TOPCONS SPBRC RAS

Report on Update of data collection and field observation approach for ecological monitoring, ecosafety and data collection for Marine Spatial planning in the Eastern Gulf of Finland: Integrative approach, Subarea 3 August-October 2012

<table>
<tr><td>Title: TOPCONS SPBRC RAS Report “Update of data collection and field observation approach for ecological monitoring, ecological safety and data collection for Marine Spatial planning in the Eastern Gulf of Finland: Integrative approach, Subarea 3 August-October (Integrative approach subarea 3_step 1.doc)</td><td colspan="3">TOPCONS activities: Activity 2. Data collation, collection and harmonization; Activity 3. Landscapes; Activity 4. Database of Human impacts, Sensitivity</td></tr>
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<tr><td>Draft Report</td><td>MO</td><td>LS</td><td>26.12.2012</td></tr>
<tr><td>Final Report</td><td>DR, LS, LZ, MO</td><td>MO</td><td>31.01.2013</td></tr>
<tr><td></td><td>Checked</td><td>Approved</td><td>Date</td></tr>
<tr><td colspan="4">Key words
Satellite super high resolution image, marine landscape, subaqual and aerial parts of coastal zone, water-land interface, sea uses, field work planning, data inventory, decoding, verification, geo- and biodiversity, coastal fishes, macrophytes, WP-2, 2st Reporting Period, TOPCONS project, ENPI program, Baltic Sea, Eastern Gulf of Finland, MSP (Marine Spatial Planning)</td></tr>
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SPBRC = Saint-Petersburg Research Center of the Russian Academy of Sciences
VSEGEI = A. P. Karpinsky Russian Geological Research Institute, St. Petersburg, Russia

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Summary

The report provides summary description of the first draft/ schematic layout for the combined use of remote sensing (RS) (spatial) and traditional sampling and measurement (point) methods. This combination, referred to as ***integrative approach***, is aimed at assessment of modern state of underwater and coastal landscapes. The description of the results from primary approbation of the approach, on the example of underwater biotopes in the Kurortny district of St-Petersburg is also presented in the PUBLICATION (see "MATERIALS" section in the Narrative reports).

This report (as well as a significant part of the Narrative report) deals mostly with introduction to selection of areas and variables. The report contains the annotated list of the most important variables for implementing the integrative approach (see separate file ***SPBRC sampling strategy_***2013 in "MATERIALS") aimed at assessment of living communities/ associations/ assemblages, habitats, as well as potential impacts from important anthropogenic loads and sources. It also includes the overview of the most important ecological threats (including sea uses) and natural driving forces of impact on (1) dynamics of underwater and coastal landscapes of the studied area; (2) distribution of key species and their associations. A number of principles for selection of areas and variables are considered.

1. Introduction

This report is (1) successive to the report "Inventory of Remote Sensing Data for Marine Shallow Water and Water-Land Interface Landscapes: Part 1, Subarea 3" (IRS_SPb:1_3_2012) presented in MATERIALS to the 1st RAS TOPCONS Narrative report and (2) complementary to the report "TOPCONS CRUISE REPORT 2: September-October 2012 Kurortny District Marine Landscapes (KurDML 2012) The RV Risk 25th September– 1st October 2012 (file TOPCONs Field Cruise 2_VSEGEI_SPBRC RAS.doc).

1.1. Objectives

This work contributes to the achievement of three main goals of TOPCONS Action Plan, Activity 2, through providing additional information, particularly important for the Russian part of TOPCONS model area, as well as for the project outputs addressed to final beneficiaries, including two Associated Partners.

The goals are:

(1) To collate existing datasets on biology, geology, hydrography and other environmental variables that affect the distribution of biological communities;

(2) To harmonize methodologies used by geologists and biologists in Finland and in Russia;

(3) To collect new biological, geological and hydrographical data to characterize the geological and biological diversity of the Eastern Gulf of Finland.

Within the WP 3 and 4 we expect to provide

(4) large-scale visual information for estimation of structure of landscapes and
(5) estimation of real extension of some human impacts upon them.

1.2. Outputs

The expected outputs:

(1) Routemap for Marine Spatial Planning (***thereafter MSP***) and territorial land planning
(2) Navigation in changeable areas, where precise navigation maps are absent (shallow water zones)
(3) Research and monitoring underlying MSP
(4) Ensuring of ecological safety
(5) Visual information for supporting EIA and making decisions.

Available outputs:

(1) Inventory of satellite images
(2) Assessment of advantages and plan (logical framework) for satellite images use (Figure 11)
(3) Collation of Remote Sensing (***RS***) information with Arthedian database

1.3. Place of this Report in the logical framework of the Project

Within the logical framework of the project, this report contributes to:
- collation and production of datasets
- combining nature values with human activities and stakeholder values.

Super high resolution remote sensing, as any method of a remote sensing is also:
(1) supportive instrument for planning of data collection and data interpretation;
(2) instrument that provides true (vs. visualization resulting from modeling or extrapolation resulting from sampling) general view of a given area (space), on the one hand, and possibility to successfully identify the most important elements of biotope (landscape), prior to the field observations and sampling;
(3) a source of information, which makes a direct input to the MSP process;
(4) a source of valuable visual information for the TOPCONS project and TOPCONS target groups on the present state and dynamics of landscapes, as well as on the distribution of point sources of human impacts.

The inclusion of the remote sensing data into the TOPCONS project for both Russian and Finnish sides was approved by the decisions of TOPCONS Workshop-1 in Helsinki, 14-15 November, 2012. This decision is substantiated by specificity and heterogeneity of the shallowest parts of the Project model areas (Figure 1 A), see also Section 2 herein.

2. Study area

2.1. Specificity of the area

Concerning the TOPCONS model sub-areas from the Russian side of the border, especially the Spb III (Figure 1), the *integrative approach* represents a supportive instrument for planning data collection and data interpretation, as well as an instrument for revealing spatial effects caused by large-scale activities, those transforming the entire, or significant part of the Gulf of Finland ecosystems (Figure 2).

The following features are characteristics for this subarea and require application of the integrative approach including spatial satellite data and methods:

- significant impact of catchment areas on marine underwater landscapes;
- mobile coastline;
- discrepancies in the real position of coastline and shallow water structures with existing navigational maps (potentially dangerous area for field work from vessel), due to natural and human-induced driving forces;
- extended shallow water zone with mobile sediments exposed for wave and wind actions, unavailable for geological remote sensing with use of acoustic methods on board of a research vessel (R/V);
- extended areas with aquatic vegetation, playing their role as fish reproduction habitats;
- water level oscillations and therefore an extended water-land interface;
- diverse land-based sources of human impacts and absence of systematized information on them;

A.

B

XXX – geobotanical sampling and observations; XXX – fish sampling and observations;

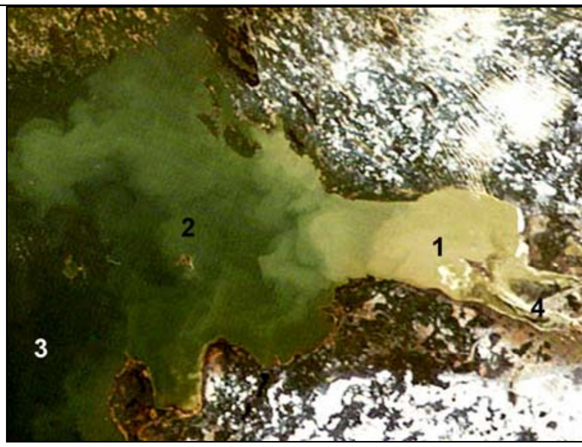
XXX – combined geobotanical and ichthyological works; XXX – stations sampled onboard of R/V ("Kaira" in Kurortny District and "Zaslon" in the Neva Bay).

- large-scale construction works and development activities on new territories that impact the significant part of the Subarea 3 and, partly, 1 and 2, with its coastal and underwater landscapes (Figure 2);
- developed landscape theory for terrestrial landscapes.

2.2. Sea uses of transnational importance in the Baltic Sea region (by VASAB)

- nature conservation. *Both Kurortny and Primorsky districts of St.Petersburg have existing protected areas and those being planned (proposed as compensation measures for losses caused by realisation of the "New Coast" project in the Kurortny District (Заключение…, 2011).* ***Here we also consider all current activities directed to prevention of undesirable accidents (e.g., oil spills) and proactive strategies, if such events occur;***
- fisheries;
- shipping, including fairways and seaport constructions. *Shipping and its infrastructure represents the complex and the most important sea use, which impacts all ecosystem components including coastal ecosystems (see* ***Additional reporting*** *and the file* ***markers_pollutants*** *for TBT compounds in* "MATERIALS"*); many key species are introduced into the area, directly or indirectly, through shipping, or due to its associated activities (See file* ***SPBRC sampling strategy_2013,*** "MATERIALS"*);*
- tourism, recreation boating and yachting *(see Figure. 3);*
- cables and pipelines;
- sand and gravel extraction – *extremely important, with view of planned large-scale development of new territories;*
- use of the coasts as dumping sites and, hence formation of specific technogenic landscapes;
- public hydrotechnical constructions (e.g. storm-surge barrier);
- local (*and in some cases, illegal*) hydrotechnical constructions that can impact abrasion/accumulation processes at the coasts (Figure 4)
- development of new territories and its consequences (Figures 2, 3);
- use of the area to discharge different wastes and sewage that leads to its heavy eutrophication and pollution (Figure 5, see also reporting on TBT and pharmaceuticals).

A. Landsat/TM image, date: 09.08.2007. Distribution ***of suspended matter of different origin*** in EGOF:
1 – highest concentrations of suspended matter (>300 mg/L);
2 – cyanobacteria "bloom";
3 – "reference" concentrations



B. Aqua/MODIS image, date: 24.11.2007. Distribution of suspended matter in EGOF.
1 – highest concentrations of suspended matters;
2 – lowest concentrations of suspended matter in the plume from dredging;
3 – "reference" concentrations;
4 – beginning of ice formation

Figure 2. Intensive and long-lasting large-scale dredging is a cause of changes in coastal underwater landscapes. Significant impact of dredging activity was registered in the Neva Bay and in the Eastern Gulf of Finland for the period of 2006-2007, during implementation of the large project "Morskoy Faced of SPb". According to satellite observations, during this period the area was heavily polluted by suspended matter with concentrations exceeding limits (as 10 mg/L) in 30 times (higher then 300 mg/L). The scale of dredging impacts can be estimated by means of satellite images A and B, received by MODIS and LANDSAT systems. The dispersion of suspended matter can be identified up to 150 km from its source.

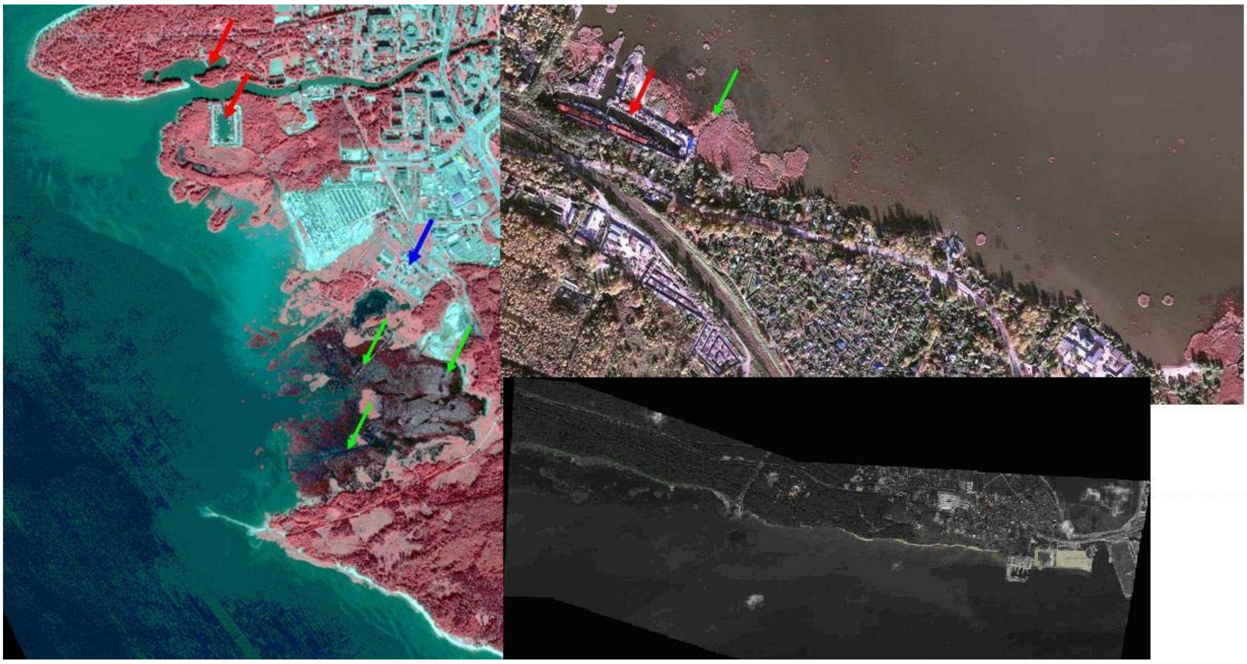
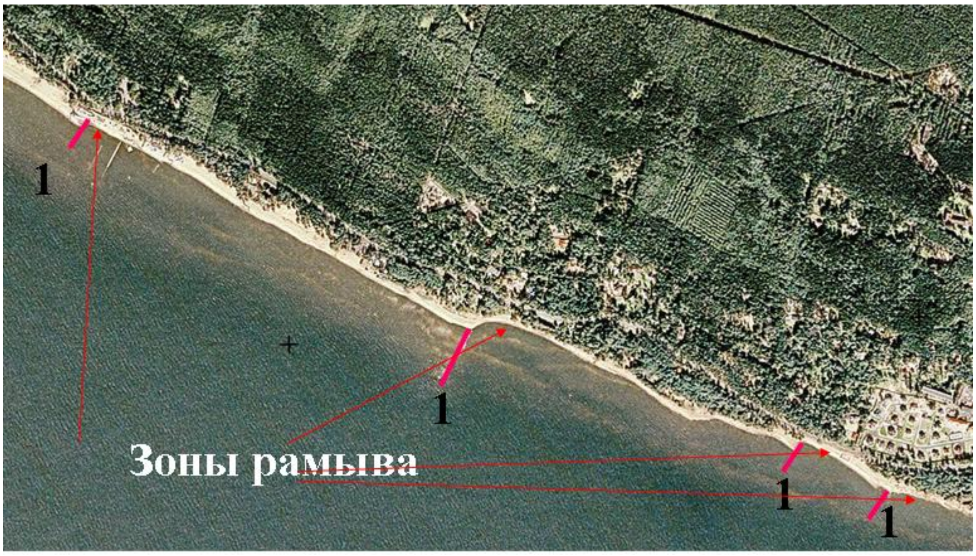


Figure 3. Three fragments of super high resolution satellite images (inventories described in IRS_SPb:1_3_2012.) There is the yacht harbour and poorly equipped recreation boating harbour

nearby Sestroretsk town, the yacht harbour on the south coast of the Neva Bay (red arrows). There is another yacht harbour on the north coast of the Neva Bay, close to artificial land aimed to build of Lakhta Center – both are close to protected areas “Yuntolovsky” and “Northern shore of the Neva Bay”. There are extensive macrophyte fields (semi-aquatic and submerged), those are important for fish reproduction but highly disturbed by pleasure boating (visible tracts, made by pleasure boating traffic) between capes Tarcala and Dubovskoy; disturbed macrophyte beds are also decoded for the south shore of the Neva Bay (green arrows). There are also purification plants on the coast. One is indicated as blue arrow – these are potential sources for eutrophication and pollution by pharmaceutical compound.

2.3. Selection of polygons for approbation of the approach

For testing the possibilities of modern spatial (RS) methods application, three areas were selected, where the overall diversity of underwater and coastal biotopes is well represented, along with the above mentioned sea uses. For these, 3 fragments of super high resolution images (Figure 6 and Report for the first RP, file ***IRS_SPb:1_3_2012***) were ordered and decoded. Field verification of selected fragments was performed, as well (see ***IRS_SPb:1_3_2012).***



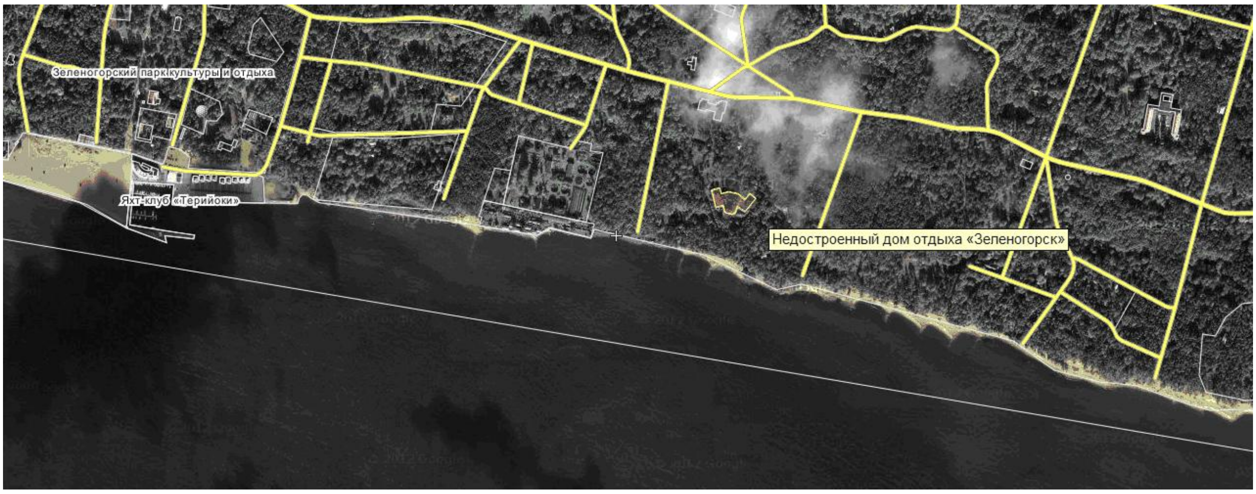
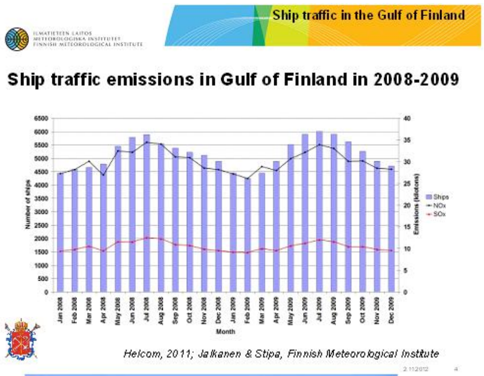
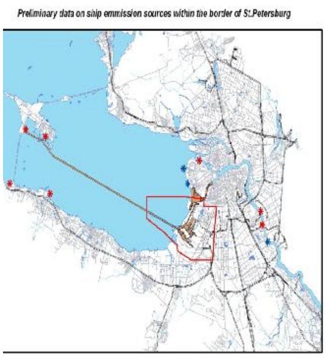


Figure 4. The uses of the coastal zone of the Kurortny district, revealed through reconnaissance surveys, photorecording and satellite data. Upper group of the photograph: resulting from a conflict between building and natural geologic processes (the vicinity of Primorskoye road), caused by insufficient knowledge about structure and dynamics of the coasts (photos are provided by VSEGEI); middle satellite image shows local hydrotechnical constructions (groins), those are created without taking into account coastal processes of erosion, transition and accumulation (also provided by VSEGEI for the TOPCONS project archive). The lower map, combined with overview satellite image show the large scale of groins distribution.





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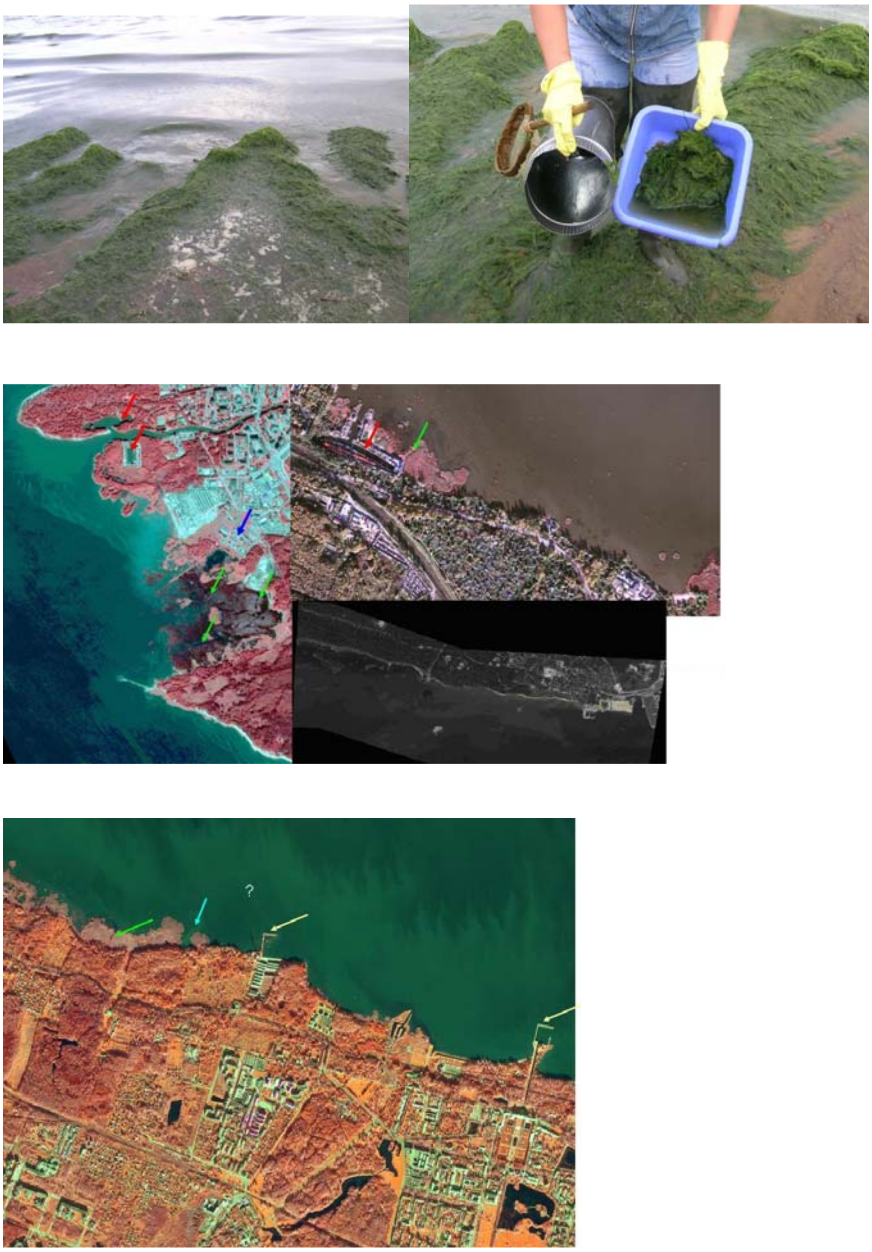


Figure 6. Fragments of satellite images used for approbation the integrative approach in 2012 and aimed to decoding and field verification completing in 2013.

2.4. Selection of polygons for coastal fishes observations

The stations sampled for coastal fishes are shown in Figure 1. The detailed report on the results of sampling is provided by Anton Uspensky (see file ***Uspensky_results of ichthyological observations*** .doc)

In selection of localities, the following considerations were taken into account:
- representativeness of the locality: native, typical for certain area, or alternatively, exposed to human impacts and anthropogenically transformed;
- possibility to combine sampling with field verification using previously ordered and decoded fragments of satellite images;
- accessibility by car;
- availability of permissions for ichthyological research;
- importance of the selected area for maintaining fish resources, nature protection, recreation, and aesthetic value.

A total of 6 basic localities were selected according to the above stated principles. An additional locality (Al-3) was included, accounting for the controversy of existing data on fishes and yet undefined significant impact of natural factors on variability of distribution and abundance of fish populations in shallow water areas of the Gulf of Finland. This locality was used for observations of diurnal cycle of coastal fishes (species diversity, abundance, and biomass), with special reference to invasive species (Tables 1 and 2 in Annex 1 to this report).

3. Specificity of integrative methodical approach

3.1. Introduction

Upon the above described situation and objectives, this section provides the initial outline of approaches, with view of updating traditional field observations by combining remote/spatial and “contact”/ “point” methods and data (Figure 7.). This outline is considered as a first step to preparation of the field guide for mapping biotic components of natural complexes (biotopes, landscapes, and ecosystems) and various sources of human impact, and, ultimately, to develop an integral express assessment of the modern state and dynamics of natural complexes combining natural values and human impacts. This assessment is expected to be based on the set of variables, those (1) describe different characteristics of the current the state of target objects (biotic and abiotic) and (2) their responses to various impacts (including seas uses), provide (3) topographic background for assessment of composition and distribution of a given biotope (landscape).

Thus it should enable to:
- fill in gaps in knowledge about ecosystem structure at micro-, mezo- and large scale, as well as about its functioning;

- promptly receive the information sufficient for planning various nature uses;
- clarify and extrapolate the available data for their use in preparation of project documentation (EIA).

3.2. General principles for methodical approach selection

The proposed partial methods are conditionally divided into (1) spatial, or RS, and (2) contact, or point methods (Figure 7). Spatial methods are aimed to obtain visual characteristics of an area (landscape, natural complex, etc.), such as position/ localization/ extension of a given object, or process, relatively to the other objects or processes. Contact methods involve sampling and measurement methods allowing for detailed investigations of a small part of an object. Some of these methods are exhaustive, since the withdrawn part (sample) is never integrated back into the system. The contact methods represent necessary counterpart of any observation, as they provide direct information about properties of an object, such as inner structure, which serves as a background for understanding its functioning.

The approach, which combines both spatial and contact methods allows:

(1) to select the most representative localities within a given area for sampling and measurements;

(2) to avoid occasional and uncertain sampling and following ineligible expenses;

(3) to decrease a number of samples (to 1 and 2) and therefore reduce the exhaustive effect of undertaken research/observation,

(4) to accelerate ("express"!) receiving of required information,

(5) to interpret and extrapolate point data onto a space (area) under observation, or under proposed transformation resulted from nature use.

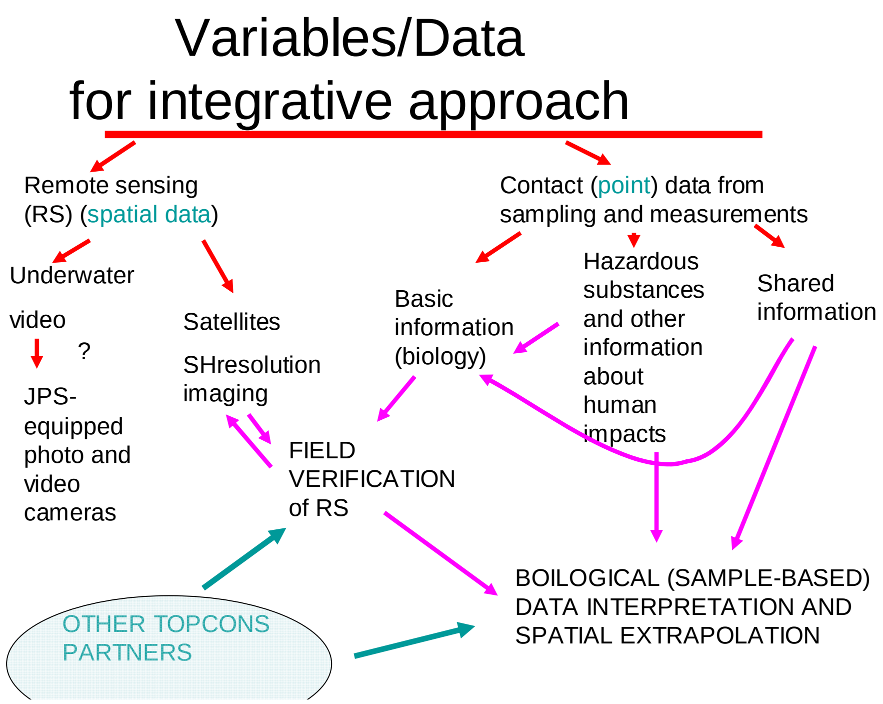


Figure 7. Spatial and contact data and their interactions within integrative approach.

3.3. Overview of the set of variables and partial methods for integrative approach to natural observations

The detailed list of variables is provided in the separate file ***(SPBRC Sampling strategy_2013***). The list consists of three sections.

Section A contains information about variables collected and analysed with contact methods. The description of this section of the list is not included in this report.

Section B. This section lists information on the requirements for photo- and videorecording, also combined with GPS navigation. This group of methods is extremely important for reconnaissance surveys preceding field verification of decoded super high resolution images and the field verification itself. Certain advantages and limitations for underwater videorecording in the project area have already been discussed in the 1st Reporting period (file VybML***_2012***).

Section C. This section lists spatial variables used for creation of topographic background and further mapping of communities/species, human impacts, and other variables distribution and their spatial variation. These are acoustic and satellite data to be used in the further TOPCONS observations and assessments in 20013-2014.

3.4. Specificity of partial methods

We exclude the description of partial methods from this interim report. However, it should be emphasised that the approach suggests that all sampling and measurements (section A, A.1. – A.5.), with the exception of vascular plants, should be carried out simultaneously, at the same time and at the same place (locality, station), and should be accompanied with photo- and videorecording whenever possible. Archived satellite images for spatial extrapolations are to be picked up to the dates, the closest as possible to the sampling date.

4. General characteristics of materials collected with contact methods are provided in the Table 2, Annex 1. The characteristics listed in the column 5 of this table are the same as in the List of selected variables (Section 3.3.).

5. Resources for remote sensing available for use in the TOPCONS project

5.1. What we use: Artificial satellites are aimed for: military use; research, meteorology, navigation, telecommunication satellites and satellites for imaging of natural resources. ***The latter type is available for the use in the TOPCONS project as no permissions are required.*** We use both ordered inventories (Figure 6) and free archives available from Internet. We use spectral and panchromatic canal for inventories processing and thematic decoding. The satellite composite images from different spectral canals are demonstrated in Figure 8. This figure represents the example of multispectral very high resolution satellite data (0.5 - 2m) from World View-2 (A, B) and Quick Bird (C). On the basis of such data we can compose thematic maps scaled up to 1:2000. Using special software (based on algorithm for multichannel and panchromatic data fusion) we can obtain the color image with spatial resolution 0.5m.

Advantages of super high resolution images in assessment of landscape structure are demonstrated in Annex 2.

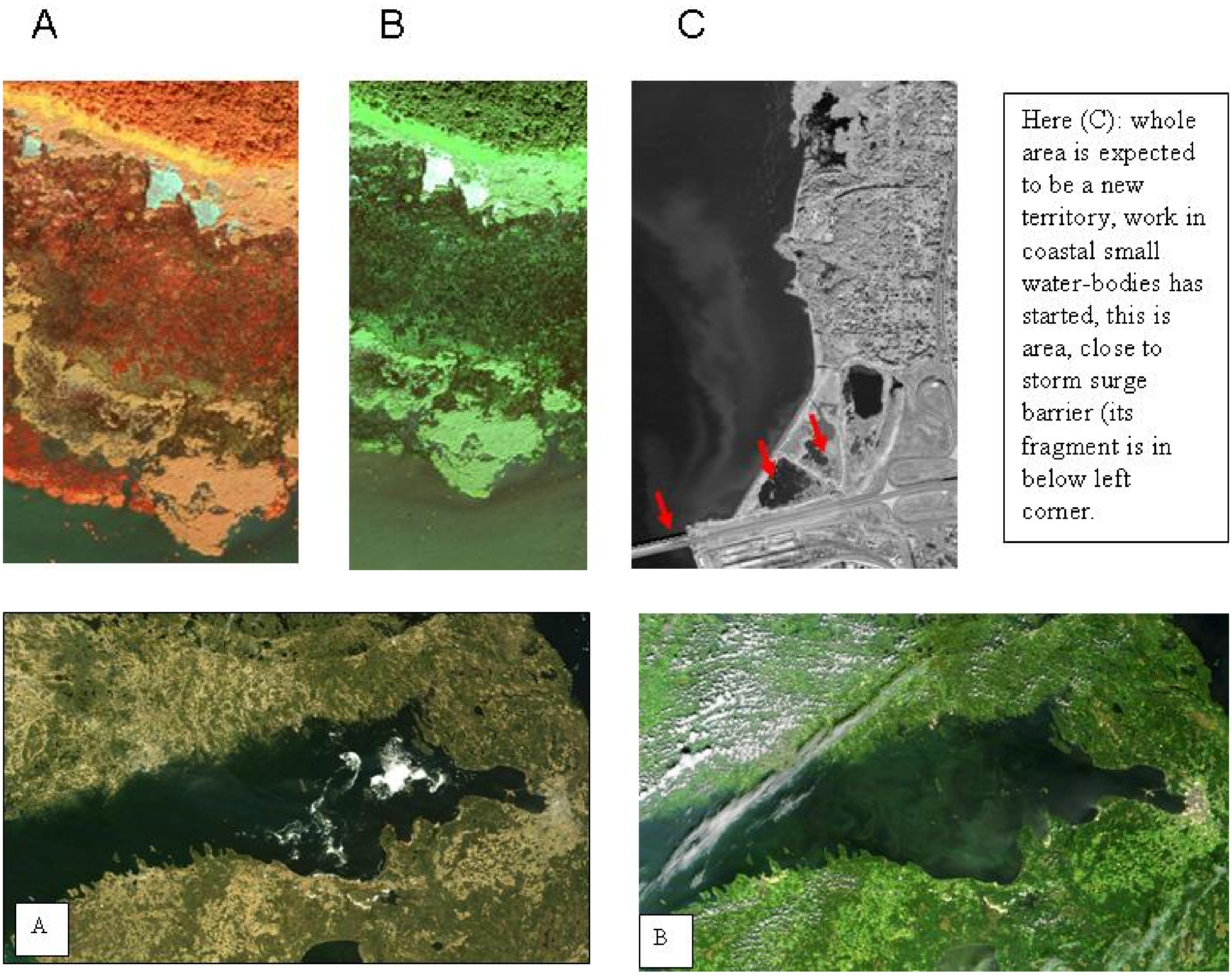


Figure 8. Variety of satellite data expected to be used for TOPCONS project and afterward.
Upper row: two type of spectral treatment of satellite image fragments for the portion of nature reserve landscape, that covers both land and water: A – composite satellite RGB image (spectral canals 421), B – composite satellite RGB image (canals 321). Such treatments are used for better decoding of plant associations. Panchromatic treatment (C) is also helpful for topographical needs and estimation of dynamic aspect. Also for study the environment change (including ecological aspects) under influence of natural and anthropogenic factors.

Below row: Temporal elements of marine landscapes in the eastern Gulf of Finland. Use of RS overviews for further landscape data interpretation and revealing of natural driving factors scale. **A**-MODIS, 8 May 2011 (terra, 250m), ice; B - MODIS, 2 June 2011 (terra, 250m), algal bloom.

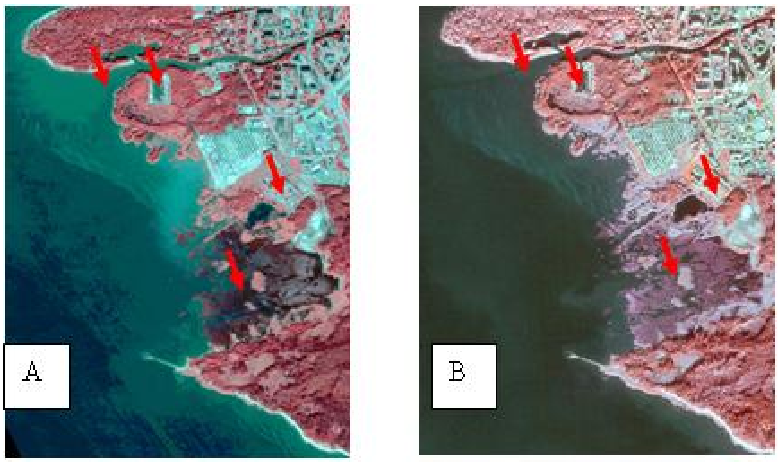
5.2. Specificity of images selected during inventory and ordering is determined by specificity of the areas described above (spatial aspect), as well as by dynamic aspects – variability of the majority of the important landscape elements over time and increase (decrease) of anthropogenic loads.

Spatial Aspect

According to this specificity, the selected images cover both terrestrial and aquatic coastal landscapes, where natural (aquatic and land vegetation, underwater geological structures, etc.) and technogenic (recreation boating harbors, purification stations (Figure 9), storm surge constructions (Figure 8C), etc.) elements are represented for the purposes of database creation, mapping, and verification of spatial tools.

The majority of selected images represent the Land and the Sea in approximately equal degree; we attempted to select the images covering 1.5 km of terrestrial (Land) and 1.5 km of aquatic (Sea) territory (Figure 6). Most images selected from the inventory and ordered refer to the areas of intensive and often conflicting sea and adjacent land uses (Figure 8C – start of development new territories in Kurortny District, SPb).

Spatio-Temporal aspect addressed to revealing structure and dynamic the landscapes can also be estimated by data RS data available from our inventory. The examples of the overview images (Figure 2, below row) for the whole project area are presented, as well as seasonal (Figure 9) and inter-annual (Figure 10) data.



This area posses diverse terrestrial and aquatic plant vegetation, it is nesting area for birds and spawning (to be resolved during TOPCONS) area for fishes, diverse underwater landscapes (estuary of the Sestra River, that connects relict Bay of the Sea (now the Lake Sestroretsky rasliv) and form specific bottom structures. Land here is diffuse source for eutropfication, it is densy populated area, area of recreation (pleasure boating, fishing, etc.)

Figure 9. Composite RGB images of the Tarkhovskaya Bay (channels 421). Anthropogenic elements of landscapes (purification station, recreation boating harbors, etc.) and temporal dynamic: A – Aug 2009, B- Aug 2011.

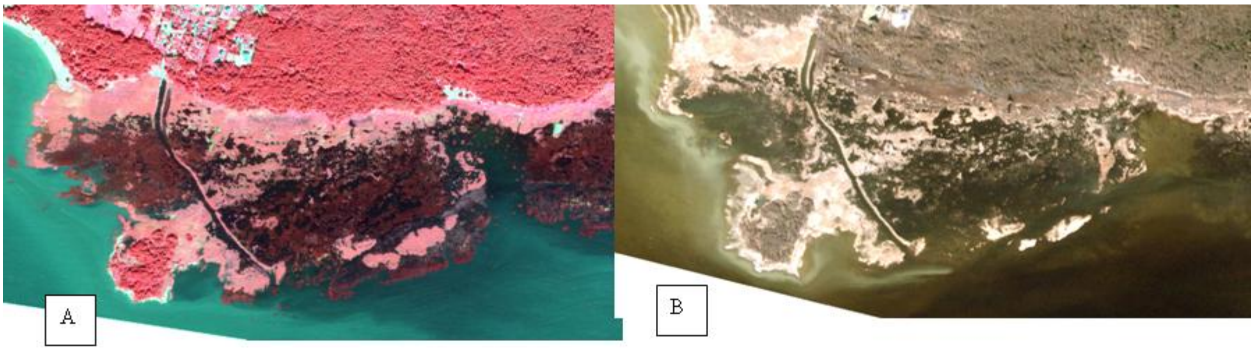


Figure 10. Composite RGB fragments of World View-2 satellite images – the same place for different seasons. Area nearby Verperluda Island (protected area “Severny bereg of the Neva Bay”): A) - in August 2005 (channels 421) and B) -overwinter, in April 2006 (channels 321).

5.3. Current use of microsatellite images in the project and the expected outputs

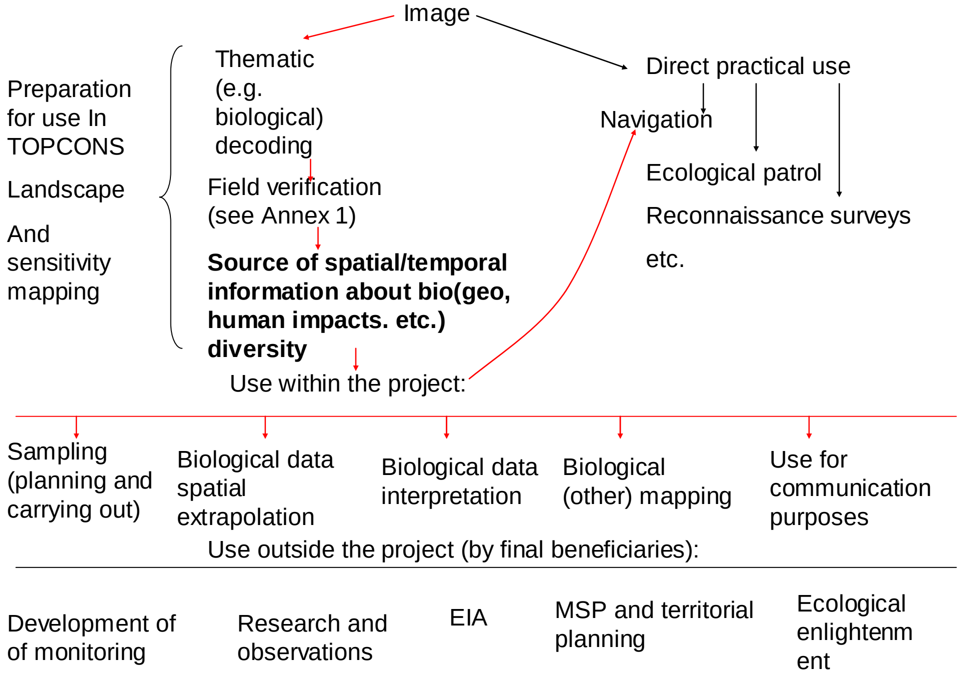


Figure 11. Scheme describing the algorithms of use of satellite images (general approach)

6. Further prospects for use of GPS and spatial technologies in biological sampling, monitoring and biotechnologies

Combining of geographical positioning, photo and video recording (documenting) and remote (satellite) sensing is considered as perspective for further developing of integrative approach.

Several previous attempts to apply underwater video in conditions of the Eastern Gulf of Finland (prior to 2011) have failed. The failure was caused by technical reasons, due to outdated equipment, and high water turbidity, as those observations were conducted in summer. Development of photo- and video equipment and the use of underwater robots (see report VybML 2012) made the latest attempts successful (see also photos taken in the Neva Bay in 2011 by VSEGEI, Figure 12 A).

Compilation of photo archives and field verification of decoded satellite images need precise geographical positioning. In 2012 we used photo camera (CANON PowerShot SX230 HS) with build-in GPS navigator and supplied with the box for underwater photo- and videorecording (WP-DC42), as well as software for aligning photo- and video files (jpeg and mp3) with geographical coordinates in GIS environment (the most suitable for this purpose is Google Map platform free software, see Figure 12B).

In the future, the more advanced software for aligning photos with linked co-ordinates to topographical basis, as well as an option to saving routes indicated on maps is desirable, and the search for such software has been initiated by the Volunteer (see file ***Sychev_review on GIS software for spatial data management and spatial planning*** .doc in “MATERIALS”).

We also expect extended options to appear for geographical positioning, in terms of their application for positioning of quantitative data from collected biological samples, as valuable logistic update for field observations and preparation of EIA documentation with GPS-monitoring.

GPS-monitoring has already been applied in private companies and among single owners and drivers of private cars (Figure 13). The everyday GPS-monitoring helps them to control land, sea and aerial cargo transportation. In our opinion, this intellectual technology applied for moving targets is fully applicable for creation of integrated system of observations under ecological safety of hydrotechnical constructions, aquatic areas, specific elements of landscapes, and for other useful options for research and monitoring. The experience of the use of GPS-monitoring in shipping and at its market services are expected to be studied in 2013.

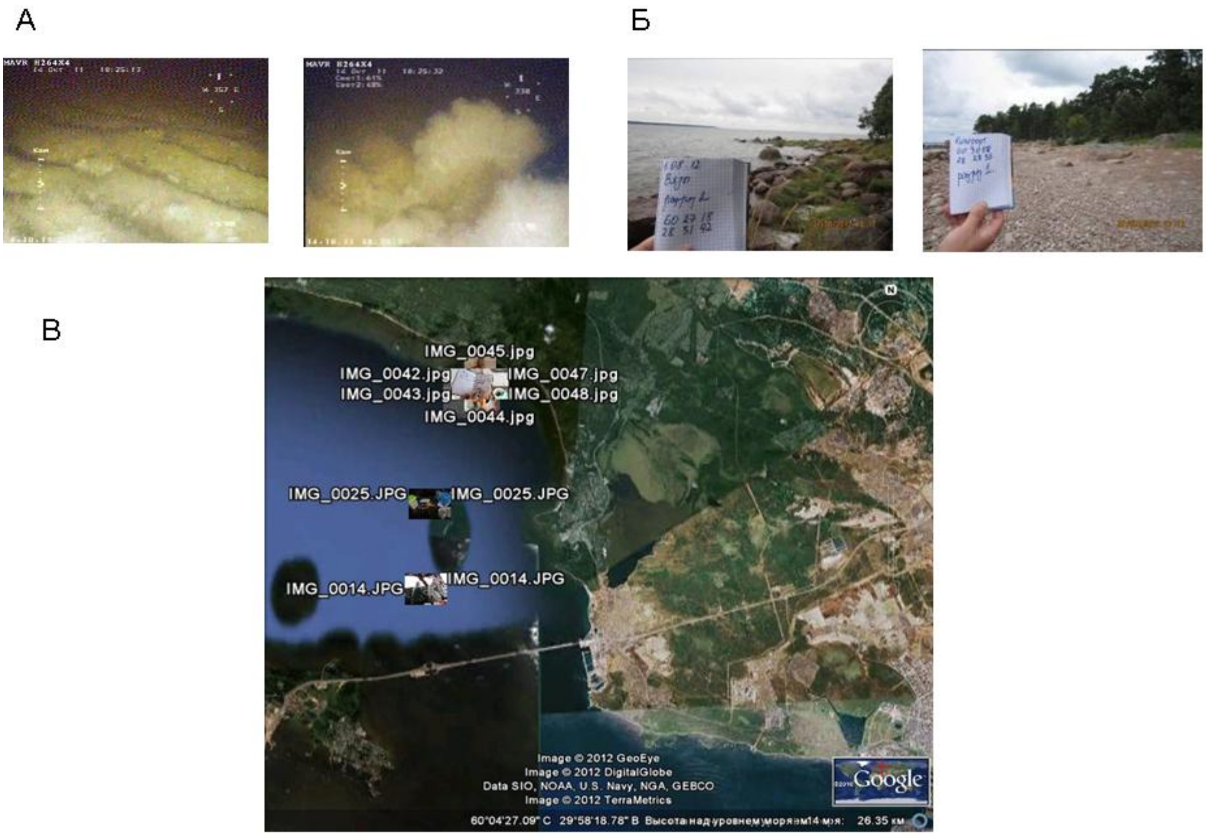


Figure 12. Use of photo and video equipment for underwater research of intact and disturbed biotopes and in reconnaissance coastal surveys.: A- first underwater photos made in October 2011, on the left – intact benthic biotope opposite the i. Verperluda (protected area "North shore of the Neva Bay), on the right – the dumping area, created in в 2006 г., close to the protected; Б- example of recording of hydrobiological locality for sampling; В – output from use of photo camera with GPS navigator built it in GIS environment provided by Google Map.

Figure 13. GPS-monitoring in optimization of automobile traffic. Major output of GPS-monitoring complete information about route and work of systems allow to completely control the process of transportation and analyse the history of each traffic event.

7. CONCLUSIONS

Analyses of EIA documentation, attempts to extrapolate of sampling data onto areas – all show that there is an evident need in spatial express methods that prove quick and reliable assessment for the state and dynamics of major components of natural landscapes in the coastal zone of the EGOF. One of the directions for such improvement of current monitoring and observation systems is introduction of RS methods and products into the everyday practice of research observations and monitoring. This is specifically important for the areas and biotopes, which are inaccessible for direct investigations.

Due to development of telecommunications, satellite and other informational technologies, as well as due to increased accessibility and cheapening of equipment, free access to some information sources and software, the development and approbation of integrative approaches based on new technologies and traditional methods become possible. These approaches are extremely well timed for mapping and collection of inter-disciplinary information aimed for development of logistic and knowledge background for MSP in the EGOF. Combination of spatial and contact methods should form the basis for such an approach.

The results of works in 2012 make the background for further development of the general protocol and procedures for integrative approach to observations within the TOPCONS project and after its completion. This report informs about the principles for selection of areas and variables for integrative observations, provides information about available “spatial” resources, and suggests the use of potentially effective new technologies. This report also offers the primary protocol for use of spatial and contact methods and suggests possible outputs from such a combination.

Annex 1
To

TOPCONS SPBRC RAS

Report on Update of data collection and field observation approach for ecological monitoring, ecosafety and data collection for Marine Spatial planning in the eastern Gulf of Finland: Integrative approach, Subarea 3 August-October 2012

Table 1

Abiotic conditions at sampled localities

Станция	Дата	Прозрачность, м	Глубина, м	Грунт	Температура °С		Соленость (г/л)	
					пов.	дно	пов.	дно
Невская Губа, Литоральная зона								
НГ-10	12.10.12	1.4	4	Песок, глина, ил	11			
НГ-2	12.10.12	0,45	1.1	Песок, щебень	12		0.18	
НГ-3	3.10.12	0.5	1.9				0.15	
НГ-1	3.10.12	1	4				0.07	
НГ-8	12.10.12	0.6	1	Заиленный глинистый песок	10			
Курортный район (Восточная часть Финского залива), Литоральная зона								
Ал-2	18.08.12.	«до дна»	0.3-0.7	Устье протоки	23.1		0.45	
Ал-3	17.08.12 (21-22 часа)	«до дна»	0.55	Каменисто-песчаная литораль	21.3		0.17	
НГ-8А	04.08.12	до дна	0.3-0.9	Песчаные пляж и каменистая литораль	22.1		0.12	
Ал-3	18.08.12 (10-11)	«до дна		Песчаный пляж, песчано-каменистая литораль	18.7		0.14	
НГ-9	12.10.12	1	1.2	песок	10			
Ал-3	18.08.12 (14-15)	«до дна		Песчаный пляж, песчано-каменистая литораль	22.3		0.12	
НГ-11	04.08.12	до дна	0.3-0.6		22.2		0.11	
Ал-3	18.08.12 (20.31-21.30)				20.5		0.11	
Лахта	11.09.2012	0.4	0-0,5	Песок, детрит	15	15	0,13	0,13
Ольгино ВР	09.07.2012		0-0,5	Песок, детрит				
7(0.5)	19.08.12	0.4	0.3-0.8	Каменистый пляж и литораль	20.6		1.12	
Морская ВР	11.09.2012		0-0,5	Песок, детрит	15	15	0.24	0.24
Зер ВР	09.07.2012	до дна	0-1,3	Камни, песок				
Реп ВР	09.07.2012	до дна	0-1	Камни, песок				
Лисий нос ВР	11.09.2012		0-0,5	Песок, детрит	13	13		
Сес ВР	09.07.2012	до дна	0-1	Камни, песок				
Тарк	17.08.2012			Песок, детрит				
Мартышкино ВР	11.09.2012		0-0,5	Песок, детрит	15	15	0,20	0,20
Сергиевка ВР	11.09.2012		0-0,5	Песок, детрит	15	15	0,18	0,18
НГ-12	12.10.12	0.5	0,3-.1.2	«Песчаный пляж, песчано-каменистая, заиленная литораль»	8.5		0.2	
Невская Губа, Открытая часть								
НГ-7	12.10.12	0.9	3	Плотная глина	10			
НГ-6	12.10.12	1.1.	1.9	глина	11		0.10	
НГ-4	12.10.12	1	1.5	То же	10.5		0.11	

Table 2

Position of the sampled localities and brief information about the works done for the period 9 July -12 October 2012

№ п/п	**Номер станции**	**Зона расположения станции**	**Координаты станции**	**Тип и количество измерений и анализов**	**Тип пробы, иные виды работ**	Дата или период работ
1	2	3	4	5	6	7
1	НГ-7	Невская Губа, Сев. Лахтинская отмель	N59º58.898 E030º09.311	Глубина (h, м) (1 раз), температура (TºC) (1 раз в поверхностном слое и 1 раз в придонном слое воды), соленость (электропроводность) (S, μS/см) ((1 раз), прозрачность (S, м) (1 раз), содержание взвешенных веществ (ВВ. мг/л) (3 пробы), взвешенных органических веществ (ВОВ мг/л) (3 пробы), хлорофилла «а» (Cchl"a" μg/л) (3 пробы)	зообентос, донные отложения, апробация фотодокументирования с использованием фотоаппарата со встроенным GPS, полевая верификация расшифровки космосъемки	12.10.
2	НГ-7А	Невская Губа, напротив Сев. Лахтинская отмель, литораль	59 59 18 N 30 09 00 E		геоботаническое обследование и полевая верификация декодированной космосъемки	11.09
3	НГ-8	Невская Губа,	N59º59.334	h, м,, TºC, S (μS/см), S м,	зообентос, донные отложения,	12.10.

		Ольгино, мелководье	E030º05.819		апробация фотодокументирования с использованием фотоаппарата со встроены GPS, полевая верификация расшифровки космосъемки	
4	НГ-8А	Невская Губа, **Ольгино/Лахта** литораль	59.9881N; 30.1385E	h, м,, TºC, S (µS/см), S м,	Лов прибрежных рыб, элементы геоботанических наблюдений, фотодокументирование для последующей верификации при декодировании космосъемки	4.08.
5	НГ-8Б	Невская Губа, Морская, литораль	59 59 50 N 30 03 55 E		геоботаническое обследование и полевая верификация декодированной космосъемки	11.09
6	НГ-11	Невская Губа, Лисий Нос, парк «Морские Дубки» литораль	60.0022N; 30.0035E	h, м,, TºC, S (µS/см), S м,	Лов прибрежных рыб, элементы геоботанических наблюдений, фотодокументирование для последующей верификации при декодировании космосъемки	4.08.
7	НГ-11А	Невская Губа Лисий Нос (Поляны) литораль	59 59 55 N 30 00 47 E		Оценка состояния прибрежной растительности (полупогруженной и наземной), верификация при декодировании космосъемки	11.09
1	2	3	4	5	6	**7**
8	НГ-11Б	Невская Губа	59 59 38 N		То же	**11.09**

		Верперлуда, мол) литораль	30 01 10 E			
9	НГ-11В	Невская Губа Верперлуда, мол) литораль	59 59 59 N 30 00 49 E		То же	**11.09**
10	НГ-12	Невская Губа, **Мартышкино**	59.9057N 29.8210E 59 54 20 N 29 49 15 E	h, м,, TºC, S (μS/см), S м,	Лов прибрежных рыб, геоботаническое обследование и полевая верификация декодированной космосъемки	**12.10**
11	НГ-12А	Невская Губа, Сергиевка (БиНИИ), литораль	59 59 38 N 30 01 10 E		геоботаническое обследование и полевая верификация декодированной космосъемки	**11.09**
12	НГ-9	Невская Губа, р- о. Верперлуда	Поставить точку мористее, чем НГ 11В и Б	h, м,, TºC, S (μS/см), S м,	зообентос, донные отложения, апробация фотодокументирования с использованием фотоаппарата со встроены GPS, полевая верификация расшифровки космосъемки	12.10
13	НГ-6	Невская Губа, мелководье	N59º59.902 E029º47.991	h, м,, TºC, S (μS/см), S м, содержание взвешенных веществ (ВВ мг/л) (3 пробы), взвешенных органических веществ (ВОВ мг/л) (3 пробы), хлорофилла «а» (Cchl"a" μg/л) (3 пробы)	зообентос, вода, донные отложения,	3.10 и 12.10
14	НГ-4	Невская Губа,	N59º57.800	h, м,, TºC, S (μS/см), S м, ВВ мг/л,	зообентос, вода, донные	3.10 и

		мелководье	E029º45.821	ВОВ мг/л, Cchl"a" μ/л	отложения,	12.10
15	НГ-10	Невская Губа, мелководье	N59º56.712 E029º47.176	h, м,, TºC, S (μS/см), S м,	зообентос, донные отложения,	12.10
16	НГ-2	Порт СПб, Угольная гавань	N59º52.892 E30,10.892	h, м,, TºC, S (μS/см), S мВВ мг/л, ВОВ мг/л, Cchl"a" μ/л	Зоопланктон и зообентос, вода, донные отложения	3.10 и 12.1009.08
17	НГ-3	Невская Губа, мелководье	N59º52.099 E30º02.623	h, м,, S (μS/см), S м, ВВ мг/л, ВОВ мг/л, Cchl"a" μ/л	вода	3.10.
18	НГ-1	Невская Губа, открытая часть	N59º57.946 E030º13.602	h, м,, S (μS/см), S м, ВВ мг/л, ВОВ мг/л, Cchl"a" μ/л	вода	3.10.
19	19	Финский залив, зона бассейновой аккумуляции	N60º6.55 E029º52.24	h, м,, TºC, S (μS/см), S м, ВВ мг/л, ВОВ мг/л, Cchl"a" μ/л,	Зоопланктон и зообентос, Вода, донные отложения	04.10.
20	20	То же	N60º8.42 E029º42.0	То же	То же	04.10..
1	2	3	4	5	6	7
21	21	То же	N: 60º05,50 E 029º43,70	То же	То же	04.10.
22	RP-01	Финский залив, мелководье	N60 08.777 E: 29 08.772	h, м,, TºC, S (μS/см), S м,	зообентос, вода, донные отложения	03.10.
23	RP-09	То же	N: 60º08,580 E 029º51,409	h, м,, TºC, S (μS/см), S м,	зообентос, донные отложения	03.10.
24	RP-19A	То же	N: 60º09,420	h, м,, TºC, S (μS/см), S м,	Зообентос, подводная	03.10.

			E 029º52,189		видеосъемка в ручном	
25	7(3)	То же	N: 60º10,942 E 029º43,479	h, м,, TºC, S (µS/см), S м	зообентос, подводная видеосъемка в ручном режиме	04.10.
26	RP-12	То же	N: 60º09,079 E 029º51,191	h, м,, TºC, S (µS/см), S м,	зообентос, донные отложения	03.10.
27	RP-10	То же	N60º08.879 E029º51.100	h, м,, TºC, S (µS/см), S м	Зообентос, донные отложения	03.10.
28	RP-14	То же	N60º09.231 E029º50.776	h, м,, TºC, S (µS/см), S м	Зообентос, донные отложения	03.10.
29	RP-13	То же	N60º09.007 E029º50.894	h, м,, TºC, S (µS/см), S м	Зообентос, донные отложения	03.10.
30	RP-04	То же	N60º09.121 E029º52.232	h, м,, TºC, S (µS/см), S м	Зообентос, донные отложения	03.10.
31	13(.05)	Финский залив, литораль	60 09 45 N 29 51 25 E		геоботаническое обследование	09.07
32	RP-07	Финский залив, мелководье То же	N60º09.048 E029º51.528	h, м,, TºC, S (µS/см), S м	Зообентос, донные отложения	03.10.
33	RP-18	Финский залив, переходная зона	N60º08.785 E029º50.112	h, м,, TºC, S (µS/см), S м,	Зообентос, донные отложения	03.10
34	RP-02	Финский залив, ложбина стока	N60º08.839 E029º52.174	h, м,, TºC, S (µS/см), S м,	Зообентос, донные отложения	03.10

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35	Ал-2	Финский залив, Александровская бухта литораль	N60°03,107’ E029°57,838’	h, м,, T°C, S (µS/см), S м,	Прибрежные рыбы, вода, элементы геоботанического обследования	18.08
36	Ал-3 суточная	Финский залив, Александровская бухта литораль	N 60°02,776’ E 29°57,807’	h, м,, T°C, S (µS/см), S м,	Прибрежные рыбы – лов в суточном режиме, всего 4 лова, элементы геоботанического обследования	17.08-18.08
1	2	3	4	5	6	7
37	7(0.5)	Финский залив, Зеленогорск литораль	N60°11,197 E29°43,315’	h, м,, T°C, S (µS/см), S м,	Лов прибрежных рыб	19.08
38	Т-1	Финский залив, Тарховская бухта, луда около очистной станции	60 03 58 N 29 56 55 E		рекогносцировочный объезд, расшифровка космосъемки	17.08
39	С-1	Финский залив, Сестрорецк литораль	60 05 23 N 29 55 11 E		Геоботаническое обследование	

Примечание:

Обозначения цветом в столбце 2

XXX – геоботанические наблюдения и отбор проб
XXX – ихтиологические наблюдения и отбор проб
XXX – геоботанические и ихтиологические наблюдения и отбор проб совмещены
XXX – обследование проведено с борта судна

ANNEX 2

Experience and advantages of RS use for biological field work planning and interpretation (example for fragment of super high resolution image)

Typical start for research (observation, monitoring, territorial planning etc.)

A. What do we have for the area: (normally just a map)

B. What do we know about the area (description):

****

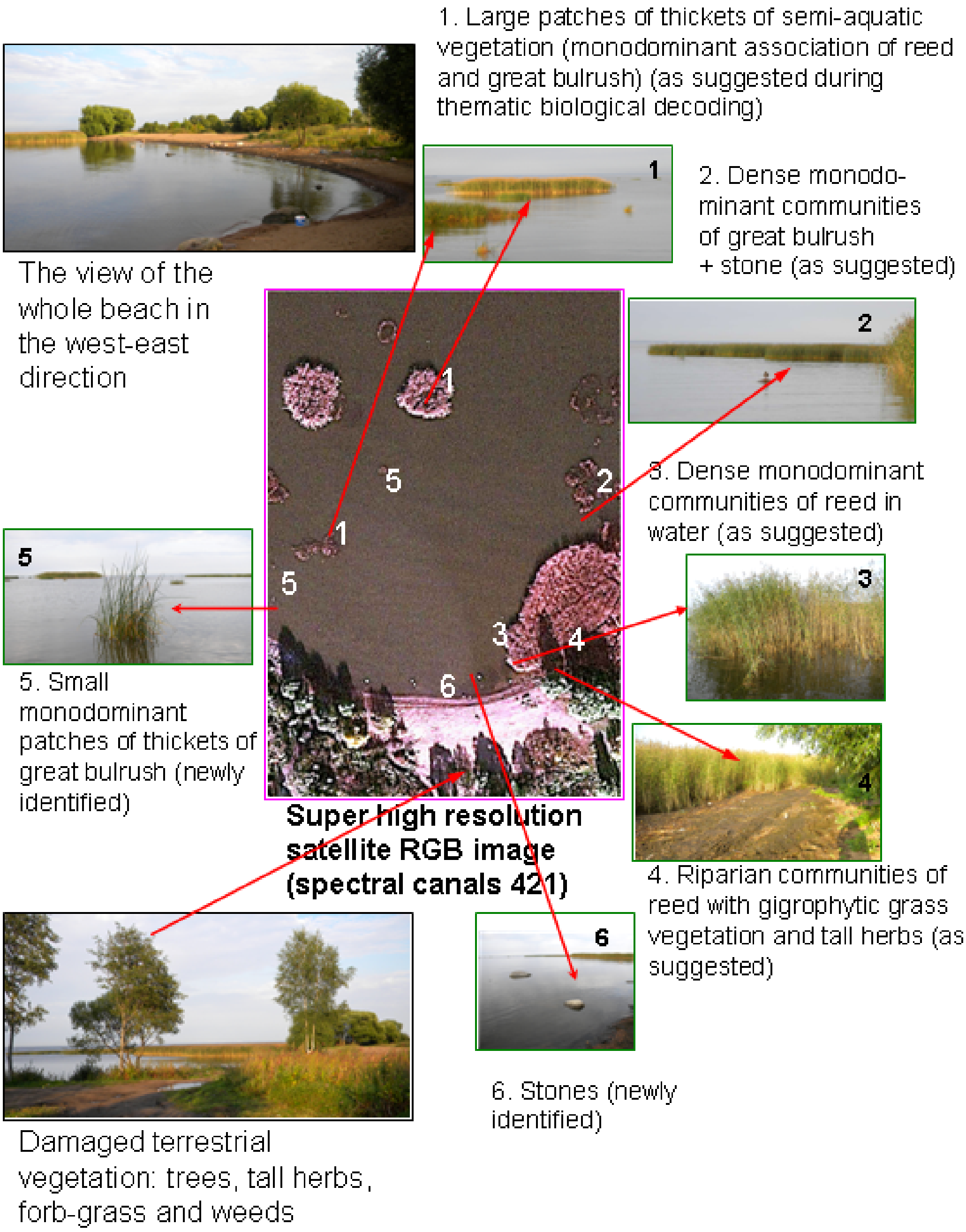
Even general description (text on the left) identifies:

- (1) high diversity of spatial elements and
- (2) high temporal (seasonal, by storm events) variety of some of these elements.

But the map normally provides just coastline and isobathic lines….

Fragment of GeoEye satellite image of super high resolution (channels 421) from ? date.. = C. Additional up-to-date start mean

Advantages of satellite super high resolution image: thematic decoding (See Figure 8 in the main text of the report) (suggestions) and one-day field verification for selection of typical landscapes' element for further research instead of long-lasting extensive geobotanical surveys



By-product: Photo archive is collated with spatial data provided by RS