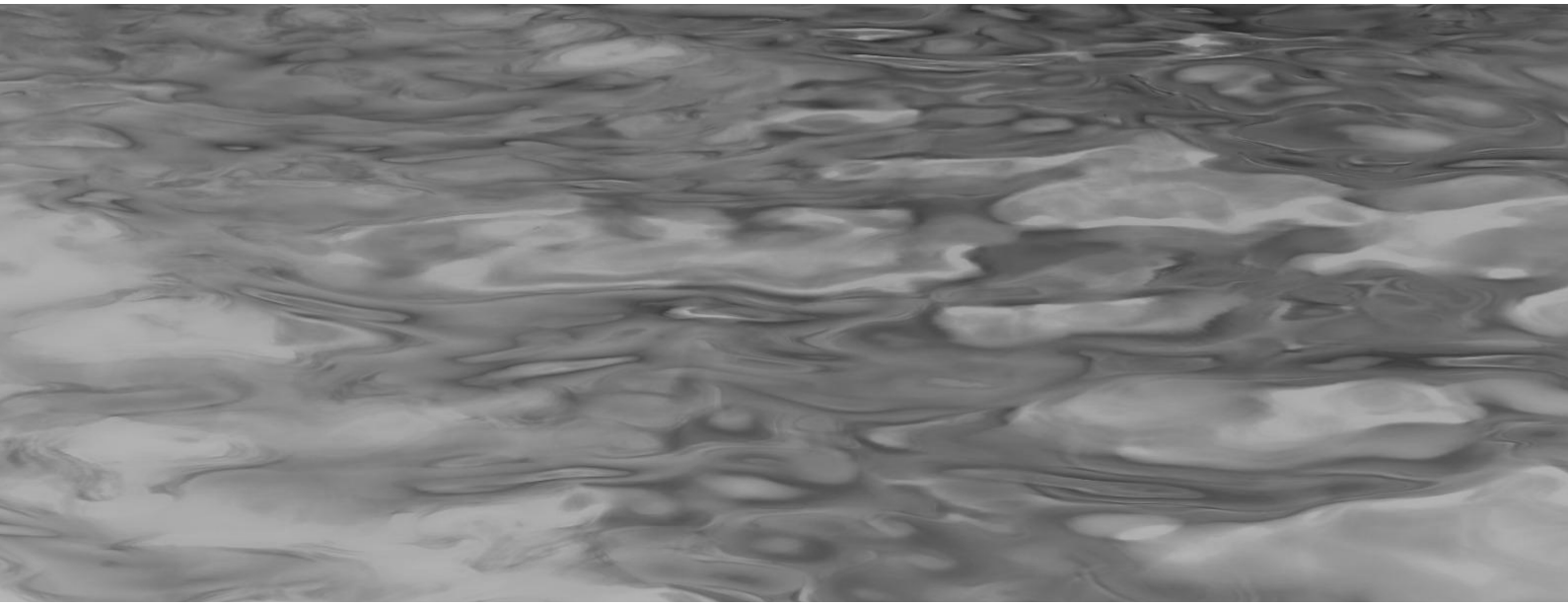
RESEARCH PLAN

Liquid Bodies of the Marmara Region

Borders & Territories Studio

MSc 3 2022



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Content

Introduction

The Marmara Sea is one of the few inland seas of the world, being a crucial passage that separates Europe and Asia with its geographical location, but it also unites them through Bosphorus and Dardanelles. Despite the significant attention the region receives for its political, commercial, and economic importance, noticeably much less coverage focusing on the characteristics and condition of the Sea of Marmara as an ecosystem is being produced. Meanwhile, more and more concerning phenomena can be observed in the western part of Turkey, especially around Istanbul. Severe droughts, aquifer salinization in both inland and coastal areas, frequent sea snot occurrences, and shrinkage of freshwater resources should be treated as indicators of a serious imbalance within a complex and fragile water system. They reveal the multitude of liquid interdependencies connecting different water bodies, agencies and organisms which are difficult to be seen from a close distance.

This research aims to uncover and trace the intricate structure of the Marmara Sea water system, treating it as one whole complex organism. Through its dissection, we plan to target the most crucial chokepoints, moments and irregularities that affect the functioning of the totality, gain a better understanding of the processes taking place and possibly foresee the forthcoming symptoms. The boundaries and shapes of the organism are determined by the basin of the Marmara Sea, however, the research does not overlook certain close and indisputable links with the adjacent Black Sea and the Aegean Sea.

Even though the State Hydraulics Works (DSI), a public agency, is standing at the forefront of efforts to reduce the water-related problems with new dams, hydroelectricity plants and reservoirs, these are only interim solutions that do not seek to understand the problems and solve them at their source. Heat waves are affecting the quality and quantity of water, causing bursts of cyanobacteria, and excessive rainfalls mobilizing pathogens in the environment, carrying them into rivers, lakes, reservoirs, coastal waters and wells.

In light of the facts mentioned above, the research aims to answer the following question: Can mapping and highlighting the liquid flows in the Marmara Region reintroduce a thorough understanding of interdependencies within a water system?

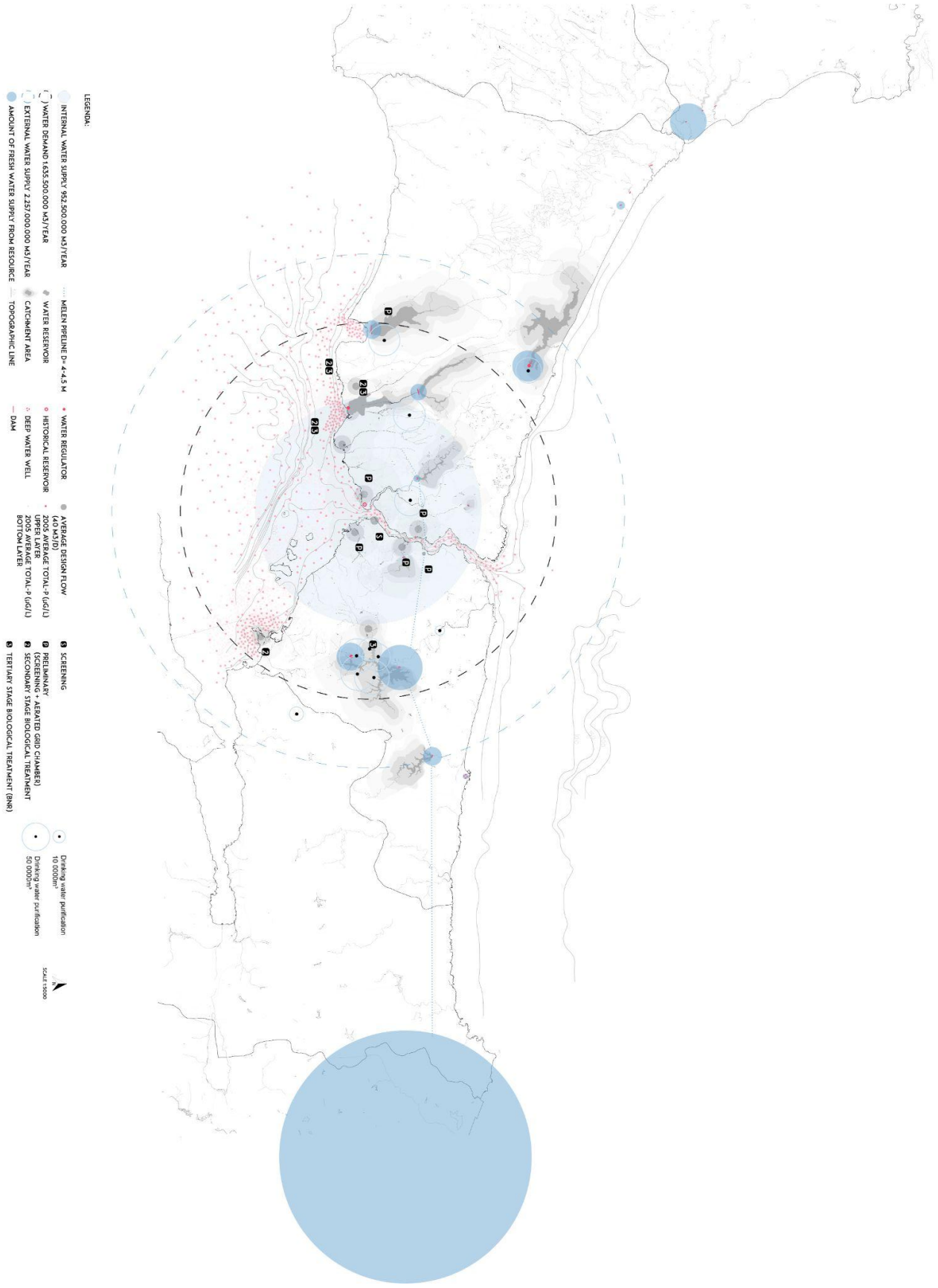


Fig.1 First attempt of overlapping the data tested on the Istanbul region only. Pure data of the common research gathered together before choosing a mode of representation.

Methodology

The collection of information and the construction of the map were enabled by process-oriented research. The exclusion of a pre-defined research goal enabled a problematization parallel and specific to the construction of the relational field. Additionally, alternating between the accumulation of knowledge and reflection on the amassed information serves to create self-awareness while shaping the topic. The research structure can be described as follows:

Exploration (Reflection, Anticipation, Narrowing down)
Gathering
Overlay
Reflection
Problematization
Sorting Out
Representing

Initially, a general exploration of phenomena connected to the topic of water and aquifers in the Marmara region was conducted. This exploration was motivated by personal interests. Subsequently, the gathered information was collected and constituted the first, broadest field of information. In an attempt at discovering relations between the accumulated knowledge, we overlaid the mapped information - with the intent of discovering 'problem areas': visual indicators of especially interesting relations between two or more of the overlaid layers. The mapped layers were:

- Location/size of water reservoirs
- Location of rivers
- Direction of surface and bottom layer currents in the Sea of Marmara
- Amount and location of wastewater discharge into the Sea of Marmara
- Differing densities of mucilage within the Sea of Marmara
- Fishing areas
- Directions of flows of underground water
- Flood areas, Drought areas
- Pollution
- Distribution of fish

Analyzing and reflecting on the research process up until this point, two major misinterpretations could be discovered: First, a dichotomy between "natural vs manmade" and accordingly "good vs bad" had been influencing the research. Secondly, the anticipated "problem areas" did not arise, as the complexity of the interrelations of water flows is too high to create singular conflicts. Defining the complex of water flows as an autonomous organism helped tackle both misinterpretations. The image of liquid interdependencies within an organism of flows allowed for a representation of water flows

from the perspective of water itself, therefore leaving out any positive or negative connotations that might be commonly associated with the “human” perspective. Simultaneously, it implies the impossibility of singling out interrelations and instead offers an exhaustive overview of the multiple interrelations.

Accordingly, several decisions on which layers to further investigate and which to leave out could be made. All effects of certain instabilities within the water flow system which are defined through the lens of human activity as catastrophes or failures were not further investigated: drought areas, pollution, dying out of fish and other species, and floods. Instead, all phenomena constituting flows of water were overlaid anew and depicted in comparable modes of representation that subscribe to the same logic. At the same time, the borders of the organism were defined as the commonly accepted delineation of the Marmara Basin.

The flows which constitute the organism were divided into three scales. Lines depict flows in a horizontal direction, points represent vertical flows. The map only visualizes the localities of water flows, while blending out all other geographical orientations. The visual dissolution of land in favor of the depiction of only water is intentional and reflects the point of view of the constructed topic.
Overall, the map is a result of procedural research alternating between explorative research and analysis and reflection of previous research. Taking on the point of view of an organism that contains different water flows, and depicting it in three inherent scales, it serves to capture the multitude of interdependencies of water flows in the Marmara Basin, dissolve the categorical boundaries between them, and articulate their ethereal character.

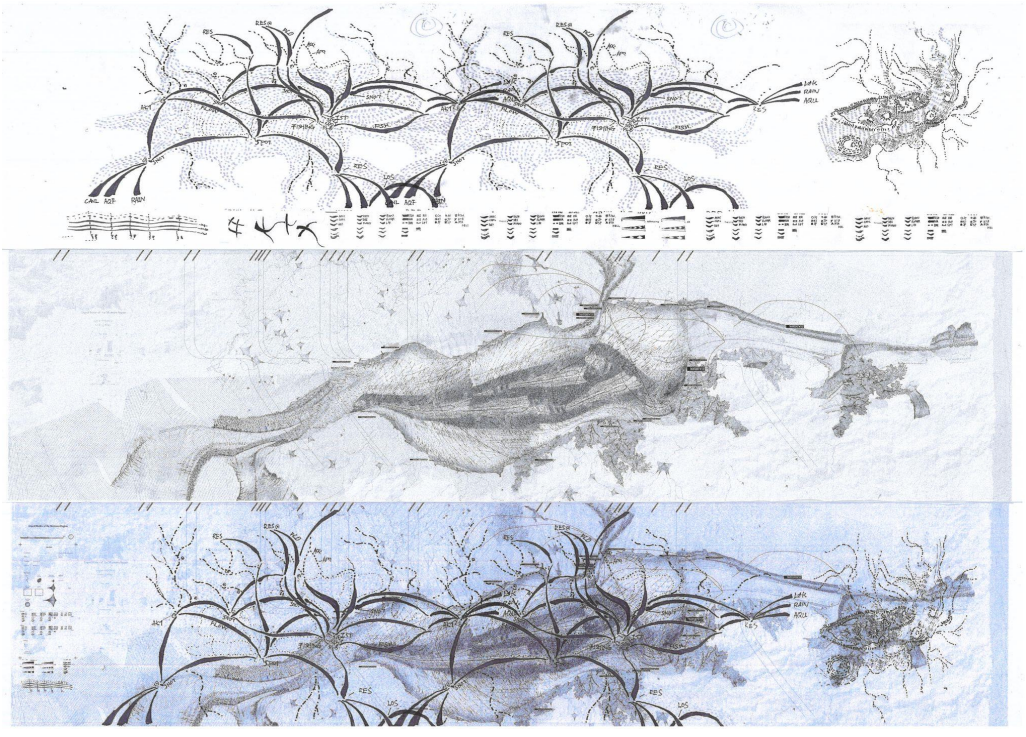


Fig. 2 Sketches of representation modes.

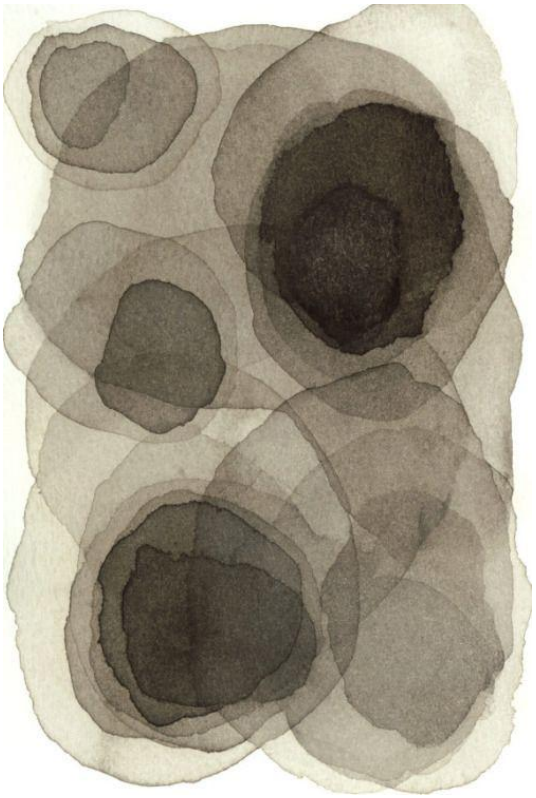
Literature review

Depending on the extent to which map production progresses over time, and on several key transitions in the map production process, the selection of a literature review can be divided into three parts: multiple 'layer' information overlays, the presentation of existing and new (unpresented) types of 'flows', and a database for data extraction.

Abstract Minimalist Watercolor[1]

This image is one of our earliest references, and its revelatory role consists of two main aspects: firstly, it simplifies the meta-information into different layers, and secondly, the superposition of different layers can get different brand-new information, and this abstraction for image expression has been maintained until the present stage of mapping.

"Evaluation of Three-Dimensional Flow Structure of Tarabya Bay and İstinye Bay on an Annual Scale"[2]



This article is a reference for the first application of the 'flow' concept to the mapping process. In this study, the annual three-dimensional flow structure of Tarabya Bay and Istinye Bay on the European side of the Istanbul Strait is analyzed based on the results of a calibrated and validated numerical model of the strait. Due to the higher water density in the Sea of Marmara than in the Black Sea, an additional barometric forcing occurs in the north direction, which leads to the fact that the current velocity in the Gulf of Tarabya is almost the same in the case of a lower water level difference in the Sea of Marmara as in the case of a higher water level difference in the Black Sea. This result suggests two things: first, we translate the graphical representation of water into 'flow'. The second is the universality and multidimensionality of 'flow'.

Fig. 3 Watercolor by Roseanne M. Watson.

[1] *Source: Roseanne M Watson*
[2] *Dokuz Eylul University-Faculty of Engineering. Journal of Science and Engineering. Volume 19, Issue 57, September 2017*

Water Resources of Turkey [3] & *Probable Water Crisis* [4]

The third part of the literature provides information and data for mapping, such as the location of dams & lakes, the type of aquifers & flow direction, and the amount of urban water use & pollution levels. Both articles are more comprehensive and general studies of water applications, with the Water Resources of Turkey being more of a natural form of water and the latter being more of an artificial form of water. These two articles are the main databases that we refer to in our mapping process.

Existing academic frame

In this chapter, previous research and ideas about water in the Marmara sea will be introduced as a frame on which we base our research.

In the research article *Critical evaluation of wastewater treatment and disposal strategies for Istanbul with regards to water quality monitoring study results*, quantities of data are given to show the parameters of pollution particles such as dissolved oxygen, total organic carbon (TOC), Total-N, and Total-P. A difference in pollution level between the upper layer and lower layer of the Marmara sea can be concluded as a result of data analysis or the difference of pollution level in geographic dimension and time dimension.

This is a research with every two-dimensional study parallel to each other, instead of a spatial view.

Another research on water quality, *Vertical distribution of mucilage typology in the water column after a massive mucilage formation in the surface waters of the Sea of Marmara*, connects pollution levels with temperatures and salinity in certain depths, shown in a combined way of charts and photos, which visualized it more intuitively and spatially.

These images of sea snots in different depths represent density and trends better than statistics. Some previous research focuses on sea currents while some others emphasize rivers, existing academic works depict the flows separately. However, when it comes to water, it's more than that. In the book *Water Capitalism: The Case for Privatizing Oceans, Rivers, Lakes, and Aquifers*, the discussion on who owns these water 'layers' in Turkey inspired us to rethink the relationships between these 'layers'. By figuring out how water goes in a circle, the truth can be found that water is dynamic flowing between oceans, rivers, lakes, water basins, and the air even. We can hardly separate water in a lake without talking about its source river and underground water basin, which means a physical privatization of a lake or a river is impossible. Water in every layer has its trends and movements, influenced by surrounding temperature, topography, geography, or human activities. However, there is not yet one map showing all the water layers together in an overview depicting all these trends and movements, which is our research goal.

[3] *Nilgun B. Harmancioglu & Dogan Altinbilek, World Water Resources, Volume 2,*

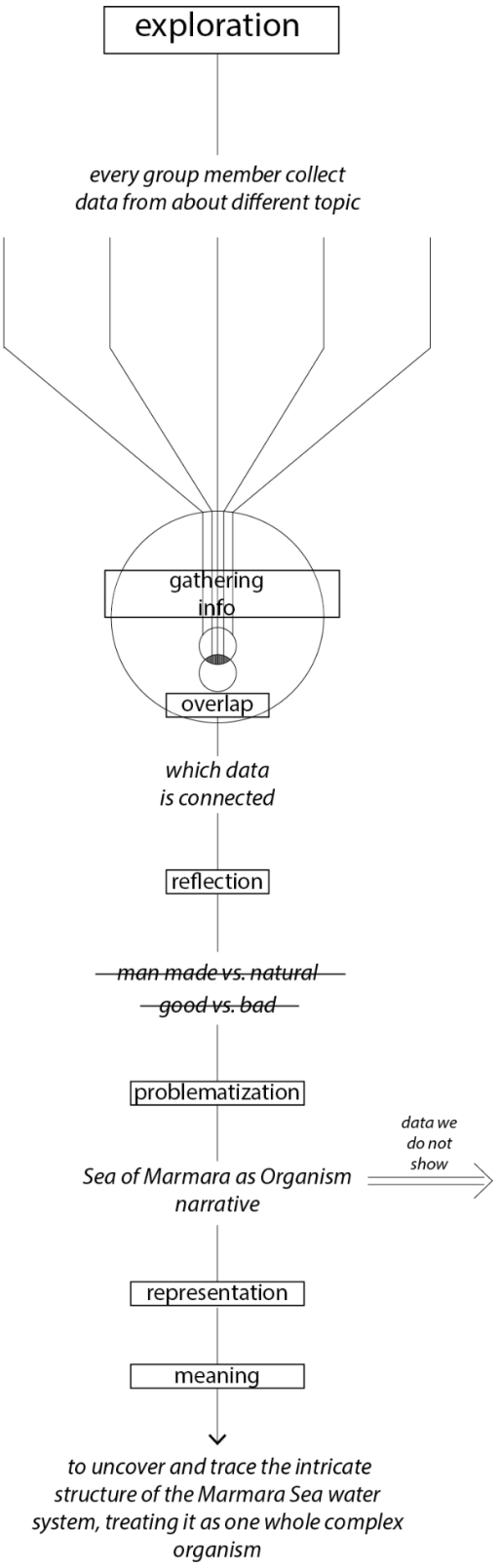
[4] *Water International, Volume 32, Number 4, Pg. 590-603, December 2007*

Reflection

As discussed in the introduction our goal of the map is to reintroduce an awareness of water flows for the multitude of their interdependencies and to characterize water and its flows as an organism. When reflecting on the methodology used, it will therefore also be examined whether our aim of the research has been made visually clear through the final map.

The methodology of mapping and trying to map water flows has its limits. The challenge is not to lose the complexity of the relationships between flows, but in addition, the map must also remain legible. These challenges are visible on the map. By introducing the different scales, an attempt has been made to analyze the complexity of the flows. In this way, an attempt was made to make the map and the flows graspable. However, a certain amount of subjectivity has been introduced with the introduction of the scales into our research, because they have been devised themselves and placed in the boxes of macro-meso-micro. An example of this is the sea currency flow and the pollution flow: both can be classified on both the micro and the macro scale because a sea current also ultimately consists of molecules. However, in our map, the sea current is classified on the macroscale and the pollution on the micro-scale. As a result, the impact of a flow can be communicated incorrectly via our methodology. The framework of the scales should therefore have been defined more clearly. In this way the map would communicate the flows more understandably, but also the process of analyzing the flows during the research would be less complex.

The second point for improvement is that the complexity of the flows has partly been lost because themes have been omitted during the selection of flows that do play a role in



the system/organism of water flows. Think for example, of the lack of precipitation, irrigation systems in agriculture, drought, but also, a more precise mapping of wastewater discharges from industries. By further developing the complexity of these water flows and the associated relationships in this way, one will be able to better understand the Marmara organism and its related flows in the framework of the different scales.

Conclusion

Examining the organism of the Marmara is relevant in two aspects. The first point is that the methodology provides a new perspective on the theme of water while also mapping crucial chokepoints, moments, and irregularities that affect the functioning of the totality of the Marmara region to understand the processes and possibly foresee the upcoming symptoms.

The relevance of mapping water as an organism is to show and experience all parts of the water cycle, the visible and invisible, to make the complexity of the system graspable. Certain ideas about water, water systems, and water mapping are put into a different perspective. These are: falsely identifying water as a perfect cycle that is meant to cater to human needs, increasing efforts in controlling water without knowing the limits and fluctuations of the system, and addressing the lack of holistic appreciation for the element of water. In this way, we hope to change the partly incorrect perception of water. By linking this goal to the critical water conditions and problems of the Marmara region, the complex water system and its flows can be clarified to address the pressure at different points in the system.

The second point is that the research on water and aquifers is part of a collective assignment in the Borders & Territories studio, in which various themes are mapped (border/migration, infrastructure/congestion, soil-fault lines & water-aquifers). All these maps together represent a selection of a large amount of information on each theme. That is why the water-aquifers map is part of an information and inspiration input for our graduation projects, but also for the other students who are part of the Borders & Territories studio.

Fig. 4 Latest attempt of mapping the Liquid Bodies.

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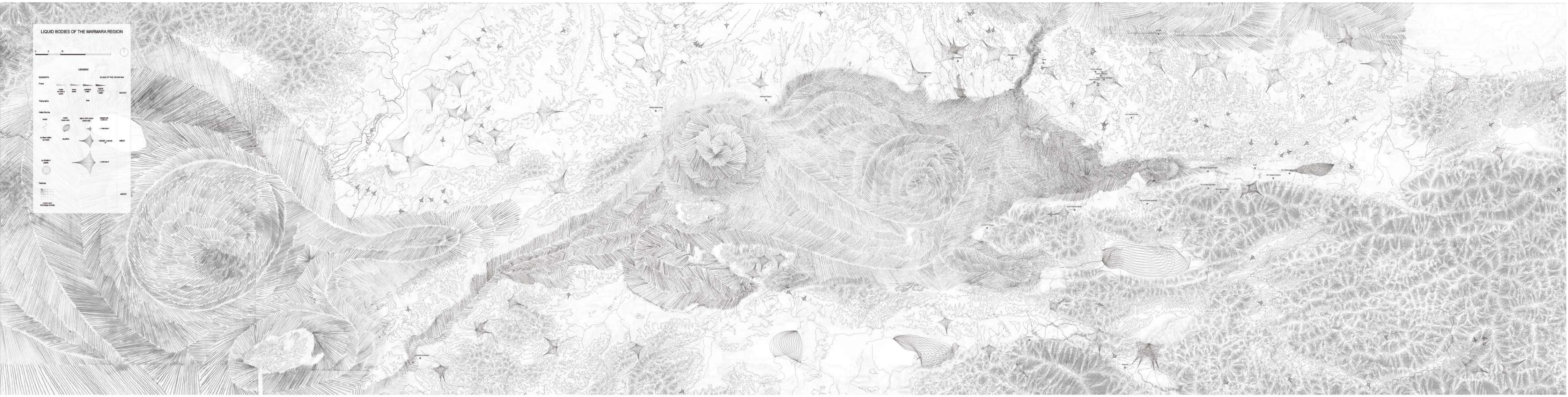
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