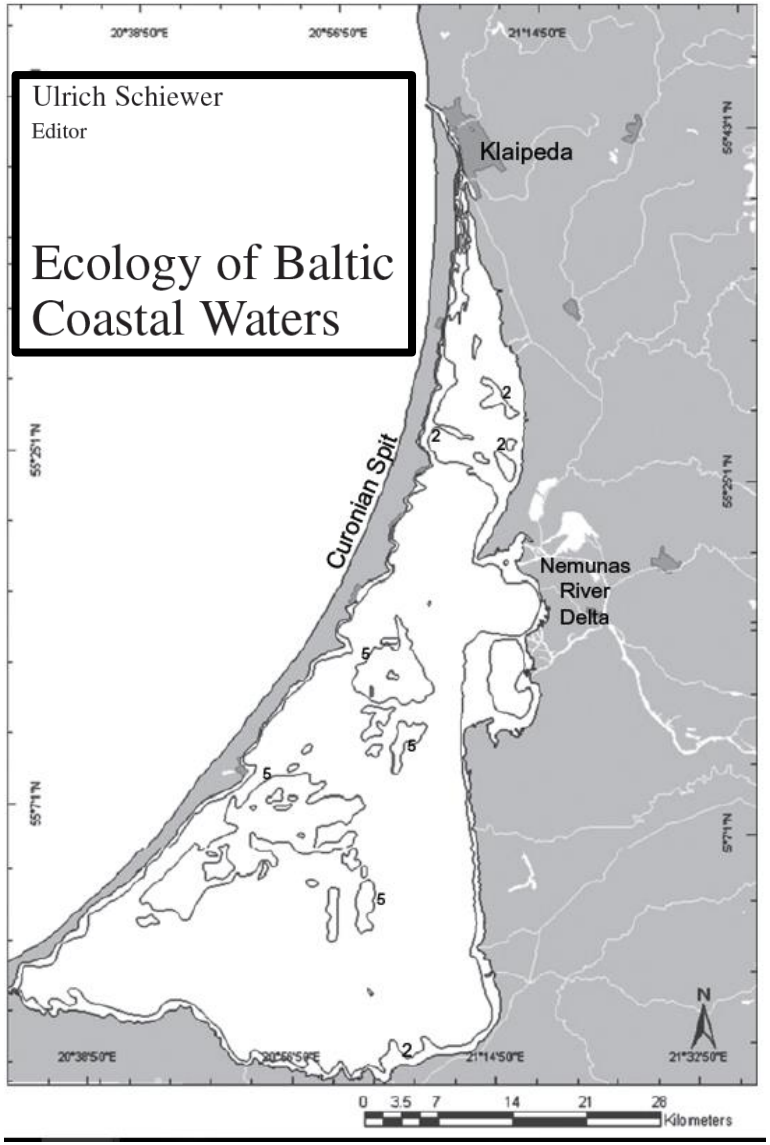
# The Curonian Lagoon Ecosystem and its Ecosystem Services

- Curonian Lagoon is **connected** with the sea by the **Klaipeda Strait**



# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Environmental characteristics of the Curonian Lagoon***:
  - **Area**: 1584 km$^2$
  - **Volume**: 6000*10$^6$ m$^3$
  - **Mean depth**: 3.8 m
  - **Maximum depth**: 5.8 (14 in navigation channel)
  - **Catchment area**: 100458 km$^2$
  - **Secchi Depth**: 0.3-2.2 m


ORIGINAL RESEARCH ARTICLE

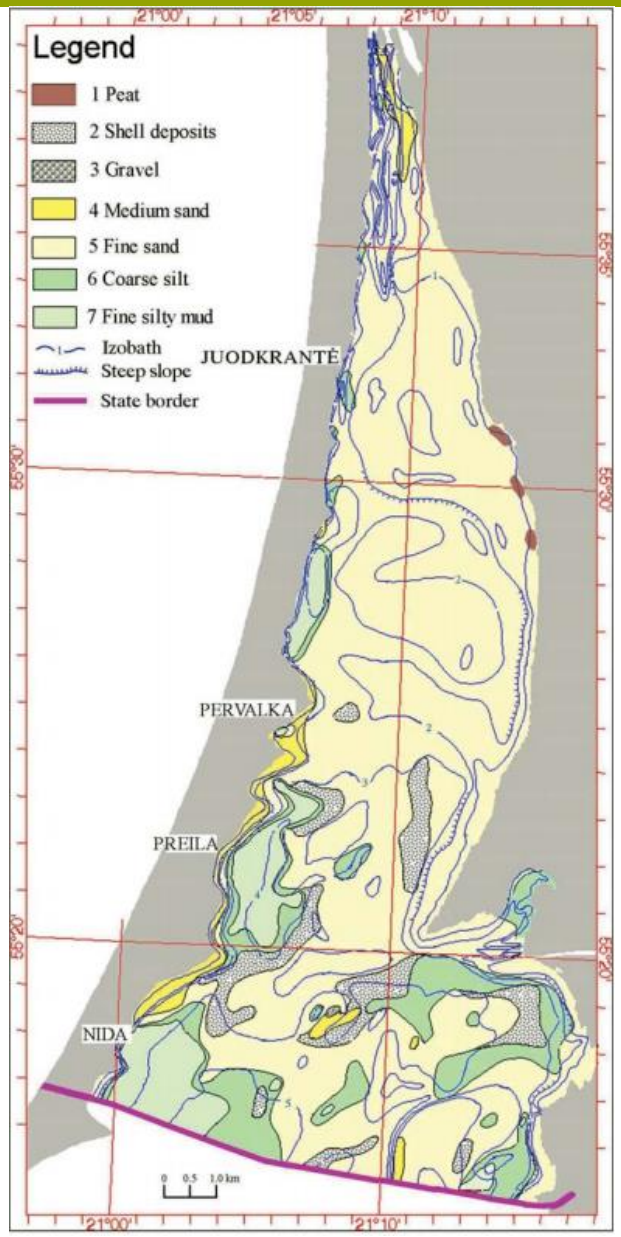
**Curonian Lagoon drainage basin modelling and assessment of climate change impact**☆

Natalja Čerkasova [a], Ali Ertürk [b,a], Petras Zemlys [a], Vitalij Denisov [c], Georg Umgiesser [d,a,*]

*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Environmental characteristics of the Curonian Lagoon***:
  - Sediment typology:
    - **Fine sand** predominantly
    - **Muddy** areas




**Baltica 16 (2003) 13-20**

**The Curonian Lagoon bottom sediments in the Lithuanian water area**

*Egidijus Trimonis, Saulius Gulbinskas, Modestas Kuzavinis*

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Environmental characteristics of the Curonian Lagoon***:

  - **Air temperature**: from -2.8 to 16.8 ˚C (monthly averages)
  - **Water temperature**: 0.1 – 19.3 ˚C(monthly averages)
    - Maximum 24-25 ˚C
  - **Residence time**: 81 days
  - **Ice covering**: 110 days per year in average

http://www.technologijos.lt/upload/image/n/technologijos/laivai/S-20947/13.jpg

*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Environmental characteristics of the Curonian Lagoon***:

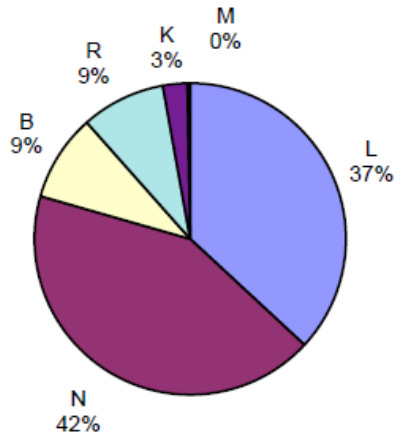
  - **Salinity:** 0-8 PSU
  - **pH**: 8.1-9.2
  - **Annual N input:** 33000 – 64000 t/yr.
  - **Annual P input**: 1200 – 4000 t/yr.
  - **Trophic level*:*** eutrophic

http://www.bonusprojects.org/files/4735/600/IMGP0492.JPG

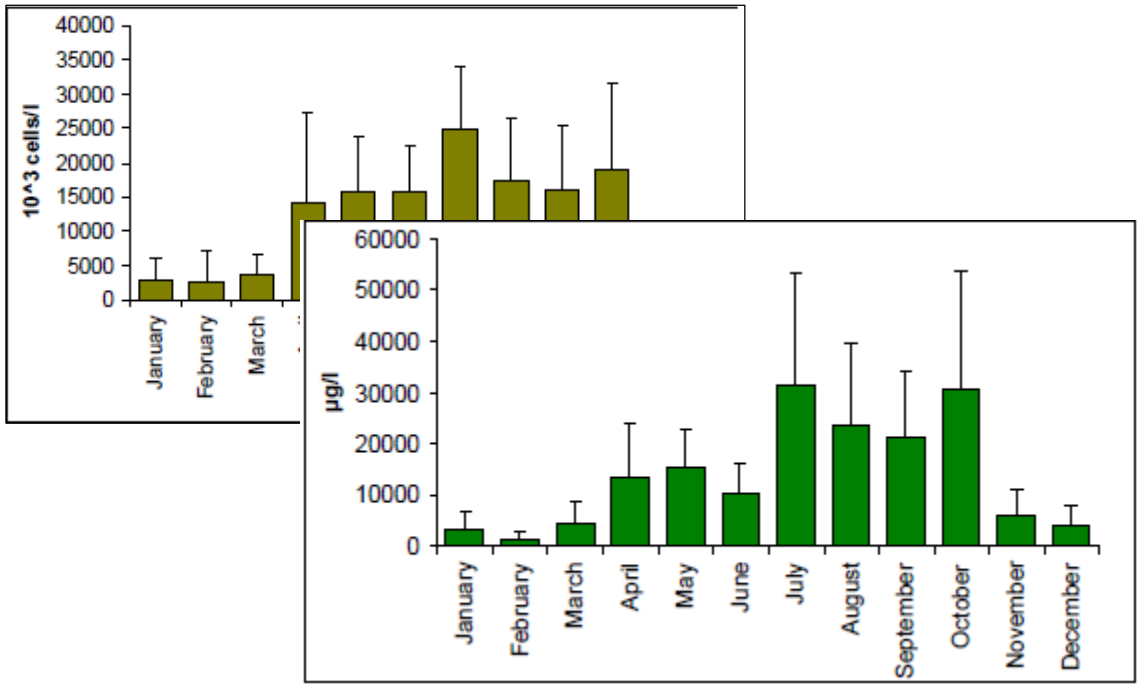
*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

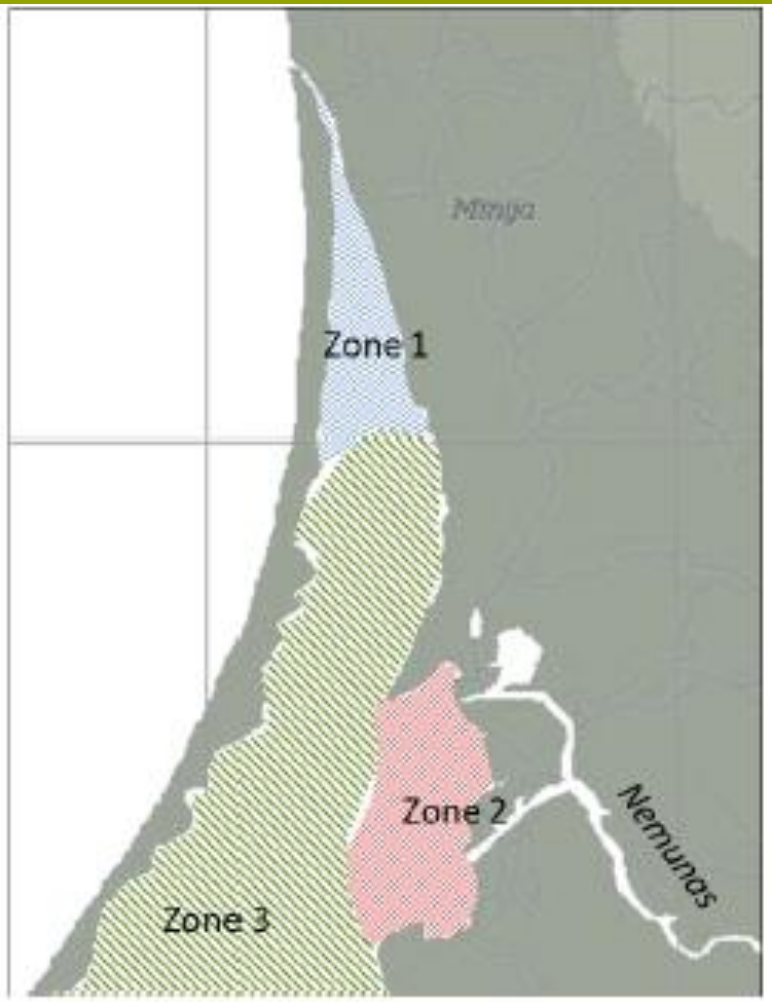
# The Curonian Lagoon Ecosystem and its Ecosystem Services

## ➢ Biological components: Phytoplankton




M - marine
R - marine-brackish
B - brackish
N - limnic-brackish
L - limnic
K - marine-brackish-limnic



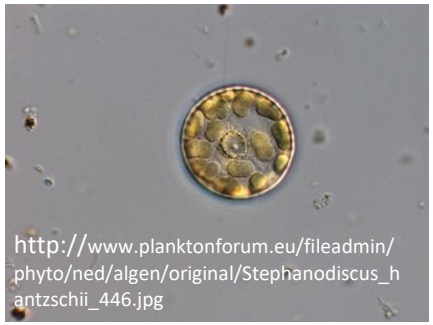

**SUBMARINER Report 2/2013:**

**Identification of algae species in the Curonian Lagoon**

Irina Olenina

# The Curonian Lagoon Ecosystem and its Ecosystem Services

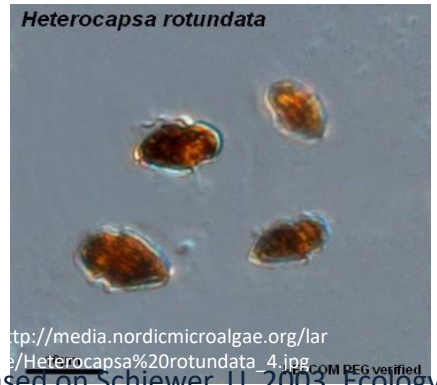
- **Biological components: Phytoplankton***
  - 526 species found in the lagoon
    - Freshwater species
      - dominant species: *Stephanodiscus hantzschii, Aphanizomenon flos-aquae, Microcystis aeruginosa*


http://www.planktonforum.eu/fileadmin/phyto/ned/algen/original/Stephanodiscus_hantzschii_446.jpg


http://www.maxx.my/images/afa/hand.png

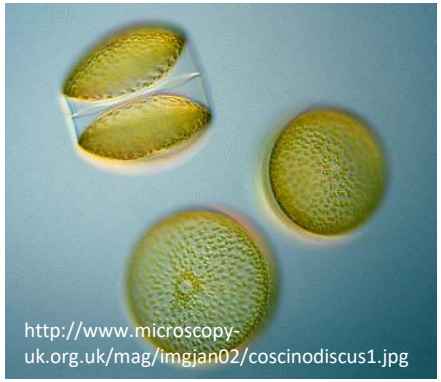

https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/Fig._3.jpg

    - Brackish-water species:
      - dominant species: *Heterocapsa rotundata, Skeletonema costatum, Coscinodiscus granii*



http://media.nordicmicroalgae.org/large/Heterocapsa%20rotundata_4.jpg

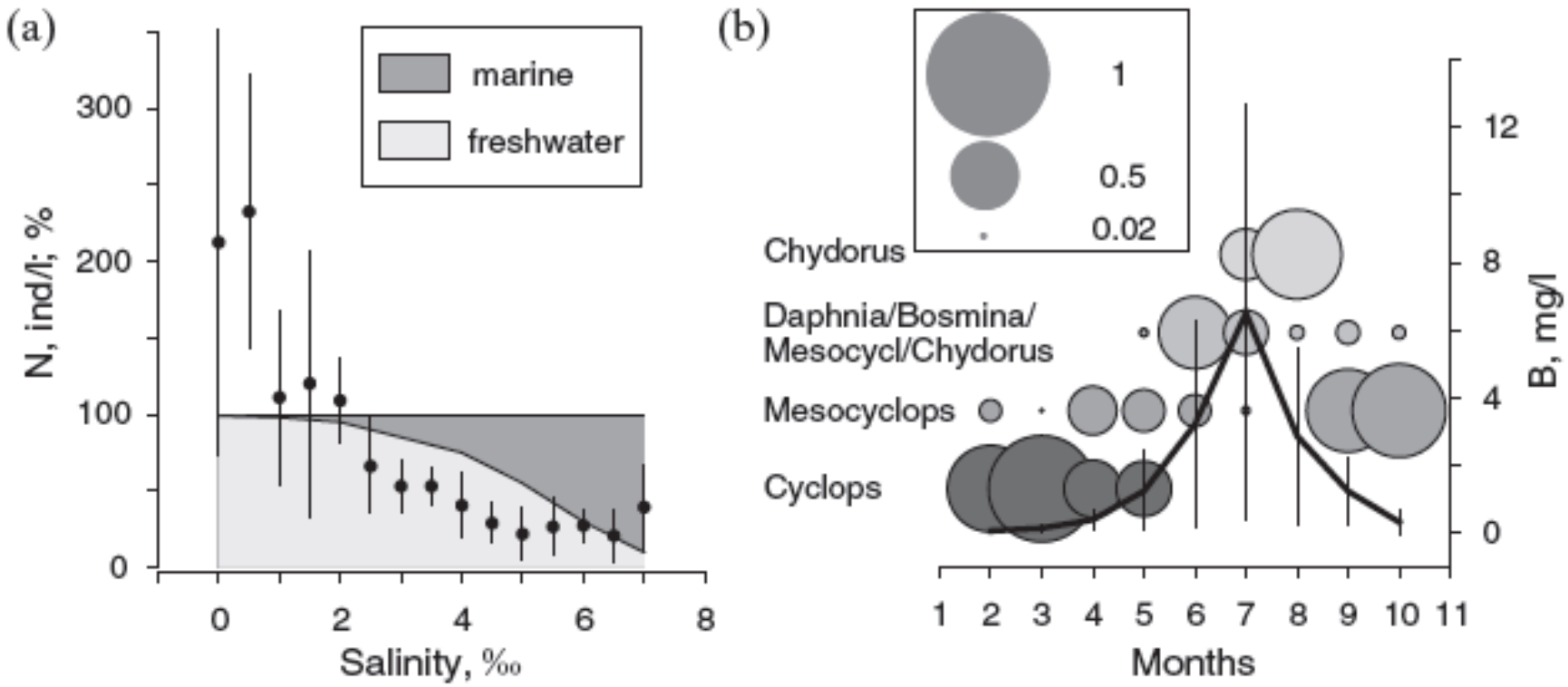

http://cfb.unh.edu/phycokey/Choices/Bacillariophyceae/Centric/Centric_Filaments/SKELETONEMA/Skeletonema_05_500x371_costatum.jpg


http://www.microscopy-uk.org.uk/mag/imgjan02/coscinodiscus1.jpg

*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

# The Curonian Lagoon Ecosystem and its Ecosystem Services

## ➢ Biological components: Zooplankton*

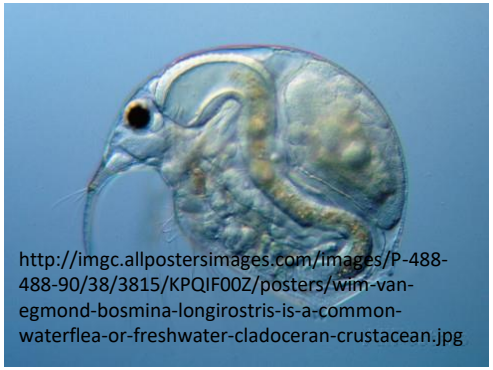



*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

# The Curonian Lagoon Ecosystem and its Ecosystem Services

## ➢ Biological components: Zooplankton*

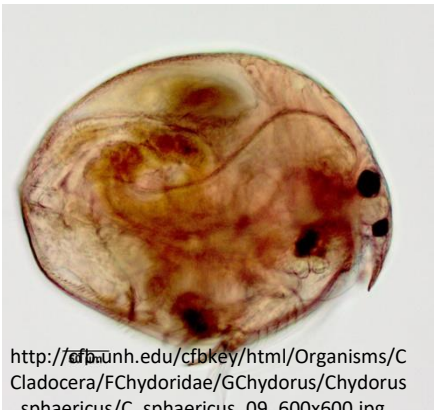
- Freshwater species
  - dominant species: *Bosmina* spp, *Daphnia* spp., *Cyclops strenuus*


http://imgc.allpostersimages.com/images/P-488-488-90/38/3815/KPQIF00Z/posters/wim-van-egmond-bosmina-longirostris-is-a-common-waterflea-or-freshwater-cladoceran-crustacean.jpg


http://www.ulrichhopp.de/bilder/kleinkrebse/Kleink_05_Cyclops_strenuus_005.jpg

- Brackish-water species:
  - dominant species: *Acartia bifilosa, Chydorus sphaericus, Cercopagis pengoi*


http://192.171.193.133/images/wb_1949.jpg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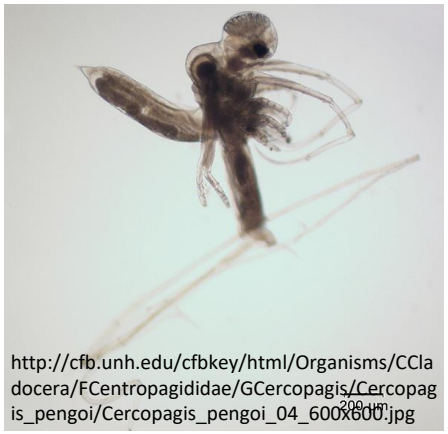

http://cfb.unh.edu/cfbkey/html/Organisms/CCladocera/FCentropagididae/GCercopagis/Cercopagis_pengoi/Cercopagis_pengoi_04_600x600.jpg

*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters. Chapter 9 – The Curonian Lagoon

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Biological components: Fish fauna***
  - 57 recorded fish species:,
    - resident species: roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), common bream (*Abramis brama), redeye (Scardinius erythropthalmus)*

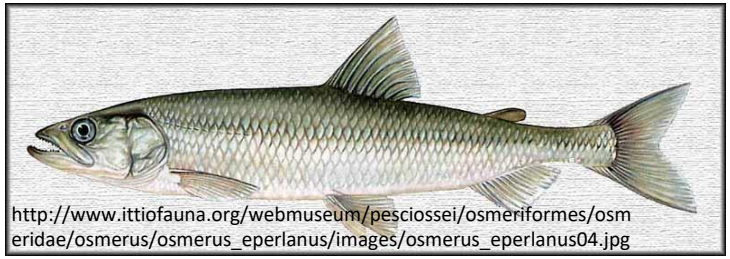


http://fishesofaustralia.net.au/images/image/PercaFluviatilisGSchmida.jpg


http://www.animalbase.uni-goettingen.de/animalbaseimage/Abramis-brama_02.JPG

    - migrating species: Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta trutta*), smelt (*Osmerus eperlanus*), eel (*Anguilla anguilla*)


http://www.animalbase.uni-goettingen.de/animalbaseimage/Salmo-salar_01.JPG


http://www.ittiofauna.org/webmuseum/pesciossei/osmeriformes/osmeridae/osmerus/osmerus_eperlanus/images/osmerus_eperlanus04.jpg


http://www.fao.org/fi/figis/culturespecies/data/assets/images/anguilla/Anguilla_anguilla.jpg

*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Biological components: Benthic communities***
  - **Macrophytes**
    - 18 submerged macrophytes species
    - dominant species: *Phragmites australis, Potamogeton perfoliatus, Potamogeton pectinatus*




*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Biological components: Benthic communities***
  - **Macrozoobenthos**
    - 85 species
    - dominant species: *Marenzelleria neglecta*, *Dreissena polymorpha, Pontogammarus robustoides*




*based on Schiewer, U. 2003. Ecology of Baltic Coastal Waters: Chapter 9 – The Curonian Lagoon

- **Biological components: Predators**
  - **Cormorants (*Phalacrocorax carbo sinensis*)**
    - Impact of fish fauna similar to fisheries

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- **Biological components: Predators**
  - **Cormorants (*Phalacrocorax carbo sinensis*)**

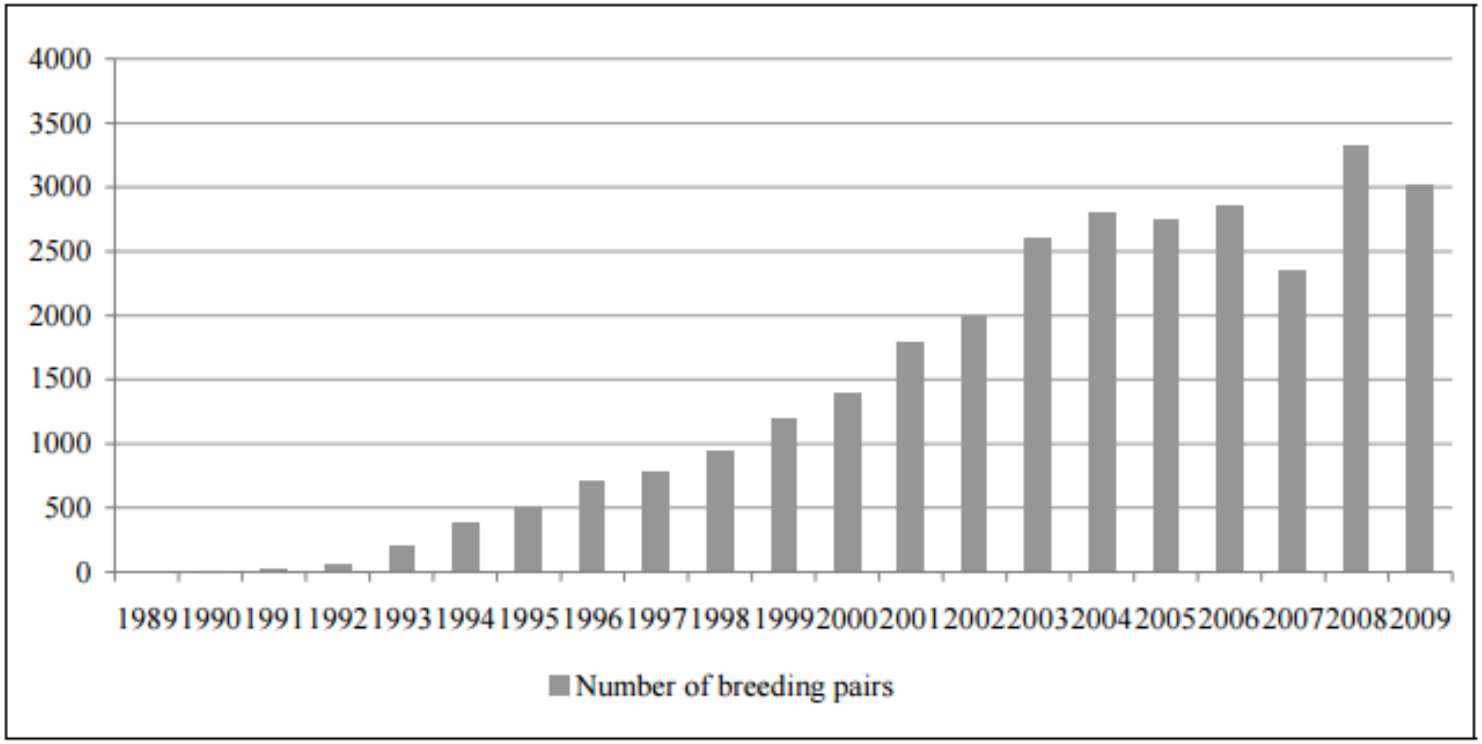



Figure 1. **The number of breeding pairs of great cormorants in Juodkrante colony** (western coast of the Curonian Lagoon, Lithuania) **in 1989 – 2009**

THE ROLE OF GREAT CORMORANT (*PHALACROCORAX CARBO SINENSIS*) FOR FISH STOCK AND DISPERSAL OF HELMINTHES PARASITES IN THE CURONIAN LAGOON AREA

Saulius Švažas[1,*], Natalia Chukalova[2], Gennady Grishanov[3], Žilvinas Pūtys[1], Aniolas Sruoga[4], Dalius Butkauskas[1], Liutauras Raudonikis[1], Petras Prakas[1]
[1]*Nature Research Centre, Akademijos str. 2, LT-08412 Vilnius, Lithuania*
[2]*Atlantic Research Institute of Marine Fisheries and Oceanography, D. Donskoy 5, Kaliningrad, 236 000 Russia*
[3]*I. Kant State University, Universitetskaya 2, Kaliningrad, 236 000 Russia*
[4]*Vytautas Magnus University, K. Donelaicio 58, LT-44248 Kaunas, Lithuania*

# The Curonian Lagoon Ecosystem and its Ecosystem Services

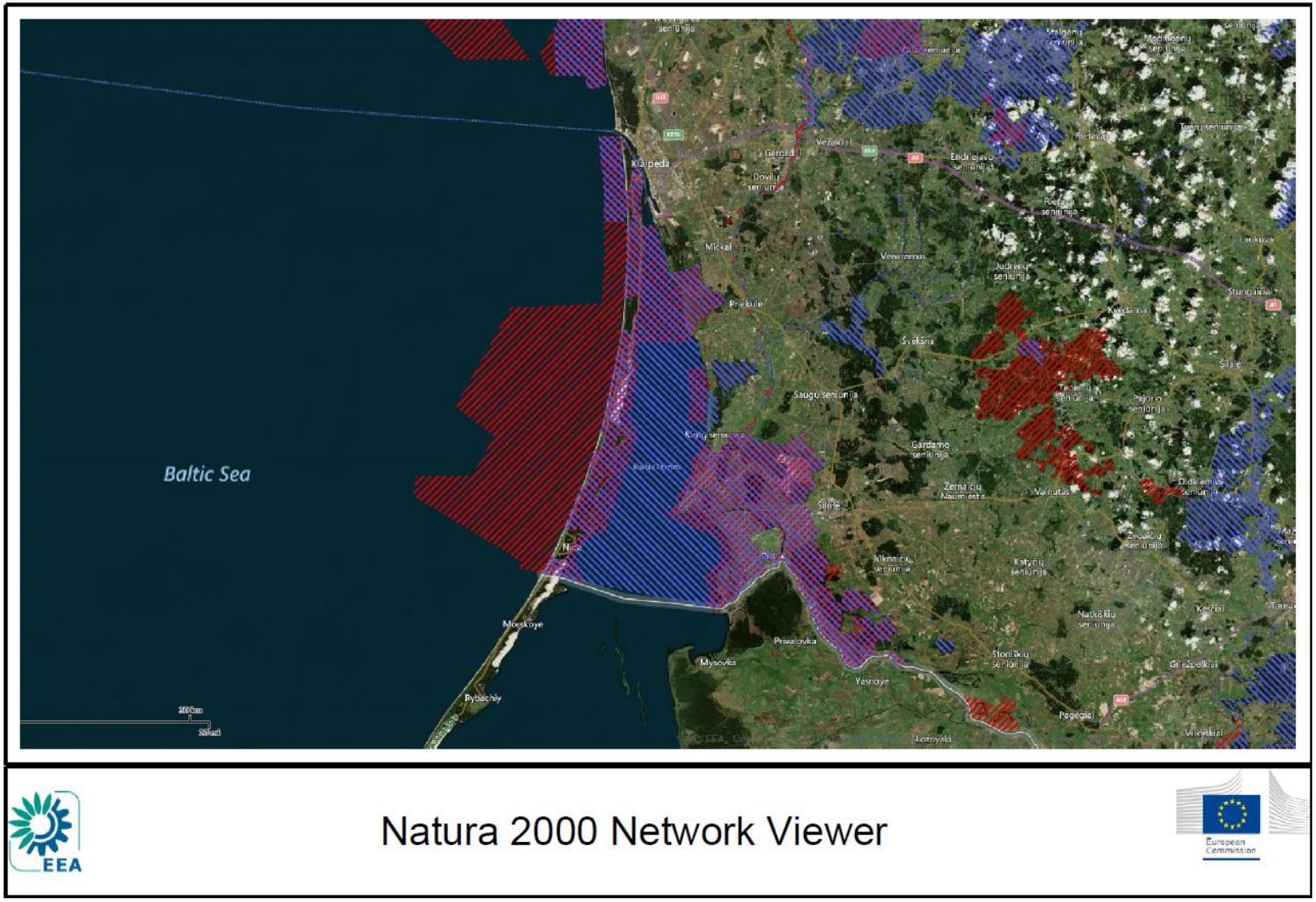
- **Biological components: Predators**
  - **Cormorants (*Phalacrocorax carbo sinensis*)**

https://media-cdn.tripadvisor.com/media/photo-s/08/85/ec/e3/herons-and-cormorants.jpg

https://media-cdn.tripadvisor.com/media/photo-s/05/04/89/65/herons-and-cormorants.jpg

# The Curonian Lagoon Ecosystem and its Ecosystem Services

## ➢ Protection Status of the Lagoon



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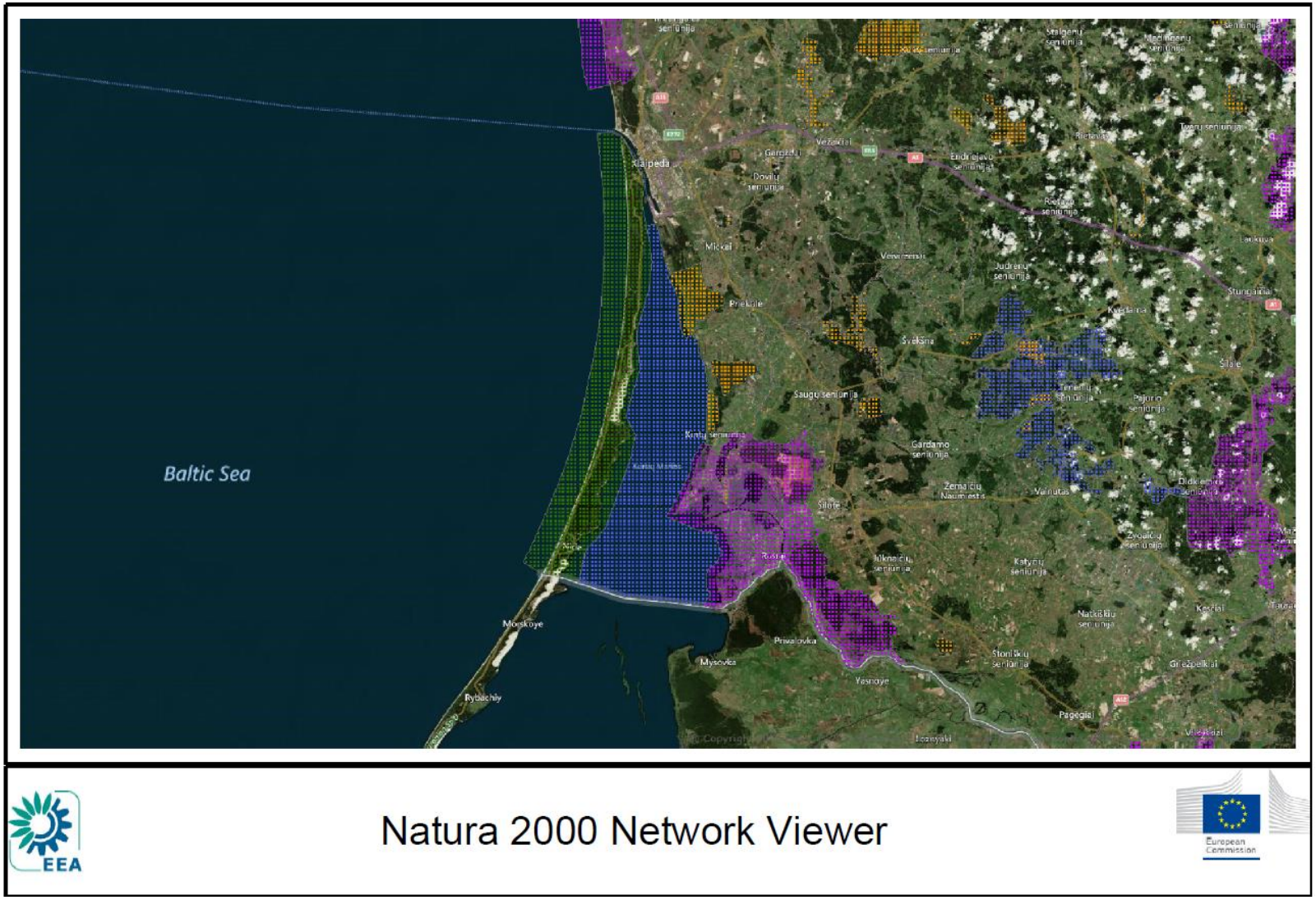


# The Curonian Lagoon Ecosystem and its Ecosystem Services

- The lagoon is important for **human development** because of the delivery of **ecosystem goods and services**


http://66.media.tumblr.com/5ef06b48efeb63a7ac1dd656ecfb5c19/tumblr_n5s6eyhlcF1rcoy9ro1_1280.jpg


http://4.bp.blogspot.com/-ArZIHUqDWIc/UUKX6IQZK9I/AAAAAAAAAuw0/Tn1FVUksLJE/s1600/Memel+Hafen+1930s.jpg


http://www.portofklaipeda.lt/uploads/prezentacija_port/Portalui_nuotrauka_8.jpg

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- The lagoon is important for **human development** because of the delivery of **ecosystem goods and services**

https://media-cdn.tripad
s/02/be/9d/c5/curonian-

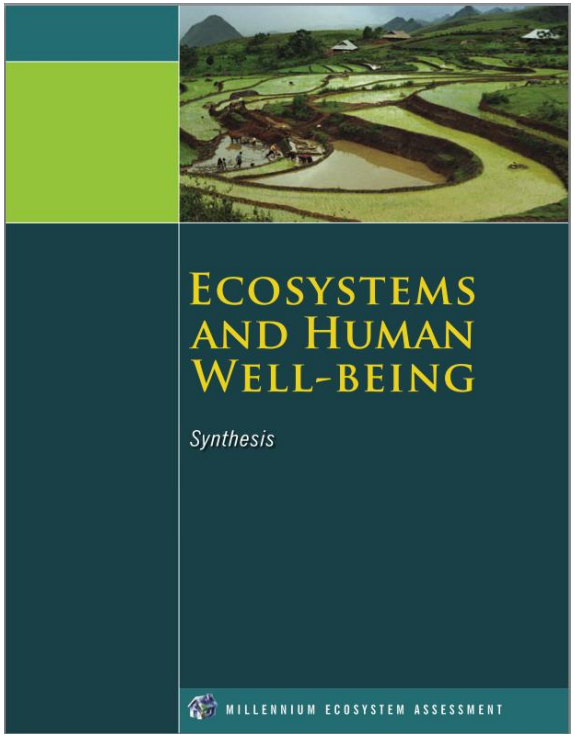
on///repair/repair

http://www.ve.lt/uploads/img/catalog/1/615/792/regatos-proga---mini-juros-svente2.jpg

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- Ecosystem services can be defined broadly as:

**“ the benefits people take from the environment”**




Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis.* Island Press, Washington, DC.

# The Curonian Lagoon Ecosystem and its Ecosystem Services

- According to Common International Classifications of Ecosystem Services (CICES), services can be divided into 3 groups:

**Provisioning Services**

**Regulating & Maintenance Services**

**Cultural Services**

**Common International Classification of Ecosystem Services (CICES): Consultation on Version 4, August-December 2012**

***Haines-Young, R. and Potschin, M. (2013):*** **Common International Classification of Ecosystem Services (CICES): Consultation on Version 4, August-December 2012.**
***EEA Framework Contract No*** EEA/IEA/09/003
(Download at www.cices.eu or www.nottingham.ac.uk/cem

Report to the European Environment Agency

*Revised January 2013*

# The Curonian Lagoon Ecosystem and its Ecosystem Services

## Provisioning Services of Curonian Lagoon (most common)

- Wild plants, algae and their outputs
- Wild animals and their outputs
- Animals from in situ aquaculture
- Plants and algae from in situ aquaculture
- Surface water for drinking purposes
- Fibers and other materials from plants, algae and animals for direct use or processing
- Materials from plants, algae and animals for agriculture
- Surface Water for non-drinking purposes
- Plant based resources
- Animal based resources

http://www.pervalka.com/image/repository/zvejyba_ziema.jpg

http://www.15min.lt/images/photos/616148/original/1234333384fbkv28840.jpg

# The Curonian Lagoon Ecosystem and its Ecosystem Services

## Regulating & Maintenance Services of Curonian Lagoon (most common)

- Filtration/sequestration/storage/accumulation by ecosystems
- Dilution by atmosphere, freshwater and marine ecosystems
- Mass stabilization and control of erosion rates
- Buffering and attenuation of mass flows
- Flood Protection
- Maintaining nursery populations and habitats
- Pest and Disease control
- Decomposition and fixing processes
- Chemical condition of salt waters
- Global climate regulation by reduction of greenhouse gas concentrations
- Micro and regional climate regulation

https://upload.wikimedia.org/wikipedia/commons/9/95/Pervalka_lighthouse1.JPG

http://www.corpi.ku.lt/databases/application/views/admin/static/images/uploads/aquanis/resources/9a1e91710a556d5618d326f6a6b1547f.JPG

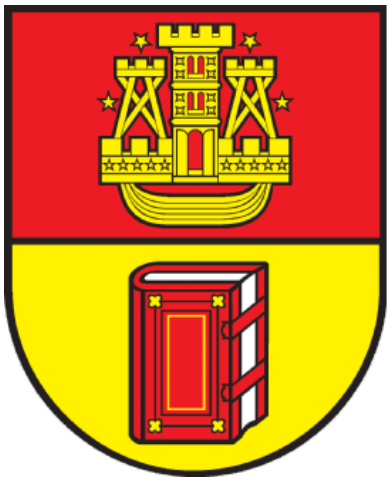
# The Curonian Lagoon Ecosystem and its Ecosystem Services

## Cultural Services of Curonian Lagoon (most common)

- Experiential use of plants, animals and land-/seascapes
- Physical use of land-/seascapes
- Scientific and Educational
- Heritage, cultural
- Entertainment
- Aesthetic
- Symbolic
- Sacred and/or religious
- Existence
- Bequest

http://www.klaipedosrajonas.lt/data/tourism_objects/large/Andre_Baldi_architecture_urbanism_picture_09.jpg


http://www.nerija.lt/Files/files/Kestutis%20Musteikis%20Lygiadienis(1).JPG



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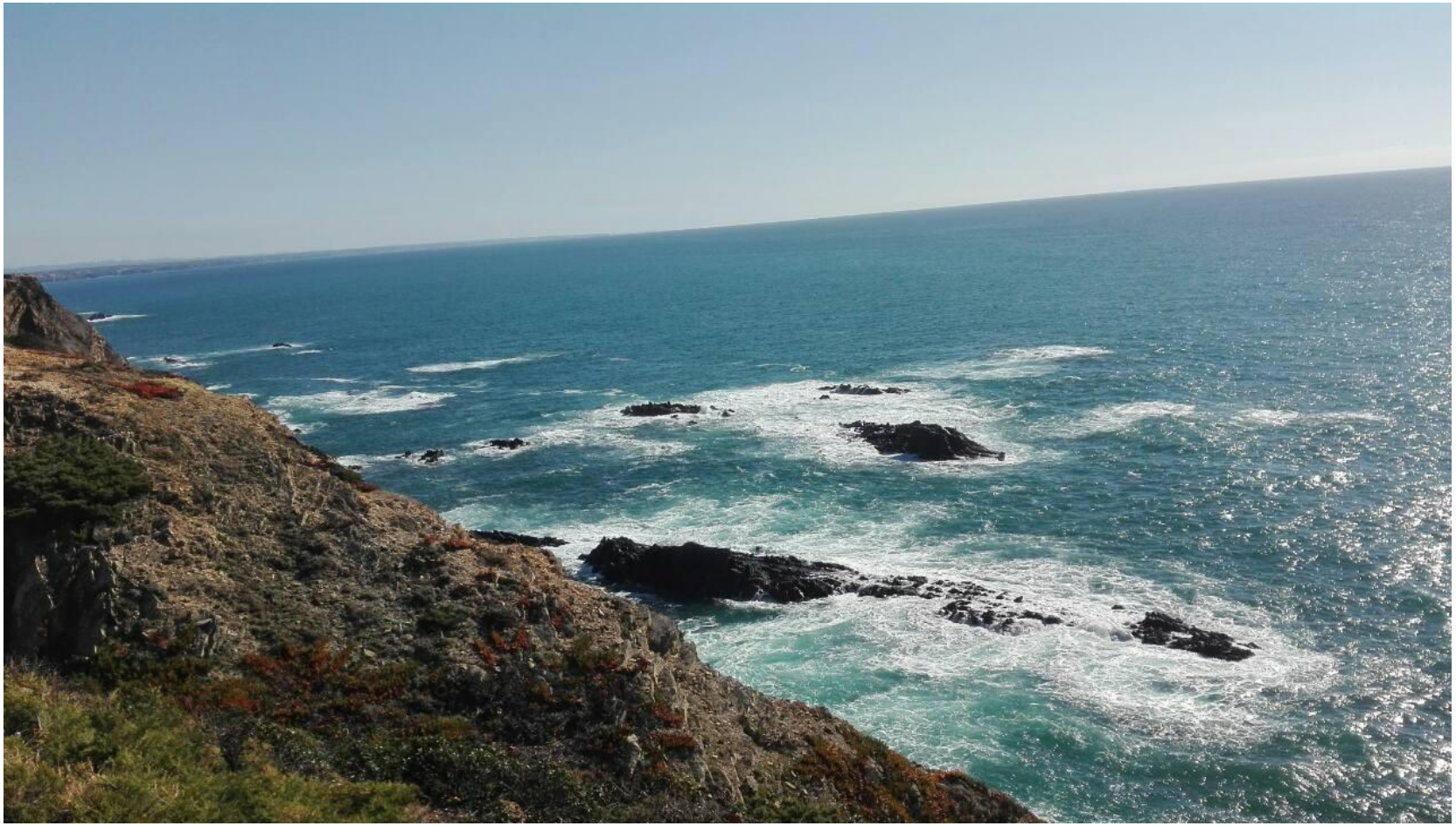

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SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION