Fishing Architecture The Ecological Continuum between Buildings and Fish Species

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doi: 10.5281/zenodo.10912540

To what extent can fish produce architecture? This project sets out to trace a socio-ecological history of North Atlantic architecture in relation to fisheries, elucidating the relationships between marine environments and terrestrial landscapes and assessing the ecological impact of fishing constructions and the natural resources they depend upon.

Fishing Architecture covers a broad spectrum in terms of both geography and time, a choice that was made to avoid deterministic analysis and engage with transnational phenomena. Thus, the focus is on the North Atlantic—its shores housing diverse architectural cultures and its waters home to a wealth of fish species—and follows a time frame that runs from the industrialization of fisheries in the early 19th century to the full globalization of the industry at the end of the 20th.

The extant scholarship on marine ecology, fisheries, and fishing communities includes extensive research on fish populations, navigation systems, technology, bioeconomics, architecture, and cultural practices. Yet, comprehensive interdisciplinary analysis of the field is hindered by its own specialization. Facing the impending challenges of the environmental predicament, this project will use the material history of architecture as a powerful tool for advancing interdisciplinary research and, along with it, our understanding of the ecological impacts of human activity.

The assessment will be organized along five analytical axes: (1) marine ecosystems; (2) fishing technology; (3) food processing; (4) politics; and (5) consumption habits, effectively avoiding the conventional architectural approach to understanding the built environment. This strategy allows us to identify critical knowledge gaps to be worked on and, most significantly, fosters a fresh perspective on construction in which fishing landscapes and buildings are understood as material traces of dynamic socioecological relationships and as part of the continuum between land and sea.

Thematic Panels
SH5 Cultures and Cultural Production
SH5_6 History of art and architecture, arts-based research
SH7 Human Mobility, Environment, and Space
SH7_5 Sustainability, environment, and resources

Submitted for publication: 1th September 2022
Published: 8th January 2024

Funding
Research funded by the European Union (ERC, Fish-A, 101044244). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or the European Research Council. Neither the European Union nor the granting authority can be held responsible for them.

The *Fishing Architecture* project is based on a simple research question: What is the relationship between architectures built for fishing and the ecological balance of fish populations? The overarching hypothesis is that it is an intricate relationship embodied in the continuum between terrestrial and marine landscapes. To tackle its different factors, mechanisms, and consequences, the research team will assess and render visible the dimensions and characteristics of architecture built for this purpose and to relate these factors to the scale of its impact on the unstable ecological dynamics of fish species within marine ecosystems.

As with any simple question which goes beyond the established limits of a field, a scientific answer requires a large body of expertise and a broad range of knowledge. Previous research has assessed local coastal landscapes, mainly in Portugal. The angle of approach targeted the relationship between natural resources, such as algae and sardines, and the urbanization patterns of twentieth-century coastal settlements. The research results were perplexing: (1) the historical narrative on fisheries was, in every North Atlantic country, national if not nationalistic; (2) what is termed vernacular architecture throughout the Atlantic region is not, in fact, vernacular, and patterns of knowledge transfer can be traced through apparently unrelated locations; (3) there is a still unexplored relationship between what happens on land and what happens in the sea. This research project aims to: (1) conduct an ambitious large-scale research project embracing the Atlantic from a specific new angle; (2) overcome the common national scope of existing literature; (3) tackle a highly interdisciplinary topic; (4) consider architecture within a land-sea continuum and assess some of its effects on marine ecosystems and vice versa.

Architecture is a discipline that operates at the interface of many discourses, challenges, and dilemmas. Not only do constructions have material histories, hosting, symbolizing, and synthetizing social networks and conflicts but they also respond to specific functional and programmatic requirements, reflecting transformations in production technologies, networks of transportation, and human behaviour. Buildings are paradoxical: although their material life cycles seem to be long, they quickly become obsolete. Every generation sees buildings being erected, transformed, and demolished, not always in the same order and not necessarily the monuments of art history.

The locus for the *Fishing Architecture* research project is the North Atlantic. By selecting three specific valuable commercial fish species (such as cod, sardines, tuna, and/or salmon) and looking at major technological changes in fisheries and food processing (such as trawling, canning, freezing, factory boats, and the international law of the seas), the project will address a long-term chronological span ranging from the early nineteenth century to mid-twentieth century. Following the fish is the key methodological strategy to avoid being trapped in specific architectural typologies, locations, and narratives. By understanding the marine ecosystem inhabited by fish and tackling the transformations inflicted by human predation, it is comparatively easy to find out where the architecture that provokes and serves such transformations is located. Then, in analysing the architecture of fisheries, it will become clearer what social context induced the pressure that was put on ecological systems, thus delineating transformations running in parallel to the transformations in the marine ecosystem. The resulting picture will be that of an environmental history of architecture which does not yet exist.

Marine ecology has demonstrated the need for and benefits of careful consideration of the biological history of the sea and especially that of fisheries beyond the shifting baselines of short-term periods. Climatic cycles or particular combinations of technological and political factors can affect measurements of fish biomass and induce a misreading of quantitative and qualitative data. There have been ambitious long-term research projects on the history of fish populations—including the History of Marine Animal Populations (HMAP)—and these have resulted in ongoing international databases of fish biomass, such as the Ocean Biodiversity Information System (OBIS). These research paths, combining the expertise of marine ecologists with that of historians, have enabled intertwined readings of a variety of case studies that feed the growing body of socioecological studies. But marine ecology and socioecology have so far largely neglected the built impact of such dynamics. Their focus has remained local and limited to specific fisheries and fish populations as well as to relatively narrow time frames. For this reason, architectural history can bring a fresh perspective to socioecological studies.

Objectives

The *Fishing Architecture* research project has three main overarching objectives:

— to contribute to an environmental history of architecture and identify the Atlantic as a key player in the construction of marine and terrestrial landscapes;
— to establish new knowledge on coastal environments and their socioecological character in order to inform marine conservation policies;
— to nurture the historical and theoretical backgrounds of nature-based design solutions.

These broader aims unfold in more precise objectives:

— to use fish as an entry point to assess the human consumption of natural resources and relate the pace of this consumption to the growth and transformation of the built environment;
— to correlate the fluctuations of fish populations with building cultures;
— to identify historical cases where building practices have had a measurable impact on natural resources, and to identify the criteria and instruments to describe such impacts.

Framework and methodology

The hypothesis is that there is an intricate relationship embodied in the continuum between terrestrial and marine landscapes. While architecture is the object, fish is the agent via which to tackle the intricacies involved in this endless process. From fish to fishing communities, the adopted methodology can be characterized as a case of systems within systems. The research revolves around five key questions:

— Are there variances in the architecture built to catch, process, and consume different species of fish?
— What architectural forms do different fishing technologies have?
— What fish biomass does each type of architecture/building consume?
— What is the spatial relationship between the activities of harvesting, processing, and consuming fish?
— How do fluctuations in marine ecosystems impact the performance of fisheries-related infrastructures?

This project reverses the angle from which architecture is approached: it moves from humans to fish. Can a fish make architecture? The question might seem silly, but fish feed people: they attract fishermen whose labour requires architectural infrastructure. Inverting the gaze, looking to land from a marine perspective, reshuffles the conventional order by which we understand the built environment. As architecture is seen to be independent of marine ecology, the eminently causal connection between them is overlooked.

There is no need to recapitulate or emphasize our environmental predicament, and how much we must address marine life and the oceans in order to confront the impending challenges. What is more difficult to do is to demonstrate that our terrestrial constructions are intimately related to a broad ecosystem and, more specifically, to represent the dynamics of these relations. To achieve this, the project will set up a team capable of: (1) articulating knowledge from fields that are seldom put together, such as building technology and the statistics of fish landings; (2) experimenting with new analytical and interpretative tools, such as the combination between architectural typology and data mapping; (3) tackling architecture through the lenses of marine biology and tackling marine biology data through the lenses of architecture; (4) producing a compelling visual output that represents the dynamics of fish populations and their relationship with terrestrial landscapes.

The project will start through relatively standard procedures within the field of architectural history. Seven locations across the Atlantic will serve as case studies (Gloucester in the United States, Bonavista in Newfoundland, Grindavík in Iceland, Grimsby in England, the Vesterålen archipelago in Norway, Lorient in France, and Matosinhos in Portugal). They will not function as conventional case studies but rather as anchors to access regional sources, problems, and examples, and they were selected to guarantee a balanced geographical distribution while addressing different scales, fishing cultures, food processing techniques, and political contexts. The research will draw on a variety of sources from material evidence of past buildings to archives, which will provide material to feed the empirical research. In parallel, architectural instruments—visual representation—will be used to build up a typological inventory. The data from these locations will be analysed in parallel to the selected fish species (cod, sardines, tuna, and/or salmon). These reference species were selected accordingly to their historical relevance in commercial fisheries and prevalence throughout the North Atlantic.

To thoroughly assess the existing scholarship and sources and organize new sets of data, to visually represent the historical dynamics and the resulting constructions, and to navigate through the relationships between marine ecosystems and construction, the team will focus on five interlocking critical layers of inquiry: a) marine ecosystems; b) fishing technology; c) food processing; d) politics; and e) consumption habits. Each of these topics has an expertise of its own, but since the architecture of fishing results from the networks generated between them, it permeates them all. These five critical layers will be the research project's methodological keys.

The research strategy will be balanced between the three fish species and the seven case-study locations. They will be used as entry points to prepare the deliverables and work packages (WP), which will be spread through the timeline: WP 1 typologies; WP 2 species; WP 3 gear; WP4 landings; WP 5 networks. The WPs will gather and scrutinize data and become the structural output of the project, both in terms of the quantitative and, more significantly, the visual output of the data. Each WP will comprise maps and statistical visualization to illustrate the outputs. The WPs and deliverables will address the five research questions plus the five critical layers, providing a constant cross-pollination of ideas to synthetise a narrative with the features of the historical processes of fisheries, their practices in relation to fish behaviour, the constructions each relationship involves, the geographical distribution of fish populations biomass, and so forth.

The project will take five years to gain momentum and deliver the substantial contribution it is aiming for. The first semester will be dedicated to setting up the project, hiring staff, and activating the required network for its development. The last semester of the last year will wrap up the materials produced by the team, update data sets, and complete any pending publications. The project will run full steam for four years, with each semester having a thematic focus on one of the five critical layers (marine ecosystems, fishing technology, food processing, politics, consumption habits) and on one of the three reference species (cod, sardine, tuna, and/or salmon). The first semester of the fifth year will be dedicated to hosting a major conference to cement the intellectual community in which the project will operate.

The project aims to deliver a significant number of visual outputs (from the Atlantic scale to the detail of constructive technical solutions) that will be tailored to the thematic approaches and render visible the physical characteristics of fishing architecture (related both to the critical layers and to fish species), assess the ecological impact of fishing architecture, and understand the intricate relationship embodied in the continuum between terrestrial and marine landscapes. This will take the form of open-data scientific publications, a main research monograph, scientific reports, and a variety of outputs.

Fishing Architecture will be a significant contribution to the field of architectural theory and history, and that marine biology, fisheries, bioeconomics, nature-based design, and other areas of knowledge will benefit from the research outcomes. Above all, we are interested in fostering an environmental approach to architecture and producing a fundamental body of knowledge to support further research relating the abiotic to the biotic. It is expected that each member of the team will afterwards be able to develop their own career paths and imagination, contributing to an enlargement of the field and in-depth knowledge of architecture's ecological and environmental impact. In future ramifications, the focus will not necessarily be on fish but will move off into areas as different as algae and intertidal zones, addressing marine landscapes, coastal regions, or even the urbanization of the sea.

Implementation

Geographical mapping and architectural typology

Architecture will be the matrix where all the *Fishing Architecture* data converges. Manifesting as harbours, factories, navigational markers like buoys, piers and warehouses, drying racks and freezing plants, there is a network of constructions related to fisheries that will function as the core of the research project. An initial step of the project will consist in establishing an inventory of examples organized by typology (WP1). Typology is an analytical tool of architecture that preserves the links to the local conditions of a place while highlighting the universality of its design and its constructive and formal qualities (Crist & Gantenbein, 2012). Function and form will be the main key descriptors, and a standard representation method will be employed for a homogeneous output of North Atlantic *Fishing Architecture*.

The second matrix element will be a systematized mapping of the North Atlantic (WP2), synchronizing various analytical scales (from the small scale of architecture to the large scale of navigation routes and fish population distribution). The team will experiment on representing sophisticated fisheries and biological data into an articulated visual form in relation to the mapping and typological materials. A fish shoal is not a fixed measure that is constant through time. Digital mapping tools, fish specimen GPS tracking, 3D sonar scanning will feed this approach to create new methodologies and generate original visualizations. This cross-representation of architecture and fishing data is the methodological core of the project. Here we find the project's more significant risks and its most powerful outputs: a synchronized vision of how the environment is shaped between human and non-human species, between the biotic and the abiotic.

Empirical research

The research will draw on primary sources as disparate as inventory data sets (both on cartography and fish species biomass), governmental reports (providing figures on fish landings and political strategies), municipal archives (with holdings on cartography and architectural projects), trade magazines (covering fisheries practices and views), literature and photography (representing architecture), and the urban remnants of canning factories and port constructions (architecture per se). There are important contributions from the history of marine ecology that assure the effectiveness of this kind of methodology (McClenachan et al., 2017; McClenachan, 2009). In parallel, there are well-known methods from the current research on modern architectural history, which have departed from past visions of individual architects as single-minded authors in order to understand the social entanglement of building practices. These procedures will require a substantial amount of fieldwork to consult archives and confront on-site architecture and the remnants of fishing practices. Hence, the empirical research will approach the methods of architectural and marine ecology history to envisage a combined output. There will be a constant back and forth between the research and the illustrated typology/mapping output, with one feeding the other and vice versa. In fact, elaborating the typological inventory will mean looking for archival material and sources that will, in turn, inform the research content. Conversely, findings in empirical research will feed the examples in the inventory.

Fieldwork

This is a crucial aspect of the methodology. It will be prepared in the first semester of the research project and will comprise seven locations that will act as case studies. The fieldwork will allow local archives to be consulted, local history to be studied, primary sources to be gathered, and surveys to be conducted on architectural remnants and past examples of fishing architecture. The rationale behind the selection of the locations is explained below. The first fieldwork campaign will happen at the turn of year 1 to 2, allowing the results to be assessed and the methods and practices refined before further campaigns are undertaken, at first every six months, then more intensively in years 4 and 5. Each location will be scouted and researched by two team members, with hired local assistance capable of providing guidance and translation (if required) as well as technical support on the preparation of the campaigns. The fieldwork will provide the fundamental elements for conducting empirical research and building up the content of the various WPs.

— Deliverables: Three months after the conclusion of each campaign the responsible team members will deliver a report to be appended to the ongoing work package (D1–7).
— Timeline: months 13, 19, 25, 30, 31, 36, 37.

Workshops / Lab meetings
After the project warm-up, to ensure collaboration within the group, a monthly lab meeting will be held to report on developments within the project. More important, every semester there will be a more ambitious workshop welcoming visiting scholars. These sessions (five in total) will also be a venue for presenting mini briefs on ongoing research findings deemed relevant to the group. The workshops will be important occasions for expanding the scope of the lab meetings, and we expect to be capable of welcoming undergraduate students and thus enriching the pathways for imbibing environmental science within the academic context of architecture.

— Deliverables: The warm-up workshop and the final conference will originate two reports addressing the main discussion topics (D8–9). — Timeline: months 7, 17, 23, 29, 41, 48 + conference month 54.

Discussion
The discussion will not be based on the locations or the data of specific fisheries—which will provide the sources to access examples to move on with in-depth discussion of the hypotheses—but will revolve around the research threads (research questions and critical layers). This strategy will guarantee the collective endeavour of the discussion, while fostering individual inventiveness and paths to progress and achieving knowledge breakthroughs. The discussion will take the form of six in-depth historical essays, which will be produced to compile the research progress in terms of data, methods, and hypotheses (WP6). The discussion will be a collective debate between team members and will incorporate the expertise of the interdisciplinary advisory board as well as visiting scholars. The essays, along with the content of the different WPs, will be collated in a collective research monograph.

Outputs
The main output of the research will be a collective research monograph, synthetizing the data, mapping, and typological inventories produced, and bringing

together six essays covering a variety of topics (WP6) with one of the team members acting in each case as main author. Within the field of architecture, and especially architectural history, research monographs have proved to be the most reliable instrument for the dissemination of knowledge. They synthetize a large amount of information in visible form, combining text and image in a form that is appealing to both scholars and the layperson. The outreach of books remains powerful, but thanks to the ERC grant it will be possible to envisage a monograph with a large print run whose content is also made available through open-access channels.

A secondary project output will be the reports delivered with each of the work packages (WP1–5, discussed below) and field work campaigns (D1–7). Instead of the synthetical and selective approach of the historical essays, the WPs will present exhaustive compilations of quantitative data and strong visual outputs of processed data. Each WP, which will mainly involve the collating, organizing, and processing of data, will be assigned to a duo of team members (WP1: Senior A + Postdoc Type; WP2: PI + Postdoc Data; WP3: Senior E + Senior A; WP4: Senior E + PI; WP5: Senior A + Postdoc Map). The WPs content will be cross-referenced to the fish species and locations, although the WPs are not necessarily limited to those selected (for instance, data will be gathered on whaling and herring, with examples from Denmark and Scotland). Each WP will include a synthetic annex addressing the five research questions and critical layers in light of the topic in question.

There will be other partial outputs, including the writing and publication of scientific essays, theses resulting from the PhD grants, public presentations of the work, and possible reports and recommendations to be addressed to the institutions and players involved. Nevertheless, they are not a structural part of the research project, which will be conducted with the WP reports and research monograph in mind. Despite this marginal presence in the proposal, these partial outputs will play an important role in shaping the project outreach and are by no means negligible. Instead of being the result of a strict and quantitative agenda, they will unfold organically in relation to the project's evolution, taking advantage of the working relations fostered during the fieldwork campaigns, the expertise of the advisory board and visiting scholars, and other adventitious opportunities. This organic evolution will guarantee the appropriateness of *Fishing Architecture* in the various contexts in which it will be mobilized.

Work packages

WP1 Typologies

What are the most characteristic elements of fishing architecture? Harbours, fishing stations, drying racks, freezing plants, and warehouses? If there are specific constructions for specific fish species, there is a wealth of typological equivalents between the architecture of different regions and fishing practices.

This WP consists of a detailed illustrated inventory of fish-related constructions, from all along the North Atlantic coast. There will be three descriptive levels: general identification; reference representation; detailed design. The inventory will become a fundamental resource in the development of the research and will be continuously updated until the conclusion of the project.

— Deliverables: a set of files with architectural examples from across the North Atlantic region, comprising elements drawn from the seven locations; written annex addressing the research questions and critical layers (D10). — Team: Senior A + Postdoc Type. — Timeline: month 18.

WP2 Species
What is the spatial behaviour of fish? Depending on the species, fish have individual and collective behaviours: they live in different areas of the Atlantic according to the various stages of their life cycles (embryonic, larval, juvenile, adult, and senescent), migratory patterns, and environmental factors. This work package will represent fish according to architectural standards, describing both their sizes in spatial terms and their geographical distribution. Significant investment will need to be made in understanding and adapting existing tools from fisheries (sonar visualization such as TruEcho CHIRP FCV-1900B) and converting them to the standards of architecture. This multidimensional graphic rendering differs from marine ecology representations of fish species and is one of the high-risk components of the research project. It happens that if successful, it will provide a tool for visualizing the characteristics, behaviour, and status of fish species. Eventually, it can perhaps be reproduced and expanded to other fields of marine research.

— Deliverables: a set of files with quantitative data and visual output related to the selected species and complementary data and outputs on other species; written annex addressing the research questions and critical layers (D11). — Team: PI + Postdoc Data. — Timeline: month 24.

WP3 Fishing gear
What is the architectural apparatus of different fishing gears? This work package will visually represent fishing technology with architectural tools. Previous research has demonstrated the convenience and novelty of such representations (Fernandes & Labastida, 2020). It requires a representation not only of fish traps, to show how their autonomous mechanisms function, but also of the ecological system they are part of. The scale of such an apparatus set up in the open sea matches the scale of urban settlements, while combining the reading of marine landscapes with terrestrial constructions provides useful insights into the intertwined nature of

land and sea that this research project is assessing. The systematic representation will focus on as many examples as possible, approaching the rationale of an open inventory. Its files will be combined and intertwined with the architectural typologies inventory.

— Deliverables: set of files with architectural drawings of fishing gear and related data; written annex addressing the research questions and critical layers (D12).
— Team: Senior A + Senior E. — Timeline: month 30.

WP4 Landings
This work package will focus on gathering data from fish landings. It is a necessary organization of existing information and, in principle, it does not involve original research. Most of the data has already been compiled into important collaborative platforms, a valuable work resulting from the thorough critical assessment of primary sources. Still, for the project it is vital to master the existing data and have access to reliable statistical information in order to verify the research hypothesis. From a marine ecology perspective, statistical data sets, although incomplete and possibly biased, are still the fundamental instrument for building historical accounts of the functioning of past ecological systems. From an architectural perspective, managing this data will provide a vital counterpart to the physical description of terrestrial transformations.

— Deliverables: a set of files with quantitative data on fish landings focused on the main species throughout the North Atlantic, including visual output of the main figures; written annex addressing the research questions and critical layers (D13). — Team: Senior E + PI. — Timeline: month 36.

WP5 Networks
People fish for food. The ability to preserve a fish is the key to transforming a fish into a commodity and a venture into an economic success. It is the wealth generated by fisheries that pushes trade to the point of putting pressure on the balance of marine ecology. The networks of fish distribution vary greatly according to the fishing techniques, food-processing technology, and commercial networks involved. Food processing has a direct impact on the form of architecture. This work package will describe the multiple scales implicated in various fish-network systems (fresh consumption, salting, canning, freezing, etc.) addressing three lines of inquiry. How far does a fish travel from the place it was processed? To what extent do these networks depend on terrestrial infrastructure, such as railways, highways, and airports?

— Deliverables: a set of files with mapping, tracing the main logistic and ecological networks implicated in Fishing Architecture; written annex addressing the research questions and critical layers (D14). — Team: Senior A + Postdoc Map. — Timeline: month 42.

WP6 Essays
Each team member will be responsible for delivering a historical essay connecting the relevant hypotheses to address the specific research questions. There is no preliminary plan for the content of the essays, and they will result from each researcher's perspective, interests, and knowledge breakthroughs. This WP will provide the material for the research monograph, which will synthetize and divulge the outputs.

— Deliverables: historical essays (D15–20). — Team: PI + Senior A + Senior E + Postdoc Map + Postdoc Data + Postdoc Type. — Timeline: month 48.

Locations / Case studies
Seven locations across the Atlantic will serve as case studies. In methodological terms, they will not function as conventional case studies but rather as anchors to access regional sources, problems, and examples. For instance, Gloucester in Massachusetts can provide the local contacts to extend research to Cape Cod and Maine, following United States institutional threads and documentary sources. Another might be Harbour Grace, rather than St. John's, in Newfoundland. Focusing on a settlement in Conception Bay does not mean that the case study will not unfold to include Fogo Island or even the Labrador coast, but that the selected location will provide a way in to a larger-scope analysis. Other tentative locations will be Grindavík in Iceland, St Ives in England, the Vesterålen archipelago in Norway, Douarnenez in France, and Olhão in Portugal. These location case studies are part of the risk-mitigation strategies, narrowing down the broad scope of a research project that spans the entire North Atlantic and quickly creating entry points into the research. The goal is not to produce outputs as case studies but rather to structure the empirical research.

The selection of the locations will be finalized during the project warm-up. Their choice combines the logics of fish species and the relevant architectural remnants of fisheries. For instance, Gloucester and Olhão are cases in point for tuna fisheries, although Gloucester may be better known for its cod (or now lobster) fisheries and Olhão for sardine fisheries. Grindavík and the Vesterålen are examples related to cod fisheries, whereas Douarnenez and St Ives are reference points in the history of sardine fisheries. In all cases, despite their strategic relationship to fish species, each location has developed various fishing practices and cultures, expanding its own logic and providing reference material for the data, research questions, and critical layers.

Critical layers
These are key to understanding how the methodology unfolds. It may be that the critical layers have a stronger intellectual impact in the research process than the operative choice of case studies or the contents and methods used to organize the work packages. Even though the critical layers do not correspond to specific deliverables, they are a pervasive feature of the project and of structural importance to the research.

a) Marine ecosystems
This is where the fish lives. To assert the relationship between architecture and marine ecosystems, we will have to consider both environmental and ecological histories. In the Atlantic, a variety of environmental factors in constant mutation, among them water salinity and temperature, currents, and the geological character of the seabed. These are accompanied by equally complex ecological conditions. The relationships between species in food chains, ranging from plankton to the higher trophic levels, vary according to predatorial behaviour and seasonal dynamics. Then there is the fish itself: its individual and social behaviour, dietary preferences, spawning habits, growth rate, migration patterns, population distribution, and genetic codes. The existing research on the history of marine ecosystems established rigorous critical methods for assessing records of fish landings and a variety of sources to arrive at a consistent narrative of the ecological transformations. These materials make it possible to correlate architectural events with ecological episodes.

b) Fishing technology
Fishermen chase fish. As a human activity, fishing is better documented than marine ecosystems and can be inscribed within the history of technology. Fishing history combines the histories of navigation, fishing gear and many other innovations that transformed how many fish were caught. Fishing technology is often used as an entrance point to the history of marine ecology. Our analysis begins with the fishing vessel which, in architectural terms, we will assess in two ways: first, by looking at the sea-land interface and how the boat docks; and second, by considering the implied fishing effort and the vessel's scale. The former defines the infrastructural requirements and is key to studying the establishment of settlements, the impact of artificial harbours, and the physical relationship between fishing grounds and workforce. The latter relates to capital needs and energy consumption, to the scale of the workforce and the related fishing output. Fishing vessels were transformed by the introduction of steam power, steel hulls, and diesel

motors. Such technological changes to boats had a major effect on catches, and the related variations in travel time and energy consumption between the harbour of origin and the fishing grounds are a crucial factor in the relationship between ecological pressure and architectural output. The ecological pressure exerted by the fishing vessel varies according to the fishing gear and technologies available, from navigation systems and tools, fishing lines and nets, to the maps, charts, and sonar devices used to locate the prey. At first, this gear might seem far from architecture, but with increases in the speed and the scale of fish landings, higher-capacity processing facilities must be built. Its characteristics of the fishing gear also determine the crucial moment of capture, when the balance of environment and ecosystem is actively interfered with, as well as the results of this interference.

c) Food processing

Food processing is the pivot of all fishing architecture, and fish-processing facilities, from drying racks to canneries, are the most obvious architectural by-product of the industry. The production chain that starts in the boat when the fish is caught ends when the edible merchandise is shipped to consumers. Studying the nature of each chain and its repetitive mechanics provides an architectural framework by means of which we can assess the implications of the fishery, and it provides statistical data to relate the processing unit to its ecological counterpart. Each processing chain has a specific technical apparatus, and thus to historicize fishing architecture requires its various iterations to be taken into account. For instance, the most dramatic historical shift in the architectural shape of fishing landscapes accompanied the introduction of the freezer. This is not just because of the monumental presence of freezing plants within ports and fishing villages but also due to the use of freezers at various points in the production and consumption chains. The use of drying racks has also had a significant impact. Each of these processing techniques implies a different landscape.

d) Politics

Fish have no nationality, and an environmental history of architecture is not possible within conventional national boundaries. Nonetheless, most of the data and architectural phenomena are still explained with reference to specific sociopolitical contexts. Politics inserts itself between fish and fishing architecture. It interferes with the ecological pressure exerted upon fish populations. The dynamics involved in fishing politics can be assessed from different angles: in terms of territorial disputes over maritime sovereignty and fishing rights; of state support for specific fishing policies and technologies; of the ties of the fishing industry to navies and war efforts; of national cultural and economic policies that foster biased narratives, folklore, and heritage to nurture a specific imagery of fishing. A history of Atlantic architecture that transcends local biases requires us to confront Atlantic politics. The shifting lines of maritime sovereignty are indicative of major fishing disputes, with various countries claiming their right to access fishing grounds. Such disputes allow us to follow the fish to shore and to answer the question of how the path of two fish from the same shoal, captured by vessels of different nationalities, will differ both geographically and architecturally.

e) Consumption habits

Fresh, dried, salted, canned, frozen: fish can be consumed in many ways. Consumption habits dictate the urban expression of fisheries, from market stalls and fishmongers to supermarket freezers and, most importantly, place specific demands on associated processing chains. Thus, how we eat affects ecosystems and their architectural counterparts. Consumer behaviour depends on the effectiveness of investment policies ranging from advertising to legislation. The price of fish is a key factor in determining demand on fish biomass, and the scale of food processing responds to the balance between supply and demand that sets the market value of fish. The economic value of ecological systems fluctuates according to demand for resources as well as ecological factors. This relationship seems to have no architectural manifestation, but it is within these economic dynamics that architecture operates, and thus practices that shape consumer behaviour also affect fishing architecture. For example, increasing demand propels industrial development and favours construction. Once built, factories and processing facilities have a powerful inertia and foster increased consumption to secure their economic survival and growth.

Fish species

Three fish species, different in terms of physiology, life cycle, and ecological characteristics, were chosen to structure the project. They were selected on the basis of their commercial value and the historical role they have played in the fishing industry:

(1) cod, which shifted from a long-established culture of drying and salting to the fish-filleting process; (2) sardine, which took on a key role in the popularization of canning;

(3) tuna, one of the most valuable commercial fish species, and/or salmon, whose ambivalence toward saltwater and freshwater habitats can cast a different light on the project.

Cod

Cod (*Gadus morhua*) is a demersal fish that preys on other fish: it has a strong muscular mass and is low in fat. Cod inhabits the zone where warm and cold currents meet, which allows it to seek out the particular water temperature and food that accords with the various stages of its life cycle. Today common cod range from 75 to 100 cm and although commercially extinct in the Grand Banks, it is still an important economic resource in the Eastern Atlantic up to the Barents Sea, whereby its conservation status is vulnerable.

Sardine

Sardine (*Sardina pilchardus*) is a pelagic fish that lives in the upper levels of the water column and occupies a lower rank than cod in the trophic chain. Rich in fatty acids, it benefits from strong upwellings, where the upper layers of the water column are simultaneously cold and rich with nutrients. It migrates in large schools, which protect it from predators, moving in deeper layers of the water column during the night and moving up to feed near the surface during the day. Its distribution ranges throughout the northeast Atlantic. Average sardines measure about 20 cm in length, reproducing between October and April with a conservation status considered “least concern”. The fact that it occupies a lower rank in the trophic chain makes it a sensitive species to environmental cycles, with volatile populations responding to better or worse recruitment years.

Tuna

Atlantic bluefin tuna (*Thunnus thynnus*) is a large apex predator capable of swimming at great speed, and it is part of a large family of tuna with a variety of related species and subspecies. They can average between 2 and 2.5 metres in length and are found throughout the Atlantic since they can adapt to cold and warm water temperatures, diving down to depths of 500 to 1,000 metres. They concentrate to spawn, which they do mostly in the Mediterranean and in the Gulf of Mexico, and they are highly migratory, crossing the Atlantic at speeds up to 88 kilometres per hour. Most species of tuna are listed as endangered.

As an alternative to tuna, Atlantic salmon (*Salmo salar*), an anadromous fish, could provide an outlier case study. Spawning in rivers, they spend their lives in the sea and return to their natal rivers to spawn once in their lifetime. One interesting detail of salmon biology that is of great relevance to our research is that, once in the ocean, European and American salmon are difficult to distinguish, and despite their unique terrestrial filiation, they are part of a common ecological pool. Once salmon is fished in the international waters of the Atlantic, the ecological balance of both European and American rivers is challenged. Furthermore, salmon is the star of fish farming and aquaculture, a fundamental touchstone for assessing contemporary ecological challenges in marine systems, a subject which is beyond the limits of our historical research. Other examples of fish and marine creatures could and certainly will form part of the research, as would be the case for large mammals such as whales or other historical commercial fisheries like herring, haddock, or hake. In any case, the methodology we will use will follow the thread of three main species of the kind tentatively described here to articulate the five critical layers of the research project.

Research questions

1

Are there variances in the architecture built to catch, process, and consume different species of fish? — Imagine a canning factory and a smokehouse: How does sardine architecture differ from salmon architecture? Even the same fish has different landscapes, as is the case with cod: What are the differences between a landscape built to salt and dry cod (imagine Newfoundland in the nineteenth century) and a cod fillet-freezing facility (imagine Norwegian freezing plants or even a factory boat)?

2

What fish biomass does each type of architecture/building consume? — Every day, a canning factory processes a quantity of fish. What are the dimensions of the factory in relation to the area in the sea occupied by the fish that it processes during one day? What are the scale relationships between resources, food production, and consumption? Unlike buildings, fish do not occupy a fixed position, making any linear answer difficult. Still, these simple questions open up a broad exploratory field for assessing architecture in relation to fish. If we compare a cod-fillet-freezing plant in the 1950s to a contemporary canning factory, what are the architectural scales and forms in relation to their consumption of fish biomass?

3

What physical forms do different fishing technologies have? — A fish trap has an architectural form. Trawling nets are not all the same: their dimensions vary and their physical form can be represented in equivalent terms to buildings. The scale of gear has an immediate impact on the amount of pressure put upon ecological systems. Reading the fishing technology in parallel to the architecture directly relates the different scales that exist in land and on the sea.

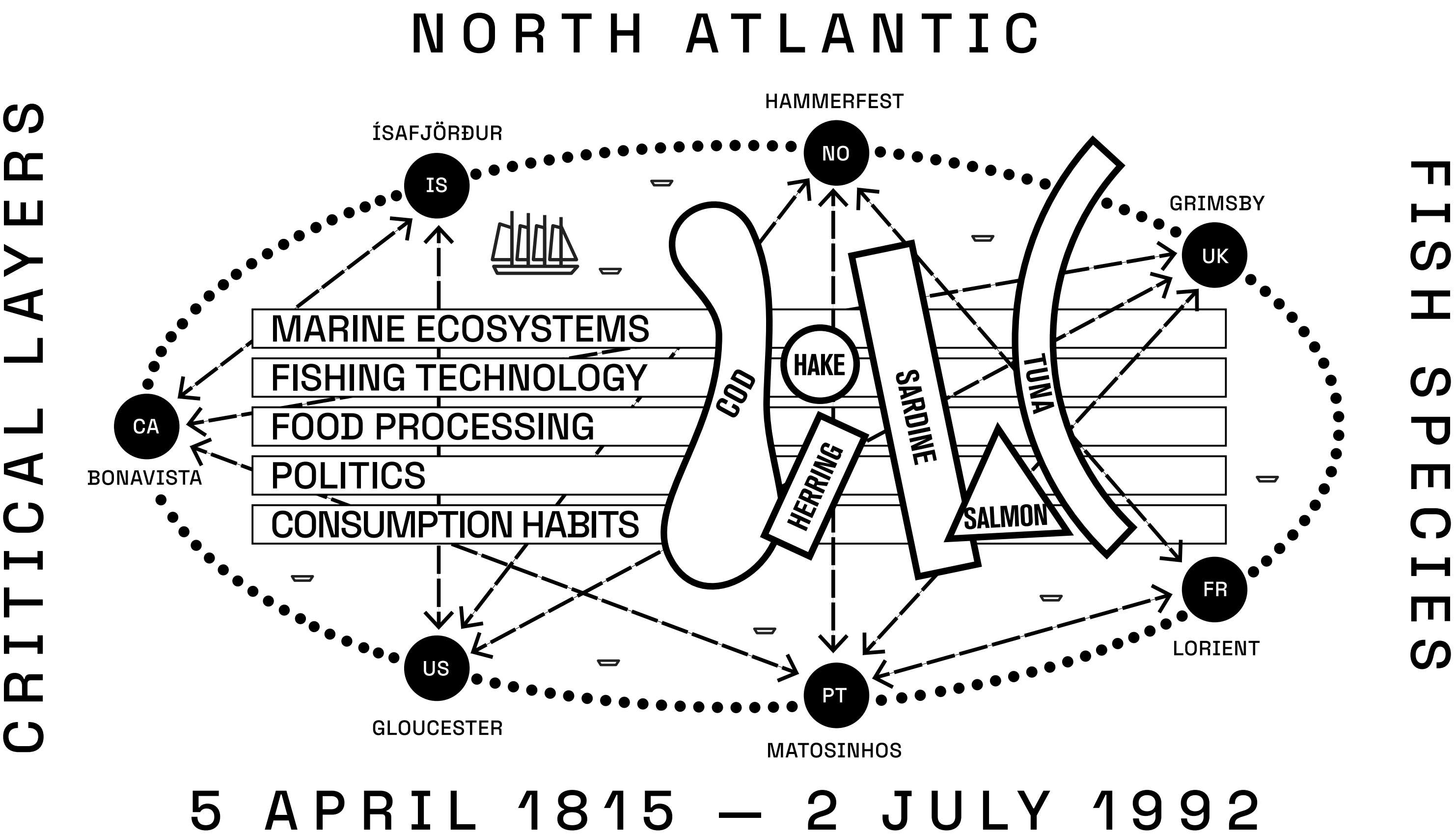
4

What is the spatial relationship between the activities of harvesting, processing, and consuming fish? — After mapping and layering the various scales and contexts of fishing architecture, the key research question focuses on the spatial relations that will become visible in between. How can that biomass be traced in terms of the fish's spatial occupation of their wild oceanic environments? And how does that distribution relate to the overall fish species population distribution within the North Atlantic?

5

How do fluctuations in marine ecosystems impact the performance of fisheries-related infrastructures?

— Is there a connection between the distribution of fish populations and fishing communities? If so, how did it change over the last century? How many former fishing communities disappeared or readjusted their economies when their natural resources vanished? What were the new forms of architecture when fishing had gone? And what happened to the marine ecosystem in the process of readjusting its ecological balance?



FISH-A Funded by ERC-CoG2022 101044244
— European Comission, Horizon Europe

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European Research Council
Established by the European Commission