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COMMUNITIES

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Analyses of fishing cultures identified by core features pertaining to life modes, modes of operation, fishing gears, communities and economic value chains in the Jammer Bay area

Søren Qvist Eliasen
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AAU OPEN

AALBORG UNIVERSITY
OPEN PUBLISHING

Fishing Cultures: Contrasts, Co-Existence, Contradictions & Communities

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1st Edition 2026

Graphic layout: Anja Lykkegaard/AAU OPEN

Cover design: Louise Højrup Sørensen

Graphic figures: Lise Glindvad

ISBN: 97887-7642-177-9

DOI: 10.54337/aau.fishing.cultures

This publication is published exclusively in electronic format and is only available online.

Published by: Aalborg University Open Publishing | www.open.aau.dk

The research in this publication is funded by the European Union through the European Maritime and Fisheries Fund (EMFF) and the Ministry of Food, Agriculture and Fisheries of Denmark, and the Danish Maritime, Fisheries and Aquaculture Programme (EHFAF) and the Danish Fisheries Agency, respectively via the projects "Mapping of seabed habitats and impacts of beam trawling and other demersal fisheries for spatial ecosystem-based management of the Jammer Bay (JAMBAY)" (EMFF grant agreement No. 33113-B-23-189) and "Ecosystem-based spatial high-resolution tools for marine fisheries management (ECOSPACE)" (EHFAF grant agreement No. EFMBV-23-0024).

Co-funded by the European Union

This book has been published in collaboration with Han Herred Havbåde and Center for Sustainable Lifemodes.

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Abstract

By developing the concept of Fishing Cultures, the study offers new structured ways to understand the complexity, dilemmas, and modes of coexistence of the different kinds of fishery in one of Europe's most productive marine habitats, Jammer Bay in Skagerrak. The linkages between the distinct fisheries and communities are further qualified by the assessment of the Fishing Cultures' contribution to the local economy, via the development of a model of Local Economic Effects (LEE). Hence, the study contributes with conceptual tools for managing the fisheries in Jammer Bay area taking into consideration environmental aspects as well as cultural, social and local economic aspects. The method and conceptual development may be applicable and appropriate in other seas and fishing fleets.

Dansk resume om den uløste konflikt mellem bomtrawl og dansk kystfiskeri i Jammerbugt (Danish summary)

Jammerbugtens danske fiskere er fanget i et modsætningsforhold til store hollandske bomtrawlere, som driver fjernfiskeri i Jammerbugten. De danske fiskere, der rammes, kommer fra flere forskellige fiskerikulturer, som er identificeret i bogen. Det er i høj grad de, der fisker lokalt og lander på standen, men også fartøjer, der fisker med langliner, garn og snurrevod samt mindre trawlere fra de små og større havne i og omkring Jammerbugt. Konflikten skyldes bomtrawlernes manglende evne til at dele fælles fiskeområder og fiskebestande med andre fiskerikulturer på en bæredygtig og holdbar måde. De tunge bomtrawls påvirkning af havbunden, havets fødenet og ungfisk truer hele fiskeriet i Jammerbugten:

1. Bomtrawling flår stenrevene fra hinanden og forårsager permanent skade.

2. Bomtrawling ødelægger fiskenes levesteders biodiversitet, resiliens og holdbarhed i havet.

3. Bomtrawling med tunge kæder og høj hastighed hindrer brugen af garn og snurrevod.

4. Fordi fiskeri med langstrakte garn og snurrevod begrænser bomtrawlernes bevægelsesfrihed, frygter de fysisk sårbare garn- og vodfiskere bomtrawlernes voldsomme og ulovlige fremfærd.

5. En 500 tons bomtrawler er 25 gange større end en dansk kystbåd og bruger 32.000 liter diesel på en 5-dages tur, hvilket efterlader et ekstremt højt CO2-aftryk.

Fra et bæredygtighedsperspektiv er bomtrawlernes brutale fangstmetode, der består i 'at åbne bunden', den diametrale modsætning til snurrevodsfiskernes skånsomme, 'audio visuelle' fangstmetode.

Bomtrawling opgraver og knuser fødekædens bløddyr for at tiltrække flere fisk, mens der trawles. Små snurrevod og garn er lette redskaber, med hvilke det er meningen at påvirke fødekæden så lidt som muligt for at bevare fiskenes levegrundlag. De to måder at fiske på havbunden er ikke forenelige med hinanden.

Repræsentanter for bomtrawlernes fiskerikultur argumenterer for, at deres bestræbelse på at 'åbne bunden' ved hjælp af bomtrawl er fordelagtig for andre fiskere, hvis de tør fiske tæt på det bundområde, der er blevet åbnet af bundtrawleren, fordi skyen af knuste bløddyr, der graves op af bomtrawlens jernkæder, trækker flere fisk til trawlsporet. De lokale fiskere betragter det synspunkt som alt for kortsigtet, fordi det ikke tager højde for den langsigtede effekt af tung bomtrawling på levesteder, fødenet og fiskebestande i Jammerbugt.

Fra de hollandske bomtrawlfiskeres perspektiv skal de lokale fiskere i Jammerbugten omstille sig til at drive fjernfiskeri for at kunne udnytte andre havområder, så de kan lade fiskens levesteder i Jammerbugten komme sig efter at være blevet 'åbnet op'. I bomtrawlfiskernes verden er det kun 'de alt for høje brændstofpriser', der kan bremse den udvikling. Kystfiskernes modsvar er, at det hverken er bæredygtigt, kvalitetsgavnligt eller nødvendigt at ødelægge havbunden ved at bruge for tungt grej og meget brændstof.

Bag de to synspunkter ligger fiskernes erfaringer med at fiske i samme hav. I et havområde som Jammerbugt, hvor de lokale fiskere strækker deres kilometer lange garnlænker og snurrevodstove, er det svært for en bomtrawler at pløje havbunden frem og tilbage i høj hastighed hen over de attraktive fiskepladser, fordi et fartøj i fremdrift skal vige for et fartøj, der er forbundet med sit fiskeredskab i havet – medmindre trawlskipperen vælger at overtræde søloven. Det sidstnævnte er en praksis, som skræmmer kystfiskerne, fordi en 500 tons bomtrawler er 25 gange større end den danske kystfiskers snurrevodsbåd og garnbåd.

Hver gang de risikerer, at bomtrawlerne er på vej til Skagerrak, er det for kystfiskerne et åbent spørgsmål, om de tør sætte deres vodtove eller garn i havet på grund af faren for at miste redskaberne. Hvis bomtrawlerflåden allerede trawler i farvandet, lader man være med at gå på havet og sætte garn eller vod, hvor bomtrawlerne er. Det betyder, at de store bomtrawlere overtager fiskepladserne. Og når blæsevejr, havstrøm og bølger tvinger de lokale fiskere til at blive i land, kan bomtrawlerne i fred besætte hele området. Resultatet er, at de lokale garn- og vodbåde bliver fortrængt fra de fiskepladser, som er grundlaget for deres årscyklus. Det bomtrawlsfiskeri, som ikke leverer noget økonomisk bidrag til området, er samtidig den fiskerikultur, som systematisk ødelægger det havmiljø og den mulighed for at færdes frit og lovligt på havet, der er forudsætningen for de lokale kystsamfund i Jammerbugt, og som fortrænger det lokale fiskeri med skånsomme metoder, der bidrager mest til de lokale samfunds økonomi.

Jammerbugts fiskersamfund og fiskersamfundet i Urk kæmper begge for deres overlevelse, og så længe denne kamp foregår i Jammerbugten langt fra Urk, og derfor ødelægger Jammerbugts havbund og biotoper, så er det de danske kystsamfund, som mister deres fundament. Den nuværende bølge af bomtrawlere invaderede Jammerbugt i 2016 for at jagte rødspætter og tunger, fordi de arter forsvinder fra hollandsk farvand i den sydlige Nordsø. Kun når rødspættebestanden også forsvinder i Jammerbugt holder bomtrawlerflåden sig væk. Men de danske fiskere ved af erfaring, at bomtrawlerne vender tilbage, så snart rødspætternes levesteder og fødegrundlag viser tegn på at komme sig.

Kun en aftale mellem Holland og Danmark om at ophøre med bomtrawlsfiskeri i Skagerrak, formidlet gennem forhandlinger og beslutninger i EU, kan afslutte den katastrofale kamp og miljøødelæggelse i Jammer-

bugts biologisk højproduktive, men også sårbare marine økosystem. Som mindst af alt har brug for at blive et varigt eksempel på konsekvenserne af at overskride de planetære grænser.[1]

Map by oceanographer Pernille Schou Jacobsen (based on EMODnet Bathymetry DTM 2024).

1 Richardson 2023.

Introduction and aim

As discussed by C. F. Drechsel in his work from 1890, *Oversigt over Vore Saltvandsfiskerier*,[2] on the geology, biology, technology, and ethnology of Danish saltwater fishery, 'grand fishery' and 'coastal fishery' have always been coexisting in Danish waters. But, even if it is still common to understand the fishing sector as a continuum between two poles, this differentiation between large scale and small scale – or 'industrial' versus 'artisanal' – fishery is neither sufficient for a sustainable fisheries management nor scientifically appropriate for the explanation of the specific conflicts in and between fishing fleets. The interesting question for the fisheries management is still "how do the distinct kinds of fishery impact each other, the fish stocks, and their habitats?"

The aim of this study is to develop a mode of analysis with which it is possible to identify and describe in a systematic way the diversity and characteristics of the Fishing Cultures operating in the Jammer Bay area that is one of the richest fishing grounds with a huge biodiversity in the Skagerrak Sea between Norway and Denmark. Methodologically, the distinct life-modes of the different economic cultures in the present fishing industry are linked to distinct modes of operation, fishing gear, and catching methods applied by fishing crews coming from four different hometowns in the Jammer Bay area as well as from fishing ports far away from this area. Hence, each Fishing Culture is elaborated as a specific composition of life-mode, mode of operation, gear types, and home port communities.

2 Drechsel 1890. C. F. Drechsel did continue and improve the government-initiated studies of Danish fishery elaborated by G. C. Oeder in 1771 and A. F. Smidth in 1859, 1861, 1864. Schmidt 1864 describes among others the fishery in Jammer Bay 1863. See Moustgaard 1987.

Fig. 1: *Jammer Bay is the western part of the Skagerrak Sea between Norway and Denmark. The north-western part of the Jammer Bay area comprises a section of the deep Norwegian Slope. As shown in Figure 2, the JAMBAY research project documents, that the seabed of Jammer Bay is not a simple sandbank, but a very biologically productive structure of distinct types of habitats. Contains data from the Danish Geodata Agency, Danish Depth Model, 50 m resolution. 31012026. Model and data are not suitable for navigation.*

The empirically realised Fishing Cultures benefit from ecosystem goods and services and impact the system in distinct ways. Moreover, they contribute to societal sustenance of communities at the local, regional, and international levels in contrasting ways. Thus, the further aim of this study is to investigate interactive patterns of co-existence and competition for resource use as well as the environmental impacts and contributions to the value chains of communities in the Jammer Bay area.

Because of the politically and administrative urgent need to understand the precarious coexistence between local and foreign fishing vessels' operation in Skagerrak, the study addresses the relation between the Fishing Cultures of coastal communities in the Jammer Bay area and the Fishing Cultures of communities in the Southern North Sea area, whose long-distant vessels are also operating in the Jammer Bay. This analysis includes the development of a model for Local Economic Effect (LEE) applied on the fishing communities of the Fishing Cultures.

The conceptual development of Fishing Cultures and ethnological analysis of their empirical co-existence is part (Working Package 4) of the project "Mapping of seabed habitats and impacts of beam trawling and other demersal fisheries for spatial ecosystem-based management of the Jammer Bay (JAMBAY)" (Grant Agreement No 33113-B-23-189), that is funded by the European Maritime and Fisheries Fund (EMFF) and the Ministry of Food, Agriculture and Fisheries of Denmark. In this research project geologists from GEUS explore the deep geophysical structures and processes of the seabed, biologists from DTU-Aqua explore the marine habitats and ecosystem pressures of the different fisheries, and ethnologists from Centre for Sustainable Life-Modes, CBL, explore the system of Fishing Cultures and socio-economy, with the common aim to investigate how processes at the geological, biological and cultural levels impact each other in the Jammer Bay area of Skagerrak.[3]

This work builds on a long tradition of fishing culture studies, of which we will mention a few to clarify the perspective, point of departure, and mode of analysis this study is elaborating.

In 1949 the Swedish ethnologist Olof Hasslöf published the groundbreaking work *Svenska Västkustfiskarna*, a work comprising basic studies of the Swedish west-coast fishers' material culture, social organization and modes of operation from pre-industrial to early industrial fishing. From our perspective his most important contribution is the characterisation of the diverse ways of life and conceptual worlds of the share organised fishing crews and the cooperative culture of their local communities (in contrast to large-scale fishing companies).

Raul Andersen and Cato Wadel published (1972) the work *Comparative Problems in Fishing Adaptations* in the series North Atlantic Fishermen Anthropological Essays on Modern Fishing at the Memorial University

3 https://www.aqua.dtu.dk/-/media/institutter/aqua/publikationer/rapporter-451-500/445-2024-jambay-executive-report.pdf
Geophysical mapping of seabed substrates and habitats (JAMBAY WP1). GEUS Rapport 2024/24: https://data.geus.dk/pure-pdf/GEUS-R_2024-24_web.pdf
https://www.aqua.dtu.dk/-/media/institutter/aqua/publikationer/rapporter-401-450/446-2024-physical-fisheries-impacts-on-seabed-habitats-jambay-wp2.pdf
https://www.aqua.dtu.dk/-/media/institutter/aqua/publikationer/rapporter-451-500/448-2024-fisheries-resources-and-socio-economy-jambay-wp4.pdf

of Newfoundland, St. John's. This work is one of the 1970s new generation of anthropologists and ethnologists' attempts to elaborate a comparative understanding of 'fishing adaptations' inspired by a set of selected perspectives such as 'sexual division of labour', 'crew formation' in 'small-scale' and 'large scale' fishing, 'resource management', 'technological change', 'common property resources', 'information and decision-making' in modern North Atlantic fishing.

In 1974 the two Danish ethnologists Ellen Damgaard and Poul Moustgaard combined these perspectives into a fieldwork-based study of the contemporary sole-fishery with gillnet from the little harbour community of Hvide Sande ('White Sand City') on the Westcoast of Jutland. Their book *Garnfiskere* describes the way in which all families in a whole community took part in the throughout share organized fishing as either crew-members on the fishing boats or family-members clearing up and repairing the gillnets. Combined with high-value cod-fishery, plaice-fishery and turbot-fishery using specific kinds of gillnets in successive seasons throughout the year this highly specialised fishing community became an example upon the ideal-typical way of life of cooperatively working, income-sharing, and boat owning share-fishing families.

The Swedish ethnologist Orvar Löfgren published his *Fångstmän i industrisamhället* in Lund 1977, where he explained how new generations (between 1800 and 1970) step by step developed a specialised sea-going fishery, in which they by means of family strategies, formation of an advanced marine experience base, fisherman owned boats and share-organized crews made a 'hunting' fishing culture competitive and attractive in (contrast to the surrounding) modern industrial society.

The Hungarian ethnologist Béla Gunda edited in 1984 the work *The Fishing Culture of the World. Studies in Ethnology, Cultural Ecology and Folklore*, volume 1–2, published by the Academy of Kiadó in Budapest. This work represents a comparative ambition where the idea of 'fishing culture' is in focus, yet the sample of interesting case studies from all over the World is conspicuous by its lack of a strict selection of its multiple aspects and perspectives. 'Cultural ecology' is a main aspect, though a methodological and conceptual inspiration from the natural ecology of biological science is not an explicit attempt. At the same time Thomas Højrup published a comprehensive analysis of the struggle for survival

of distinct and opposite fishing cultures in the large Limfjord region of northern Jutland in Denmark.[4]

In 1985 the Finnish ethnologist Outi Tuomi-Nikula published the article *The cultural-ecological aspect of culture change* in Studia Fennica – Review of Finnish Linguistics and Ethnology, Helsinki. As an ethnologist Outi Tuomi-Nikula presents an attempt to elaborate a systematic conceptual framework of a 'cultural ecology' inspired directly by biological ecology. With a point of departure in biology's mutual dependency between a 'species' and its ecological 'niche'. Outi Tuomi-Nikula develops an ethnological framework and methodology with the aim to gain the theoretical advantages of this connection between a biological lifeform and its niche in the analysis of fishing cultures and their change. His differentiation (and exemplification of relations) between the 'natural resource', 'technical resource', 'economic resource', 'social resource', and 'traditional resource' results in a methodology focusing on the interplay and change between such 'factors'. Because of that, the ambition to find a cultural ecological way to elaborate an ethnological concept of cultural lifeform that is able to determine the necessary prerequisites (as its distinct niche) fails to meet the expectations. Hence no scientific 'fishing culture' concept emerge.

The ethnologists Klaus Schriewer and Thomas Højrup did in 2012 edit the work *European Fisheries at a Tipping Point?* published in English and Spanish at Universidad de Murcia in Spain. The eleven authors of the work discuss the consequences for the fishing families and communities of the political wave of privatisation of fishing rights and fishing quotas in the coastal states of Europe. Even if the fisherman owned fleet of the modern 'hunters of the sea' as explained by Orvar Löfgren are competitive, the marketisation of the 'right of catch' and fishing quotas represent a political formation of new legal conditions of existence that favours capitalisation, consolidation of ownership, and large-scale advantages at the financial market of joint stock trawler companies. Hence, the work elaborates the understanding of the ways in which different cultural 'life-modes' in the European fisheries are pointing out distinct economic, technological and legal conditions of possibility as their specific necessary prerequisites. Each specific life-mode has its special 'niche' in the European Community's

4 Højrup 2013 (1983) p. 260-447.

Internal market and legislation, which it is necessary to defend politically, if the life-mode in question are going to survive the political struggles and competition on the markets of seafood and capital.

The Danish ethnologist Jeppe Høst gave an in-depth analysis of the changing conditions of existence implied by the Danish privatisation of fishing rights in his work *Market-Based Fisheries Management: Private fish and captains of finance,* published in the MARE Publication Series 2015. Just like Outi Tuomi-Nikula, Jeppe Høst takes his point of departure in the analysis of processes of cultural change, but in the meantime (since Tuomi-Nikula's work) European ethnologists – as exemplified by the work *European Fisheries at a Tipping Point?* succeeded in elaborating the conceptual framework of 'cultural life-modes', which are able to determine the necessary conditions of possibility of each distinct cultural life-mode. Jeppe Høst demonstrates, how this necessary interdependency between the life-mode and its prerequisites (i.e. its distinct niche) makes it possible to analyse how the transformation of conditions in the niche (here: access to fishing rights) implies transformation of the existing life-modes and introduction of new life-mode features in Danish fishing. However, the strictly selected focus on privatisation of fishing rights does not give rise to the further elaboration of a conceptual framework of specific 'fishing cultures', in which the features of life-modes is only one of several necessary core features.

In the work *Life-Modes in a Changing World Order*, published in 2024, Niels Jul Nielsen and Thomas Højrup analyse how the changing international conditions of existence impact life-modes in Europe and China in different ways. Elaborating the perspective of 'neoculturation', this work explores how people realizing different life-modes are defending the specific conditions for their own forms of life, trying to renew the conditions, replace dwindling conditions, developing new conditions of possibility and expanding favourable conditions of existence – often with the un-intended result, that their own life-modes are changing. In this way modes of life are changing the conditions of existence for each other and the society as a whole. Chapter 6 of this work is analysing this kind of 'neoculturation processes', where life-modes are impacting the conditions of other life-modes during the development of European fisheries from medieval times until the present situation, where several modes of life in the fishing communities are struggling for the maintenance and

expansion of their own necessary conditions of existence at the expense of others. An important aspect of this co-existence is the ways in which the distinct life-mode-specific worldviews consider and (mis)understand each other. To improve the understanding of the problems confronting the fisheries management in the European Union and its member states – and to amend this management – the work explicates the 'life-mode centrism' and controversies between distinct kinds of fishers. To do this, the work is further elaborating the concept system of life-modes, modes of production and state forms. Hence, the aspects of habitats, fishing methods and modes of operation are incorporated into the analysis, but these features are still not brought together as necessary elements of distinct 'fishing cultures'.

It is this next step in the development of a genuine 'fishing culture' concept and methodology that is presented in the present book on Fishing Cultures and the way these cultures contrast each other, co-exist in the same sea areas, are in conflict with each other in different ways, conceive of each other, and form distinct fishing communities – exemplified by their development and present situation in the Jammer Bay of the Skagerrak Sea between Norway and Denmark.

The diversity of habitats and ocean currents of Baltic water, Atlantic water, and North Sea water with different salinity, temperature and micro-organisms form a productive ecosystem in this part of Skagerrak.[5] Hence, several distinct fishing communities and cultures of fishing are utilizing the fish stocks in the sea area with different fishing methods and scales of vessels.

5 To maintain a high resilience of this ecosystem is of serious importance in the light of the challenges described in the Global Tipping Points Report 2025: Data and models now indicate that the Atlantic Meridional Overturning Circulation (AMOC) is reaching a tipping point from where the Greenland Pump, that is integral to the Gulf Stream's transport of warm water into North Atlantic Waters and the North Sea, may tip the processes, which make the Northwestern European winters mild. The result may be a climate like that of Alasca, in which the Nordic waters will be colder and icy and the weather more stormy. Hence the marine ecosystem's ability to adapt to these changes by means of the local habitats' adaptable resilience is necessary for the survival, neoculturation, and sustainability of the Fishing Cultures around the North Sea and Skagerrak. See Lenton 2025: https://www.agenda-2030.fr/IMG/pdf/gtp_summary_report_2025-v7a-161125-pages-lo-res.pdf and Richardson 2023: https://www.science.org/doi/10.1126/sciadv.adh2458

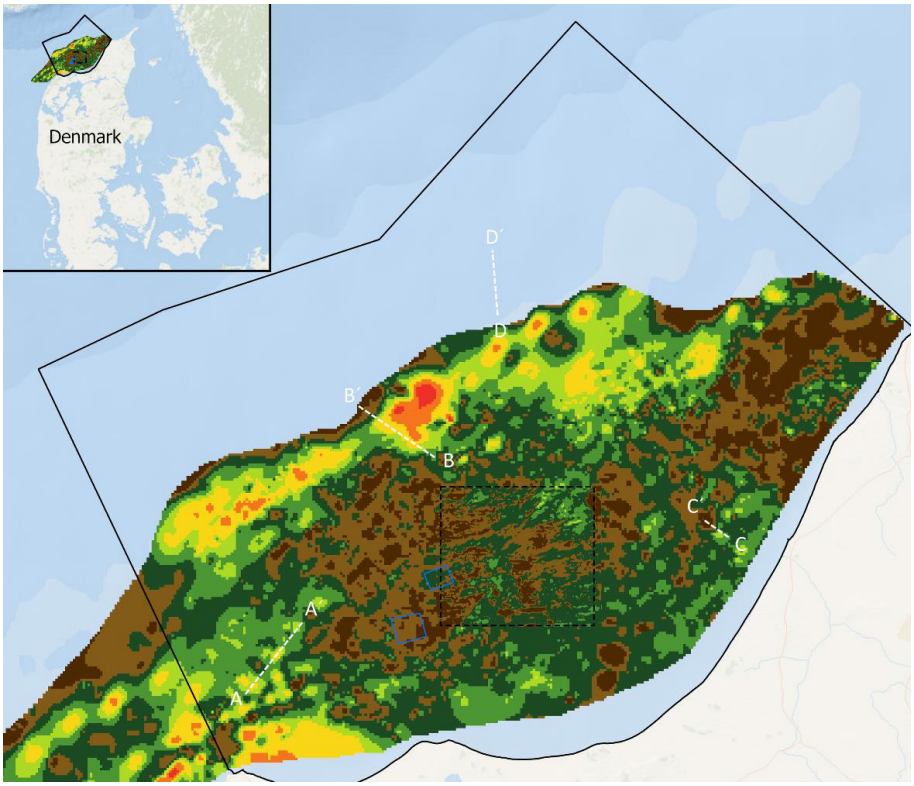

Fig. 2: *Thickness map of the mid-late Holocene sand in the Jammer Bay area. The brown colours show the areas where the thickness of drifting mobile sand is 0 – 2 m. The seabed of Jammer Bay has a mosaic structure of stone reefs, gravel and sand banks, characterised by variable sandy, clayey and stony substrates. The substrate distribution is linked to the occurrence of subsurface glacial and late glacial units cut erosively and superimposed by a Mid-late Holocene sand layer of variable thickness. The diversity of depths, currents and habitats generates the sea area's rich and vulnerable ecological food web.*[6] *Figure: 'Geophysical mapping of seabed substrates and habitats (JAMBAY WP1).' GEUS Rapport 2024/24. DTU Aqua Report no. 448–2024.*

Chapter 1, *Core features of distinct Fishing Cultures*, identifies the form variants of four common features that fishers combine in each distinct fishing culture. The number of variants comprises seven basic 'forms of life' operating in Jammer Bay area, two distinct 'modes of operation' applied by the fishermen, ten 'catching methods' used in distinct ways,

6 Dinesen et al 2025.

and five kinds of 'fishing communities' where the boats have their fishing harbour affiliation.

Chapter 2, *Fishing Cultures identified in Skagerrak*, describes the specific composition of the variants of the core features of seven distinct fishing cultures, the empirical realizations of which are operating in Skagerrak. These are: Beach landing coastal fishing (1), Dutch demersal beam trawling (2), Expansive harbour-based fishery (3), Harbour-based coastal fishery (4), Specialised gillnet fishery (5), Specialised anchor-seine fishery (6), and Profit-seeking large-scale fishery (7). It also describes how it is possible to shift Fishing Culture with the aim to maintain one's life-mode.

Chapter 3, *Value chains*, analyses two value chain links related to the Fishing Cultures in Skagerrak:

Value chain 1 – from landings to distinct seafood markets – differentiates between: 1) Direct sales of 'protein-fish' to processing meal- and oil industries, 2) Direct sales of RSW herring and mackerel to processing industry, 3) Direct sales of 'Norway lobster' to processing industry, 4) Direct sales of plaice for Urk, Netherlands, and 5) Sales via auctions, comprising a) High value products to European niche markets as well as b) Products for the general European fresh fish markets and further industrial processing.

Value chain 2 – describing each Fishing Culture's distinct contribution to local economy, community and welfare, and vice versa, – illustrates the description of these mutual contributions with flow diagrams of the use and distribution of value from the beach-landing coastal fisheries, the Dutch demersal beam trawling, the expansive harbour-based fishery, the harbour-based coastal fishery, the specialised gillnet fishery, the specialised anchor-seine fishery, and the profit-seeking large-scale pelagic and demersal fishery.

Chapter 4, *Fishing communities,* describes how the special composition of fishing cultures and their community back-up characterise five important fishing communities in very different ways.

Thorupstrand is a Jammer Bay beach landing site with ancient roots, where the fishing families encountered the privatisation and capitalisation of fishing rights twenty years ago by the formation of a common cooperatively owned community quota company. This made it possible to recruit the next generation to the share organised niche variant of high value fishery.

Hirtshals is a Jammer Bay harbour with a variable fishing fleet. The cooperative fish auction, and a variety of port-related craft businesses means that the harbour attracts many ships. Large pelagic vessels as well as a fleet of Danish seiners and small-scale coastal boats make up the fishing fleet.

Hanstholm is a North Sea and Jammer Bay harbour, where the expansive trawl fishing is dominating the community even if it is declining. In contrast to Hirtshals, Hanstholm Fish Auction is a private profit-seeking business, and the auction in Hanstholm is important for local boats belonging to all Fishing Cultures as well as expansive and large-scale bottom trawlers and fly-shooters from other North Sea countries.

Thyborøn has traditionally been the main port for landings from the Northern North Sea by Danish Seine vessels, Danish industrial vessels, and Dutch beam trawl vessels. The fish auction of Thyborøn is a privately owned profit-seeking business. The auction takes place online only. The Urk's fleet of beam trawlers is usually landing their catches in Thyborøn every Friday and the Dutch crews return from Urk after having enjoyed the weekend at home.

Urk is a Dutch fishing town in the Southern North Sea operating a long distant fishery in Skagerrak. The fishing community of Urk was originally located on an island in the Zuiderzee. Families with many sons form the basis for large family fishing businesses. In the city they talk about the 'wonders of Urk'. The first was when the Urk fishing families changed their field of activity from the classical inshore fishery to North Sea fishing for sole and plaice. The second, when they entered the fish trade and processing industry. The 'wonders of Urk reflects the self-consciousness about their own entrepreneurial spirit in the city.

Chapter 5, *Fishing Cultures as a framework for understanding and managing of diversity and co-existence of commercial fisheries*, analyses the co-existence

and competition between Fishing Cultures. The contrasts between modes of operation, fishing methods, impact on the sea-bed, habitats and fish populations, and the scale of vessels, gear and ownership make the coexistence of some fishing cultures utterly antagonistic, whereas others are able to use the same fishing grounds in harmonious ways. Their economic contribution to local communities and regional significance is measured in terms of Local Economic Effect (LEE), a method and framework elaborated in the book. This chapter further explores how fishers who are realizing different fishing cultures conceive of each other from each fishing culture's distinct conceptual universe and cultural values.

Chapter 6, *Summary, conclusions and perspectives*, summarizes the 7 distinct Fishing Cultures found in Jammerbugt and describes the deep contradictions between the fishing cultures of long-distance beam trawling and local fishing cultures, who are struggling for their survival as living fishing communities. At the basis of the analysis of their antagonistic co-existence, it is up to the Danish and Dutch politicians, ministers and senior administrative officials to find a solution and end the conflict under the auspices of EU. Finally, the chapter outlines the perspectives for further research and fisheries management, emanating from the elaboration of the Fishing Culture framework and the concrete models presented in this work.

1. Core features of distinct Fishing Cultures

In this study, we identify four core features and specify those form-variants of these features, with which it is possible to distinguish between different operational types of commercial fisheries. We elaborate these as distinct Fishing Cultures. Our elaboration of this concept is based on life-mode theory and the empirical analyses of modes of production in the fisheries. The concept of the Fishing Cultures provides a new framework for analysing and understanding how commercial fisheries cooperate, contribute and/or compete for spatial and biological resources, as well as economically sustain human societies at the local, national, and international level.

The four core features are identified based on applied conceptual theories and explorative data collection. Subsequently, further data are collected and analysed, which results in the identification and conceptualisation of seven distinctive Fishing Cultures. The conceptual models of Fishing Cultures provide a new framework for analysing and improve the understanding of how fisheries operate in the Jammer Bay area.

The four core features of commercial fishery are: 1), life-modes; 2), modes of operation; 3), fishing gear and methods and 4), communities (fishing harbour affiliations). Below are an overview (Table 1) and detailed description of each core feature and associated elements and modalities.

Table 1: The four core features to be combined into Fishing Cultures. The core features are described in detail on the following pages.

The four core features to be combined into Fishing Cultures				
Life-modes		Mode of operation	The catching methods of distinct fishing gear	Community
The self-employed, share-organised	*Thrifty*	The broadly complex, versatile mode of operation	Anchor seining	Shared landing facilities (SLF)
	Expansive		Gillnetting	Private landing facilities (PLF)
	Niche		Longlining	Shared quota ownership (SQO)
The profit-seeking entrepreneurial life-mode			Purse seining	Family quota ownership (FQO)
			Pelagic trawling	Cooperative shared quota ownership (CSQO)
Wage worker		The unilaterally specialized mode of operation.	Fly-shooting	Company quota ownership (CQO)
Investor			Bottom trawling	Harbour (H)
Profit seeking career skipper			Beam trawling	Beach landing site (BLS)

Eight basic life-modes operating in Jammer Bay area

Based on the ethnographic data from the Jammer Bay fisheries, it is possible from the ethnological theory of cultural life-modes to select eight distinct life-mode concepts, which are relevant for the elaboration of the applicable Fishing Culture models.[7] These life-modes describe the first core features of the Fishing Culture models.

The eight basic life-mode concepts applied are:

- The self-employed, share-organised fisher life-mode, which can be specified into:
  - The thrifty fisher life-mode
  - The expansive fisher life-mode
  - The niche fisher life-mode
- The profit-seeking entrepreneurial fisher life-mode
- The wage-earning fish worker life-mode
- The investor life-mode
- The career professional fishing skipper life-mode

The self-employed, share-organised fisher life-mode

The self-employed fishers' conditions of possibility are that the quantity (q) they deliver to market multiplied by the price (p) must at least cover the fishing units' overheads (r) plus the quantity multiplied by the unit cost (f).

$$p \cdot q \geq r + q \cdot f$$

The term, which on the expense side constitutes their overheads (r) is on the production side the basic means of operation, which makes it possible to increase the quantity produced (q) or reduce the cost per unit (f). The cost per unit comprises provisions, fuel, oil, ice, landing- and auction fees.

7 The basic life-mode concepts are specified in Højrup and Nielsen 2024.

The fishing crew's praxis consists of operating the means, such that the expenses of the production cycle and its earnings cancel each other out and make it possible to maintain the end of the fishers' praxis as an independent and share-organised crew of self-employed commodity producers.

For the share organised fishing unit, it is just as important to keep a skilled crew together as it is to keep the vessel and equipment in tip-top condition; basically, the personal economy and the enterprise's economy, while not identical, are nevertheless two sides of the same economic coin, i.e., they are the fishing unit's basic means of operation.[8] It would be just as precarious for the catching unit to lose the crew because they could not pay for their house as it would be to lose the vessel because they could not pay interest and instalments on the ship's purchase loan. The enterprise's overheads, both fishing- and family-related, are a necessary whole. Hence, based on experience and depending on the size and cost of maintaining the vessel, the income (minus $f \cdot q$) is normally distributed with 40 – 60% to the ship + gear and 60 – 40% to the fishing families.

The boat, gear and crew have overheads, regardless of whether the vessel is moored in the harbour or out at sea. Rent of mortgage, family food budget, insurance expenses, subscriptions to digital navigation services, interest, and instalments on bank loans (for a new or renewed vessel), harbour fees, servicing electronic equipment and membership fees to organisations must be paid, whether the crew are out fishing or at home due to bad weather. In turn, these basic means of production make it possible to go out to sea and operate a fishing enterprise, the potential capacity and productivity of which is determined by the crew's skill and motivation as well as by the efficiency of the ship and equipment.

8 In reality, this is an artificial distinction when the tax authorities try to distinguish between the ship engine's consumption of diesel fuel and the fishers households' consumption of heating oil/electricity, between the ship's accounting of its provisions and the households' food budget, between TV in the crew's cabin and the TV in their families' living rooms, between slipway expenses for hauling in the boat and engine service on the crew's personal cars, between interest payments on the vessel and mortgage on the house. This distinction between the fishers' 'business' and their 'personal' expenses is irrelevant for the self-employed producers. It is irrelevant because these kinds of expenses are equally necessary parts of the basic operational costs. The distinction appears as an alien element in the self-employed life-mode while it is the attempt of the state apparatus to impose a tax-based overlap between the wages of a worker and income of the self-employed person.

While these basic means of operation enable fishing within a quantity range, operating expenses are incurred as soon as the vessel leaves port. Depending on the length and duration of the trip, which depends on the quantity of fish that the crew aims to bring home, the ship will incur expenses for fuel, ice, spare parts and lubricating oil, provisions, landing- and auction fees as well as for ropes and nets to repair wear and tear. The more fishing carried out, the greater these operating expenses, and the greater the amount of caught fish needed to offset these expenses.

The fishing unit's basic means of production determine the extent of the quantity range within which it has its normal production; outside this range, marginal costs are incurred. In addition, the basic means of production determine the size of unit costs within the quantity range of normal production, i.e., the normal operating expenses. When the fishers use their basic means of production (to which the skills, experience, pursuit, and teamwork of the fishers themselves belong) as a means of lowering their unit costs, raising the quantity or quality, these are the fishing unit's basic means of operation, and the fishers count these as their 'capability'.

The praxis of self-employed fishers connects four manipulable components: quantity, price, overheads, and unit costs. These components can be elaborated into three basic variants by focusing on different components:

If the overheads are kept down to make ends meet, we get *the thrifty fisher life-mode*:

$$r \leq q \cdot (p - f)$$

If the quantity is increased and/or unit costs are kept down to make ends meet, we get *the expansive fisher life-mode*:

$$f \leq \frac{q \cdot p - r}{q}$$

If the price is kept high to make ends meet, we get *the niche fisher life-mode*:

$$p \geq \frac{f + r}{q}$$

The thrifty fisher life-mode

$$r \leq q \cdot (p - f)$$

When the overheads are kept down in order to lower production costs and remain independent on bank loans, we get the 'thrifty producer', characterised by saving on all investments in the basic means of operation, so that the basic operational costs ('fixed costs') remain low enough that it will always be possible to cover them by spending a little more time catching the kilos of fish needed in order that when multiplied by the market price, they can create enough earnings to cover these fixed costs for the basic means of production. In this praxis, the fishing families remain free and independent of bank loans and employees by keeping the overheads (*r*) down. The thrifty fisher life-mode operates within a *'just enough' ideology*.

The expansive fisher life-mode

$$f \leq \frac{q \cdot p - r}{q}$$

The expansive producer is characterised by large investments in basic means of operation. What are ambiguously called 'capital-intensive' sectors of the fishing industry are those fishers for which the primarily manipulable means is a growth in landed quantity and reduction in unit costs. This requires investments in the basic means of operation of the catching unit. To maintain the return on investment by increasing *r*, *f* is decreased, and *q* is increased. The expansive fisher life-mode operates within a *'we have to improve our capability' ideology*.

The niche fisher life-mode

$$p \leq \frac{f + r}{q}$$

When the quality, specialisation, or individualisation (i.e., increasing the use value for the consumer) of the product is optimised, it may be necessary and possible to keep a higher price for the product on an exclusive niche of the market and cover larger basic operational costs and/or

operating expenses, even if the quantity is lower than the conventional variants of the product. This variant explicates the niche product as a particular means to make ends meet. It may demand e.g., particular expertise in landing high quality fish, using modes of operation based on exquisite craftsmanship, cultivating storytelling about process and product, sustainable catching methods, 'fishing with care', delivering high-end, climate-friendly seafood. This feature is realised by the niche fisher life-mode who counterbalances lower quantities with higher price. This life-mode operates within a *'we are cultivating our niche' ideology.*

The profit-seeking entrepreneurial fisher life-mode

$$\mathrm{p} \cdot \mathrm{q} \geq ((\mathrm{w} + \mathrm{m}) \cdot \mathrm{q} + \mathrm{bc}) \cdot (1 + \mathrm{IP})$$

This formula describes how the profit seeking entrepreneurial life-mode's basic end is to optimise the return on the entrepreneur's total investment in wages, materials, and basic operational equipment. These three factors are means to reach the goal, which is to maximise the individual profit, *IP*. The fishing entrepreneurial life-mode operates within *'my individual profit counts' ideology.*

The formula describes the different possible means, beyond the ongoing wage negotiations (that affect *w*), of creating maximum individual profit (*IP*) for the individual company: It brings the necessary operational equipment and their basic costs (*bc*) into focus, because it is by means of these that the profit seeking investor can increase the income ($p \cdot q$) as well as decrease the total costs ($(w + m) \cdot q + bc$). The basic costs (*bc*) represent the material equipment and mental skills which are the primary manipulative means of improving 1) the productivity, the necessary unit cost ($w + m$) and the production capability (potential *q*) of the production process and 2) the (demand and) price of the produced product (*p*). On the one hand, one can lower consumption of paid work (*w*) and reduce raw material costs (*m*) by reducing the waste of time, energy, and materials, increasing productivity, and increasing the potential, produced quantity. This is synonymous with, in different parts of the value chain, reducing, on the one hand, the expenditures of paid labour and thus the finished product's exchange value. Hence, a wage-worker life-mode delivering paid labour is involved in this mode of production.

The entrepreneur's developing and managing of the individual company is primarily about cutting the determinate unit cost, increasing the capacity, quantity, and product quality, or creating a new product, all of which depends on the entrepreneur's ability to develop the basic operational equipment. This includes all the forms of machinery, plant, organisation, automation, digitisation, quality, knowledge, innovation, and motivation that are important for the levels of unit costs, the production capacity and the quality of the products produced. The saleable quantity is not only determined by the production capacity but also by the demand. Demand, in turn depends on the degree to which the entrepreneur succeeds in developing the use-value of the product for the consumer – before the competitors have achieved the same potential.

The entrepreneurial life-mode can be replaced or supplemented by two life-modes: *the profit seeking investor life-mode* (ship owner) and *the profit seeking manager life-mode* (career fishing skipper) who complement each other and appropriate the individual profit.

The wage-earning fish worker life-mode

Fish workers sell their labour power to fishing companies and are attracted by means of fixed wages, favourable tariffs, and a bonus system. They avoid personal responsibility for the economic gains and troubles of the fishing company as a means to protect and enjoy the well-being of their home and family. The fish worker life-mode operates within a *'work is a means to leisure' ideology.*

The investor life-mode

The fishing investors pick out those companies whose career fishing skippers and capital demanding large-scale advantages pave the way for the brightest prospects of profitable return on investments. As vessel owners they only keep their investments in ships and quotas belonging to the most surplus generating fishing companies. 'Outdated' vessels are sold as soon as more profitable vessels are developed. By means of expanding quota ownership they strive to gain monopoly advantages. The fishing investor life-mode operates within '*we have to invest where profitability is promising' ideology.*

The career professional fishing skipper life-mode

The profit seeking career fishermen build up unique fishing skipper competences with which they are able to operate large-scale fishing vessels so profitable that the company owners are struggling for hiring the best ones and pay these skippers a lucrative part of the achieved profit for the operation of their vessels. The profit seeking career fishing skipper life-mode operates within a '*our ship has to be ahead of the other vessels' ideology*.

The conditions of existence for the development of these eight co-existing life-modes depend on the modes of operation and the fishing methods that are appropriate to apply in the marine habitats. Hence, these conditions are the next necessary features to specify in the elaboration of distinct fishing cultures.

Modes of operation

A fishing method and its gear complex are applied to selected fish species in distinct marine ecosystems and are, therefore, dependant on the habitat preferences and behaviour of the species. Furthermore, fisheries are influenced by the natural and cultural geography of the seas in question, inshore as well as offshore. The hydrographic conditions and the distances between fishing grounds and landing sites are important for the design and application of catching methods, gears and vessel types. This combination of ecological and technical aspects of fishing practices constitutes the 'mode of operation' of a fishing industry.[9]

Two modes of operation coexist in the Jammer Bay fisheries: 1), The broadly complex, versatile mode of operation; and 2), the unilaterally specialized mode of operation.

1), *The broadly complex, versatile mode of operation* is based on the principle that the fishing unit combines the different kinds of gear of several distinct catching methods aimed to catch a range of fish species, which during the year stay or migrate through a local body of water, appearing in sufficient concentrations that it pays to fish for them. By being able

9 Højrup & Nielsen 2024, p. 859ff.

to switch rigs from one type of gear and method to another, it is possible to switch between fisheries of different species, so that over the course of a year, fishing can be operated as a versatile, local fishery, whereby the proximity to the home port can be maintained.

2), *The unilaterally specialized mode of operation* is based on the principle that the fishing unit is specialized in using a particular fishing method aimed to catch a number of distinct species or a group of species (e.g., pelagic, benthic or demersal lifeforms), which are hunted and pursued throughout the year, if necessary, in different seas. This hunt follows the ecologically and hydrographically determined migrations and gatherings of the fish populations. In the case of migratory shoals, year-round fishing with the unilaterally specialized mode of operation can be conducted by the fishing unit only if it operates far from the home port during certain periods of the year. Hence, this mode of operation brings large foreign long-distance fishing vessels into the Jammer Bay area, just as larger Danish long-distant fishing vessels operate in waters far away from the Jammer Bay area.

The catch methods of distinct fishing gear[10]

Eight distinct catch methods are described by the fishers as being the fishing gear and method used in Jammer Bay[11]

1. the audio-visual herding method (anchor seining),
2. the fish entangling method (gillnetting),
3. the baited hook, fish attracting method (longlining),
4. the fish shoal surrounding method (purse seining),
5. the pelagic fish shoal capture method (pelagic trawling),

10 The Figures 1–3 and 5–8 are based on screen dumps from active fishing vessels registered on www.vesselfinder.com. Drawn by graphic designer Lise Glindvad.

11 See also Gislason et al. 2021.

6. the fast wire towing, fish herding and encircling method (fly-shooting),

7. the seabed towed, demersal fish and shellfish filtering and catching method (bottom trawling),

8. the seabed dredging, benthic fauna churning and crushing, and fish attracting method (beam trawling).

Anchor seining

Anchor seining applies an audio-visual herding method. The vessel starts the first haul by placing an anchor at the seafloor to which the first drag-line is connected and put into the water in a 2 – 4 km long half-circle where it sinks down to the sea bed. Then the vessel swings in a bow and the seine that is connected to the end of the drag-line is put into the water. The second drag-line is connected to the other side of the seine, the vessel swings again and puts this line into the water in a half-circle going back to the anchor. The vessel is fastened to the anchor, and the two drag-lines are connected to the two warping ends of the ship's winch, with which the drag-lines are slowly hauled onto the vessel with the result, that the lines are moving ever closer to each other at the sea-floor and narrowing the encircled area of the sea bed. When the warping end of the vessel's winch hauls in the lines, each rope cracks and shakes.[12] The noise and vibrations from the drag-lines frighten the fish at the sea bed and herd them into the centre between the lines, where the seine in the last part of the hauling process collects the fish.

12 Gislason et al. 2021 also describe the method as 'herding' the fish, but do not specify the way the lines are herding, which is the lines' cracking and shaking caused by the warping end of the boat's winch. This core feature is the reason why we characterise this herding method as audio-visual. Brandt 1972, p.164f. Højrup and Schriewer 2012, p. 56. Højrup & Nielsen 2024, p. 895f and note 592.

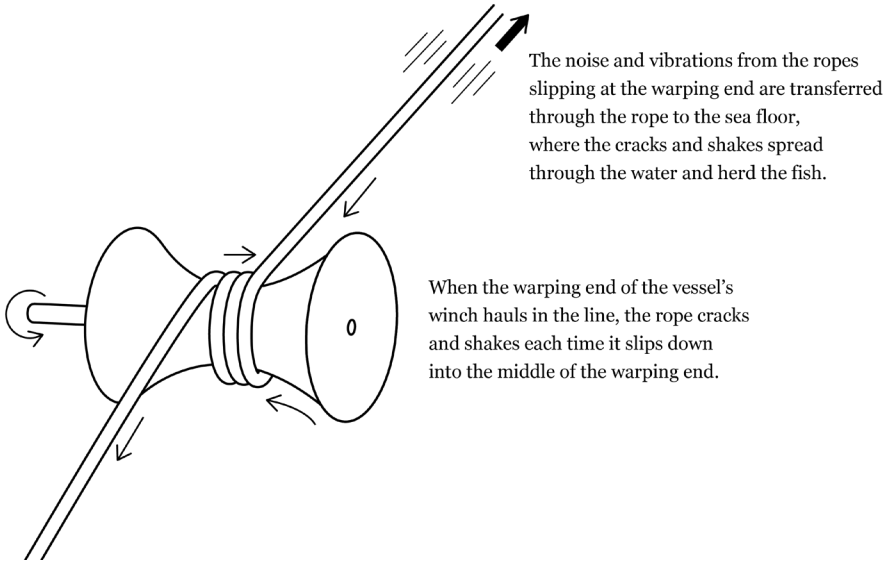

Fig. 3: *The audio-visual method of anchor seining to herd the fish together.*

After emptying the seine net, the lines and seine are redeployed for the next haul using the same anchor point. Redeployment in distinct directions from the same anchor point can be repeated several times. The method entails low fuel consumption and delivers high quality caught fish (Fig.4).

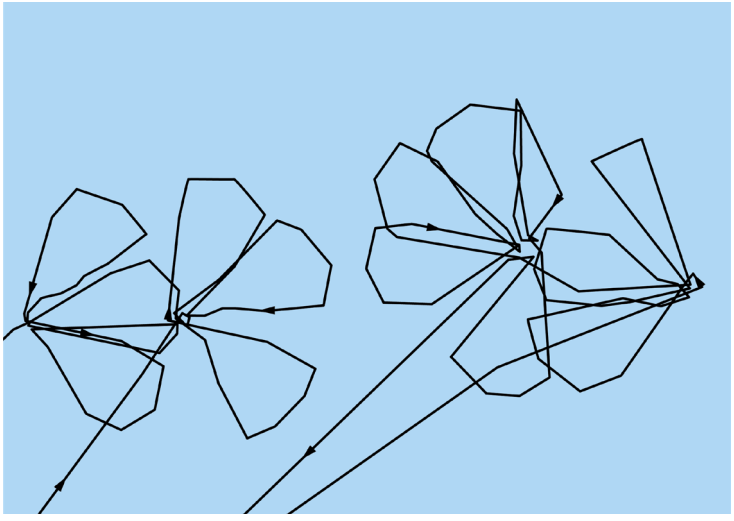

Fig. 4: *Gear track pattern from deployed anchor seining.*

Gillnetting

When gill nets are deployed fish are entangled by their gills, fins or tails as they try to swim through the net. The gillnet can be used as an anchored bottom net, or as a drift net without contact to the seafloor. The soaking time is typically short and varying between 0.5 and up to 2 days. The quality and value of the caught fish depend on the soaking time. Drift nets are used to catch schools of pelagic fish, such as herring and mackerel[13]. The method entails low fuel consumption (Fig. 5).

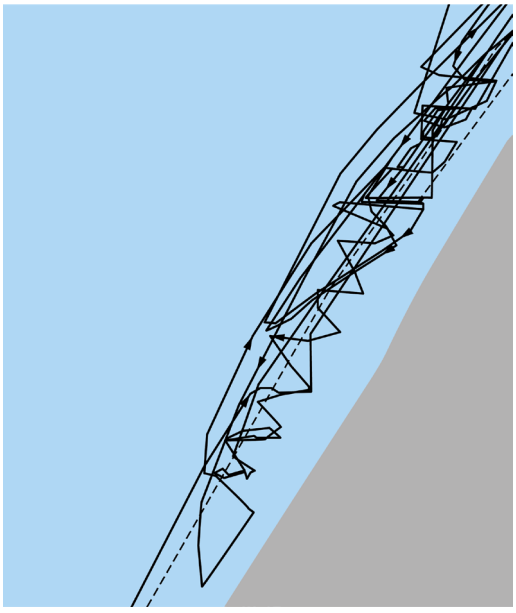

Fig. 5: *Gear track pattern from deployed gill nets.*

Longlining

Applying the baited hook, fish-attracting method, a longline is deployed to which short lines (snoods) with baited hooks are connected. On its way down to the seafloor the baited hook attracts and catch the fish. The soaking time is short and varying between 1–2 hours and half a day. The longline fishery in Jammer Bay area is mainly deployed at boulder reefs

13 Brandt 1972, p. 204ff. Højrup and Schriewer 2012, p. 54. Højrup & Nielsen 2024, note 589.

to procure day-caught cod and other high value species[14]. The method entails low fuel consumption (Fig. 6).

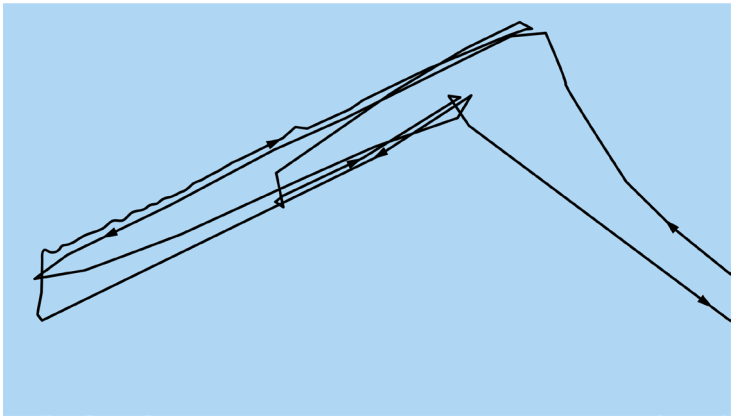

Fig. 6: *Gear track pattern from deployed longlining.*

Purse seining

Purse seines are vertical nets deployed to surround shoals of pelagic fish (e.g., herring, mackerel). After encircling a shoal, the bottom of the net is drawn together and 'pursed' upwards through the water column preventing the shoal from escape. The fish are sucked with a pump into refrigerated seawater tanks on board the fishing vessel[15]. The seize of the seine and vessel determine how large a part of an entire shoal of fish can be caught in one haul. This makes large-scale advantages possible if skipper and crew are high skilled. The method entails a moderate fuel consumption as vessels have to encircle the shoal at high speed, but without mobile towing the gear (Fig. 7).

14 Brandt 1972, p. 48. Højrup and Schriewer 2012, p. 54.

15 Højrup and Schriewer 2012, p. 56. Brandt 1972, p. 168ff. Højrup & Nielsen 2024, p. 900f and note 593.

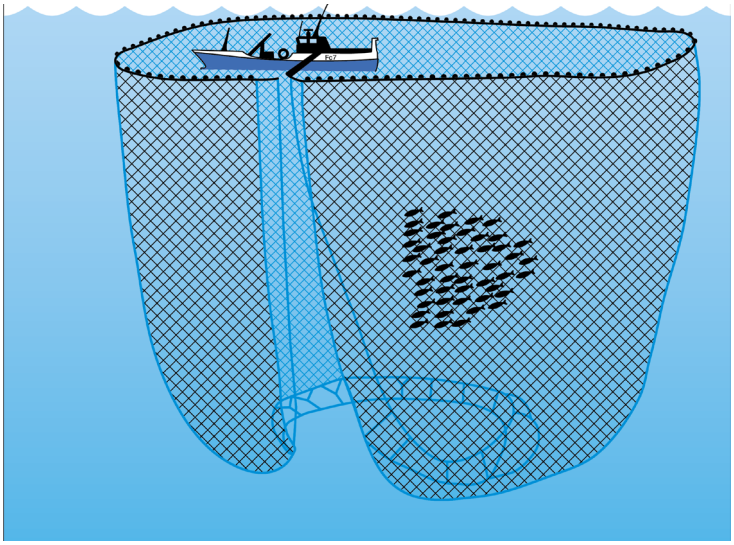

Fig. 7: *Illustration of purse seine.*

Pelagic trawling

Pelagic trawls are designed to catch fish shoals located through the water column. This type of fishery necessitates manoeuvrable and fast-moving vessels to be able to hunt the fast swimming and suddenly course changing shoals in midwater. Pelagic trawls are generally constructed with large openings. Trawl-wires, pelagic trawl doors and large meshes of ropes in the anterior part of the trawl herd fish towards the trawl opening. The narrowing of the trawl acts as a funnel, which increases the water flow whereby the fish are sucked towards the smaller-meshed cod-end. The method often entails fisheries by larger vessels with high engine power. On the other hand, because pelagic species living in shoals are highly concentrated, the pelagic trawlers may obtain an efficient fuel consumption resulting in economic large-scale advantages. These vessels bring their catch to the fish-processing plant in Refrigerated Salt Water (RSW) tanks and operate in a wide North Atlantic area inside and out-

side Exclusive Economic Zones[16], where they are competing with larger freezer factory trawlers (Fig. 8).

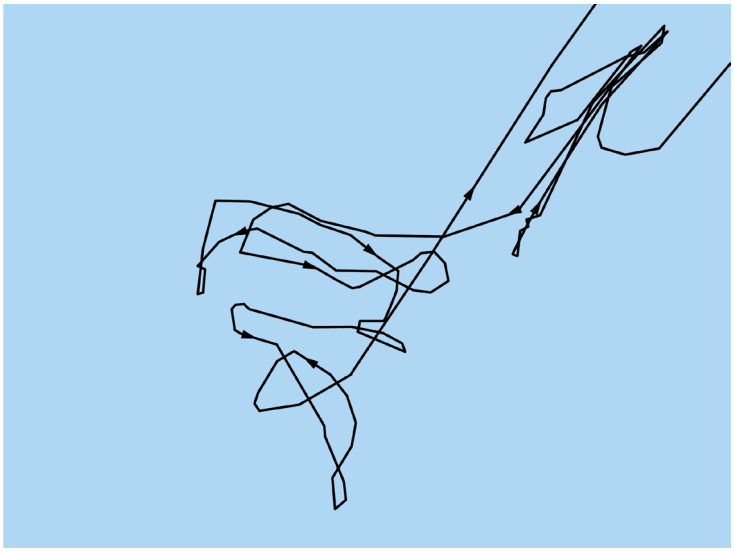

Fig. 8: *Gear track pattern from deployed pelagic trawling.*

Fly-shooting (Scottish seining)

The fast-sailing vessel starts each haul by placing a buoy at the surface of the sea to which the first drag-line of typhoon wire is connected and put into the water in a long half-circle where it sinks down to the sea bed. The vessel swings in a bow and the seine connected to the end of the drag-line is put into the water. The second drag-line is connected to the other side of the seine, the vessel swings again and puts this line into the water in a half-circle going back to the buoy. When the fly-shooting vessel returns to the buoy after having encircled a large bottom area with the draglines and seine, the crew fasten the two draglines on board. At this point, the vessel steams forward while dragging and hauling in the draglines and seine across the seafloor like a wide stretched trawl. This

16 The pelagic trawl funnel may be able to suck and catch even greater parts of a fish shoal by means of larger trawl mouths and trawl bags, towed by still larger vessels with more kilowatt engines than even the (much smaller) expansive demersal trawlers are using. Højrup and Schriewer 2012, p. 56. Brandt 1972, p. 168ff. Højrup & Nielsen 2024, p. 899ff and note 593.

'shooting on the fly' requires large engine power, high fuel consumption, draglines of unbreakable typhoon wire (twined by nylon and steel) and strong nets. With this technology, the vessel can operate on most seabed substrates, such as mud, sand and mixed substrates with gravel and boulders. Especially when fly-shooting is conducted on mixed substrates, fishers perceive the method "to level out and cultivate the seafloor". Modern fly-shooters are large vessels with powerful engines, heavy typhoon wires, and entails a fuel consumption similar to mobile bottom contacting trawling.[17] Modern fly-shooting is an elaboration of anchor seine fishing but resembles bottom trawling (Fig. 9).

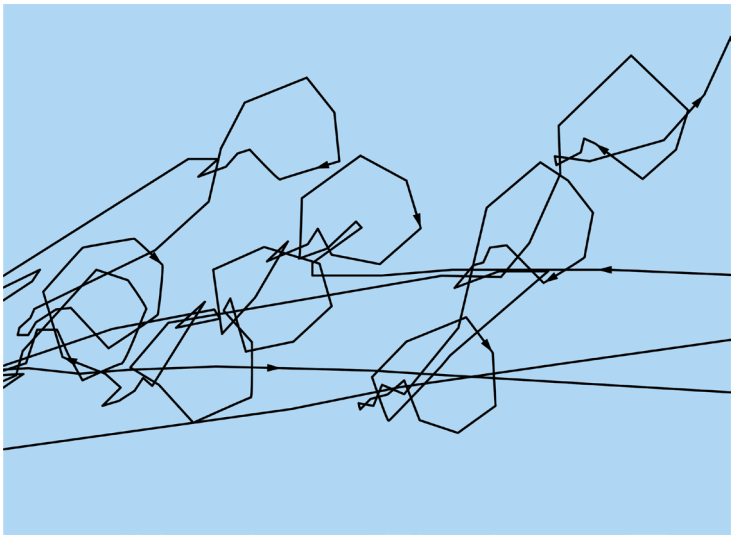

Fig. 9: *Gear track pattern from deployed fly-shooting.*

Bottom trawling of demersal fish and shellfish

In bottom trawling the trawl-net is kept open by means of two otter boards connected with long ropes (sweeps) to each side of the trawl opening. The design of the otter boards causes them to spread apart due to the hydrodynamic forces as the vessel speeds forward. This is similar to pelagic trawling, but the gear is dragged along the seafloor. The fish are

17 Højrup & Nielsen 2024, note 769.

herded into the trawl by the sweeps, which are shortened when targeting only Norway lobster. The fishers describe a suction action of the trawl funnel at the seabed causing demersal fish, shellfish and other materials to be caught. This method entails high fuel consumption[18] (Fig. 10).

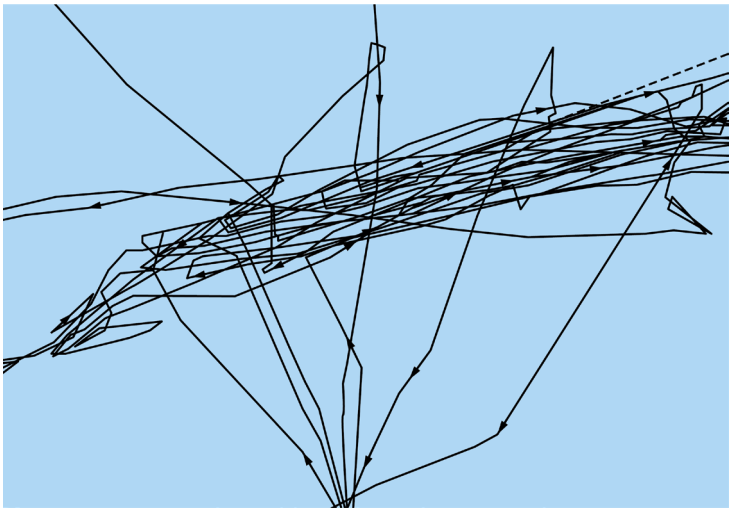

Fig. 10: *Gear track pattern from deployed bottom trawling.*

Beam trawling of demersal fish

The beam trawl method applies fast-dragged heavy chains to churn the sediment and crush benthic fauna, which act as bait to attract fish to the area.[19] This is a core feature of the method, described by beam trawl fishers as "opening the bottom". By repeating the hauls, the method attracts still more fish to be caught in that area, and the churning and crushing affects the fauna in deeper layers of the sediment with each consecu-

18 The otter trawl was developed through an epistemological rupture with the beam trawl in the 1890s. To optimise the sucking effect by so-called 'multi-trawling', the trawler may drag from 2 to 12 trawls beside each other. Twin-rigs are used by the fish- and lobster trawlers in Skagerrak. Brandt 1972, p. 136ff. Højrup and Schriewer 2012, p. 56. Højrup & Nielsen 2024, p. 884ff.

19 This gear type is briefly described by Gislason et al. 2021 (p. 24). Our detailed description herein of this gear type and method is informed by the teachers at the education and research Centre at the Maritime Campus Urk, Netherlands. See also Højrup & Nielsen, 2024, chapter 6.

tive haul. The horizontal opening of the net bag is provided by a beam. Rows of 9–10 tickler-chains are used on sand and gravel sediments, and chain-mats are used on mixed bottoms with boulder reefs. The largest gears weigh up to 10 tons and are towed at speeds up to 7 knots. This method implies extraordinarily high fuel consumption (a 500 GT beam trawler consumes 32,000 litre diesel every 5 days).[20] Small shrimp beam trawls without tickler-chains are much lighter and are towed at speeds from 2.5 to 3 knots (Fig. 11). In Jammer Bay the fishers appreciate that no shrimp beam trawlers are fishing with their very small meshes in the area, because of the urgent need to protect the spawn and juvenile fish against being caught in the small-mesh trawls.

Fig. 11: *Gear track pattern from deployed beam trawling.*

20 By pulling the beam trawl back and forth over the same piece of seabed, the beam trawler catches the fish attracted by crushed molluscs from the previous tow and at the same time scoop up a new and deeper layer of the seabed's flora and fauna, which, as food and bait, will attract more swimming fish. Hence, beam trawling can be optimised by 'syncro-trawling', which is often used by 2 – 8 beam trawlers, who are scratching the same area at the same time and by so doing maintain a huge cloud in the water of (fish attracting) crushed flora and fauna from the seabed's biotopes. Højrup & Nielsen 2024, p. 880ff.

Community (Fishing harbour affiliation)

The fourth feature of each Fishing Culture comprises the community features (e.g., quota ownership, landing facilities, homes of the fishing families, and maritime craft firms) of each fishing homeport where the individual vessel is registered, also referred to as fishing harbour affiliation. In the identification of the Fishing Cultures, we focus on the registry homeport. In the Jammer Bay area, there are four such homeports. These are the landing sites, Thorupstrand and Løkken, located on the beach in the middle of Jammer Bay, and the two harbours, Hanstholm and Hirtshals, located south and north of the Jammer Bay area. Thorupstrand and Løkken depend mainly on the fishery in the Large Jammer Bay area, whereas the local vessels of Hirtshals harbour also fish in the Tannis Bay and other parts of the Skagerrak. The Thorupstrand catch landing facility sends its packed landings to the auction in Hanstholm or to the Norwegian company Insula who pays a surplus price for certified 'Gentle caught fish' (*Naturskånsom*) from Thorupstrand. The local vessels of Hanstholm harbour fish in the Skagerrak and greater North Sea. The auctions of the two harbours, Hanstholm and Hirtshals, also receive landings from vessels and trucks coming from other Danish homeports, and from other countries around Kattegat, Skagerrak, and the North Sea.

Other important harbours for the Fishing Cultures that operate in the Jammer Bay area comprise the Danish Thyborøn, Skagen, Strandby and Nexø, as well as the Swedish Fotö, Rörö, and Donsö (in the Bohuslen archipelago). These harbours host headquarters of some of the large-scale fishing companies with subsidiary companies registered in Denmark.

Of the foreign fleets operating in the Jammer Bay area, beam trawlers from the Dutch fishing community of Urk, play an important role. Since 1980, these vessels have intensively fished the shallow grounds of the Jammer Bay area at regular intervals (three waves of several years). Beam trawls are the heaviest mobile bottom contacting gear known to impact seabed habitats in Skagerrak and after several years of intense beam trawling the food chain (not least the *Abra alba* mussels) is destroyed and only after its regeneration during a period of years the beam trawler fleet returns and resume their heavy bottom impacting fishery until the food chain and plaice population are minimised again and most of the beam trawlers leave the Jammer Bay once more.

2. Fishing Cultures identified in Skagerrak

This section describes the Fishing Cultures, which are identified based on 7 distinct socio-cultural modes of life and the distinct ways in which these life-modes organize the contemporary fishery under the conditions of marine habitats, technology, markets, landing sites, local experience, competences and traditions of the coastal communities in the local region and in regions far away, from where long distant fishing vessels arrive to the local waters.

The core features: life-modes, modes of operation, fishing methods, and communities, are combined in necessarily specific ways, thereby forming several conceptual models of distinct Fishing Cultures, which fishers are realizing when operating in the Jammer Bay area.[21] Hence, the Fishing Cultures cannot be identified by one of these features but only by their possible and necessary connection.

21 See Appendix 2 regarding the relation between life-mode and fishing culture.

Table 2: The 7 Fishing Cultures structured according to life-mode with corresponding name and number (detailed description on the following pages).

Life-mode	Mode of operation	Catching methods	Community	Fishing Culture no
Self-employed, share-organised, niche	Broadly complex, versatile	Anchor seine + Gillnetting	SLF + CSQO + BLS	Fishing Culture1
Self-employed, share-organised, expansive	Unilaterally specialized	Beam trawling	SHL (NL) +FQO + H	Fishing Culture 2
Self-employed, share-organised, expansive	Unilaterally specialized	Trawling (bottom/pelagic), Fly-shooting	PLF/SLF + SQO/ FQO + H	Fishing Culture 3
Self-employed, share-organised, thrifty/niche	Specialized/versatile	Bottom trawling, Gillnetting, Longlining	SLF/PLF + FQO/ SQO + H	Fishing Culture 4
Self-employed, share-organised, thrifty/expansive	Unilaterally specialized	Gillnetting	SLF/PLF + FQO/ SQO + H	Fishing Culture 5
Self-employed, share-organised, thrifty/niche	Unilaterally specialized	Anchor seining	SLF/PLF + FQO/ SQO + H	Fishing Culture 6
Expansive, profit-seeking/investor+career & wage worker	Unilaterally specialized	Pelagic/bottom trawl/purse seine/fly-shooting	SLF/PLF + CQO/ FQO + H	Fishing Culture 7

SLF = Shared landing facilities, PLF = Private landing facilities, SQO = Shared quota ownership, FQO = Family quota ownership, CQO = Company quota ownership, CSQO = Cooperative shared quota ownership, H = Harbour, BLS = Beach landing site.

Table 3: The detailed features of the seven Fishing Cultures (described in detail on the following pages).

Fishing Culture no	1	2	3	4	5	6	7
	Self-employed, share organised, family		Self-employed, share organised				Profit seeking + wage-earning
Fishing harbour affiliations	Thorup Strand, Løkken	Urk (NL)	Hanstholm, Hirtshals, Skagen, Strandby	Hirtshals, Hanstholm	Hvide Sande, Thorsminde, Thyborøn, Hanstholm	Thyborøn, Hanstholm Hirtshals	Thyborøn Hirtshals, Skagen, Nexø (all DK) Rörö, Öckerö, Fotö (S)
GT KW	<30 221	500 1115–1471	17–388 177–1320	1–130 16–441	20–160 81–520	25–114 121–405	111–4319 200–6.000
Landing port(s)	Thorupstrand, Løkken	Urk via Thyborøn Hanstholm Hirtshals	Hanstholm, Hirtshals	Hanstholm, Hirtshals	Thyborøn, Thorsminde, Hanstholm	Hirtshals, Hanstholm	Skagen, Hirtshals, Hanstholm
Maintenance place	Slettestrand Thorupstrand Hanstholm	NL Minor tasks: Thyborøn Hanstholm	Hanstholm, Hirtshals, Skagen, Strandby	Hirtshals, Hanstholm	Hvide Sande, Thyborøn, Hanstholm	Hirtshals, Hanstholm	Skagen, Hirtshals, Hanstholm, Neksø
Fishing distance from home port	1–30 Nautical miles	300 Nautical miles	10–110 Nautical miles	1–25 Nautical miles	10–110 Nautical miles	10–60 Nautical miles	30–350 Nautical miles
Fishing area in Skagerrak	Outer Central Coastal	Central	Outer Central	Outer Central Coastal	Outer Coastal	Outer Central Coastal	Outer Central
2016 2022 No. vessels	17 8	2 20	49 57	116 118	8 14	16 14	23 27

The Fishing Culture 1:
Beach landing coastal fishery

The niche variant of the self-employed share fisher life-mode from beach landing sites in Jammer Bay uses sandbanks and stone reefs of the inshore, central, and offshore parts of Jammer Bay area in a broadly, versatile mode of operation employing small anchor seines during summer and gillnets during the winter months (vessels below 30 GT) (Fig. 12).

They land their catches in the landing sites of Thorupstrand and Løkken, and most are sold at the auctions in Hanstholm and Hirtshals or to companies processing and selling certified fish 'caught with care'. This fishery gets their vessels constructed at the local, cooperative boatyard and maintains 1), service on boats and gear, 2), collectively owned quotas and 3), the infrastructure behind family life in the local area.

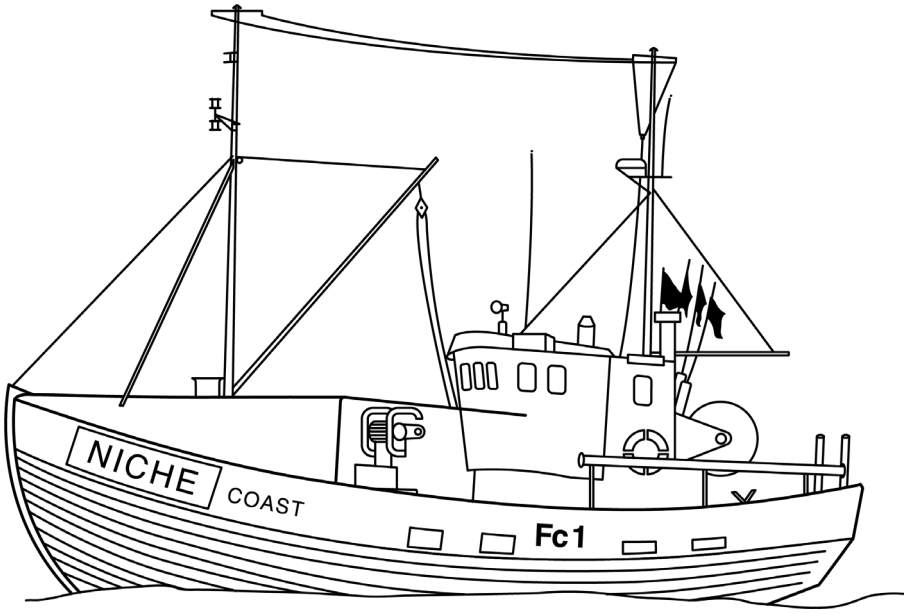

Fig. 12: *Typical vessel of the beach landing coastal fishery.*[22]

22 The drawings of the fishing vessels in each Fishing Culture are made by Thomas Højrup and finished by graphic designer Lise Glindvad.

The Fishing Culture 2: Dutch demersal beam trawling

The expansive variant of the self-employed share fisher life-mode from Urk (and other fishing communities in Holland) uses sandbanks and stone reefs in the central Jammer Bay area – as one of several long-distant fishing grounds – with a unilaterally specialised mode of operation employing beam trawl (and vessels around 500 GT) in a long distant fishery (Fig. 13).

They land their catch mainly in Thyborøn from where it is sold and transported to processing plants in Urk. Their cooperative service company delivers most of the necessary service and gear to the Dutch beam trawlers from Urk.

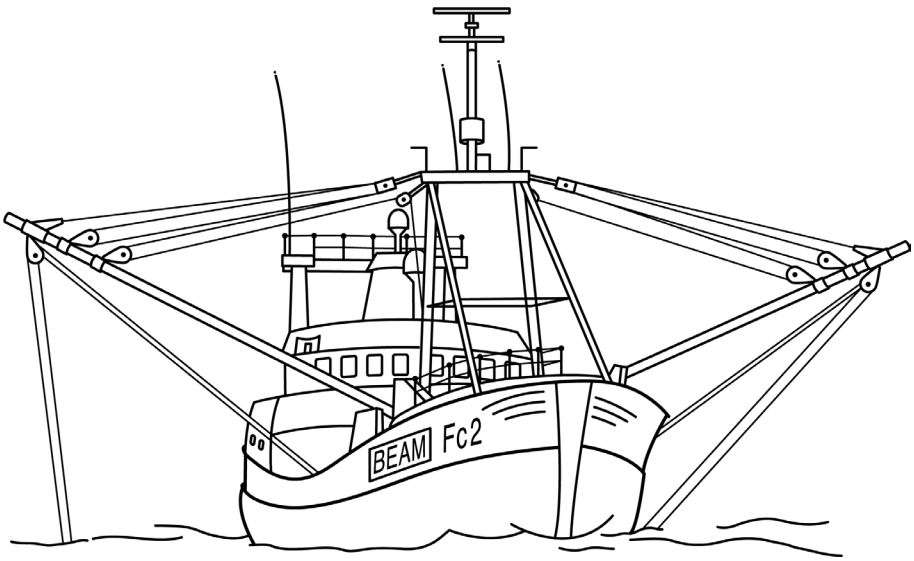

Fig. 13: *Beam trawler using two beam trawls towed from long derricks projecting over each side of the vessel.*

The Fishing Culture 3:
Expansive harbour-based fishery

The expansive variant of the self-employed fisher life-mode from Hanstholm, Hirtshals, Skagen and Strandby, as part of a yearly circle, uses sandbanks and stone reefs in the north-western offshore parts of Jammer Bay area with a unilaterally specialised mode of operation employing bottom trawl all year round or combined with fly-shooting or pelagic trawl (Fig. 14 and Fig. 15).

They land their catches at the auctions in Hanstholm and Hirtshals. This fishery gets most of their boats constructed outside the region but maintain service on boats and gear and the infrastructure behind family life in the hometowns.

Specification:
3t: Vessels using bottom trawl
3ta: Vessels 60 – 200 GT
3tb: Vessels 200 – 500 GT
3f: Vessels using fly-shooting
3p: Vessels using pelagic trawl
3t/p: Vessels using trawl and pelagic trawl

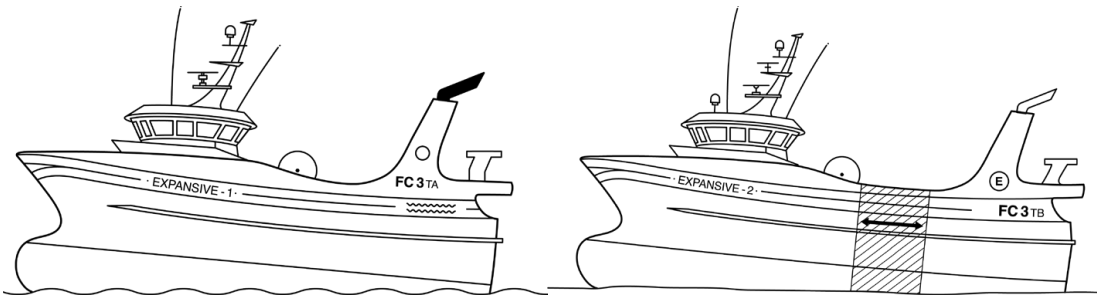

Fig. 14: *Expansive vessels are constructed so that they may easily be extended with more capacity, gear and horsepower.*

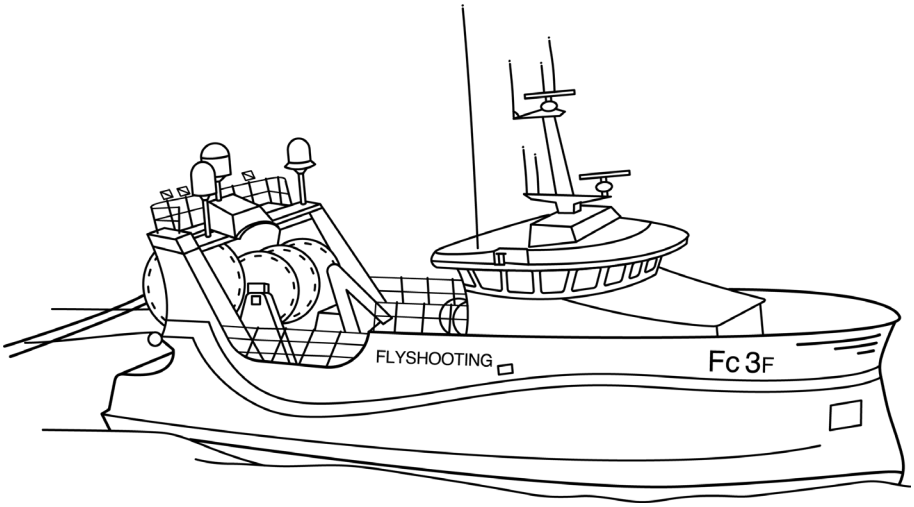

Fig. 15: *Fly-shooter vessels are constructed with still more horsepower, fish handling facilities and capacity.*

The Fishing Culture 4: Harbour-based coastal fishery

The thrifty (*th*) and the niche (*n*) variants of the self-employed share fisher life-mode from Hirtshals and Hanstholm use sandbanks and stone reefs in the inshore (close to the harbours) and offshore parts of Jammer Bay area in a broadly or specialised mode of operation employing small single bottom trawls, anchor seines, gillnets and/or longlines all year round (vessels between 10 and 120 GT) (Fig.16).

They land their catches at the auctions in Hanstholm and Hirtshals. This fishery gets most of their vessels constructed outside the region but maintain service on vessels and gear and the infrastructure behind family life in the two towns.

Specification:
4t: Vessels using bottom trawl
4ta: Vessels 5 – 15 GT
4ta n: Vessels 5 – 15 GT
4tb: Vessels 15 – 60 GT

4tb th: Vessels 15 – 60 GT
4tc th: Vessels > 60 GT
4g n: Vessels using gillnet
4l n: Vessels using longline
4p: Vessels (4tb & 4tc) using pelagic trawl part of the year
4t/s/p: Vessels using trawl/danish seine/pelagic trawl part of the year
4t/g: Vessels using trawl/gillnet part of the year

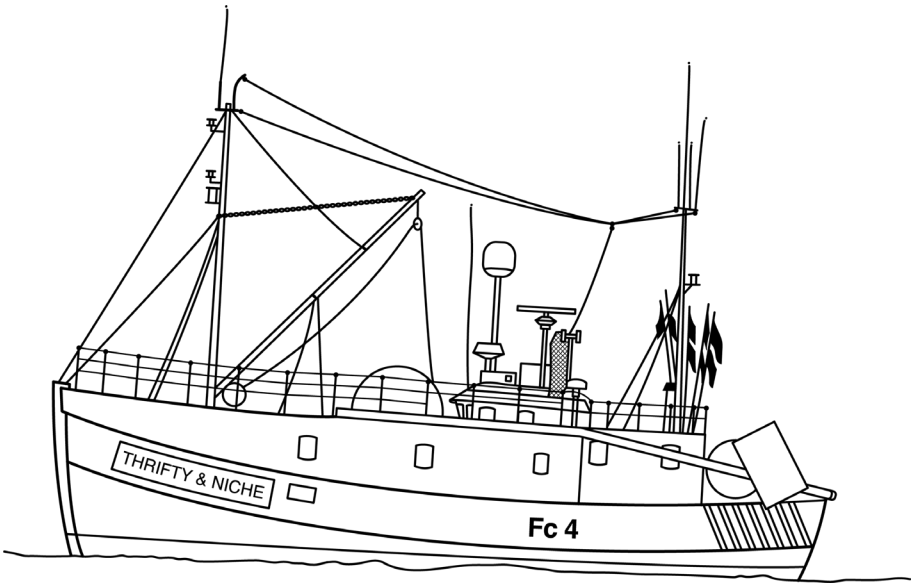

Fig. 16: *Multifunctional coastal vessel that can easily switch between e.g., gillnetting, trawling, longlining, trap fishing or seining during a year-cycle.*

The Fishing Culture 5: Specialised gillnet fishery

The thrifty and the expansive variants of the self-employed fisher life-mode from Hvide Sande, Thorsminde, Thyborøn, and Hanstholm, as part of a yearly circle, use sandbanks and stone reefs in the inshore, central, and offshore parts of Jammer Bay area in a unilaterally specialised mode of operation employing gillnets (Fig.17).

They land their catches at the auctions in Hirtshals, Hanstholm, Thyborøn and Thorsminde. This fishery supports suppliers of construction and service on vessels and gear and the infrastructure behind family life in the hometowns.

Specification:
5: Vessels using gillnets
5a: Vessels 20 – 50 GT
5b: Vessels > 100 GT

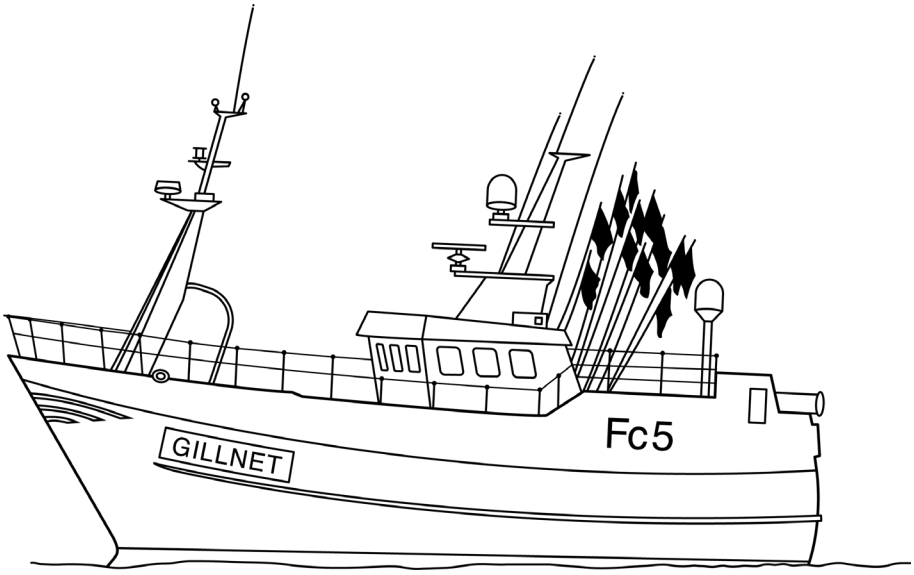

Fig. 17: *Specialised gillnet vessel with full shelter-deck to protect the crew when handling nets and fish.*

The Fishing Culture 6: Specialised anchor-seine fishery

The thrifty and niche variants of the self-employed fisher life-mode from Thyborøn, Hanstholm and Hirtshals uses sandbanks in the inshore, central and offshore parts of Jammer Bay area in a unilaterally specialised mode of operation using large anchor seines (Fig.18).

They land their catches at the auction in Hirtshals. This fishery maintains local service on boats and gear and the infrastructure behind family life in the homeports.

Specification:
6: Vessels using large anchor seines
6a: Vessels 20 – 40 GT
6b: Vessels 50 – 60 GT
6c: Vessels 80 – 120 GT

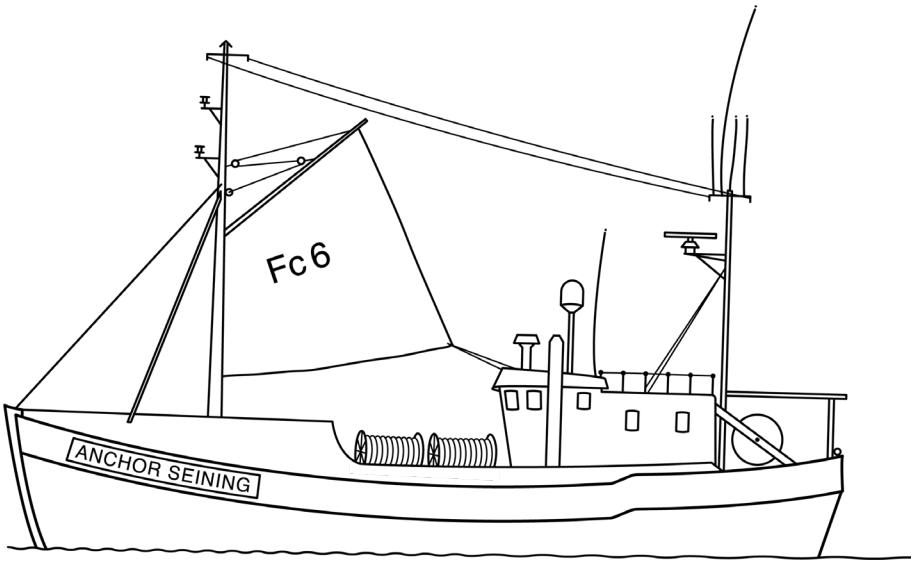

Fig. 18: *Specialised Danish anchor seining vessel equipped with half shelter-deck and large line drum magazines.*

The Fishing Culture 7: Profit-seeking large-scale fishery

The expansive variant of the entrepreneurial life-mode, investor life-mode, career professional skipper life-mode and wage-earner life-mode from Hanstholm, Hirtshals, Skagen, and Nexø, (Denmark) and Rörö, Öckerö, and Fotö (Sweden) uses sandbanks and stone reefs of the north-western offshore parts of the Jammer Bay area with a unilaterally specialised mode of operation employing pelagic trawl, purse seine, and – to a lesser

degree - bottom trawl as part of a yearly circle. Their total field of activity covers the entire North Atlantic area. These vessels are less bound to the home port, also for maintenance and service. Most of the vessels are constructed in Skagen. The crew is recruited from a larger area, including the northern and western Jutland (Fig.19).

Specification:

7sv: Vessels owned by Swedish companies (Bohuslän), registered in Denmark.

7dk: Vessels owned by Danish companies.

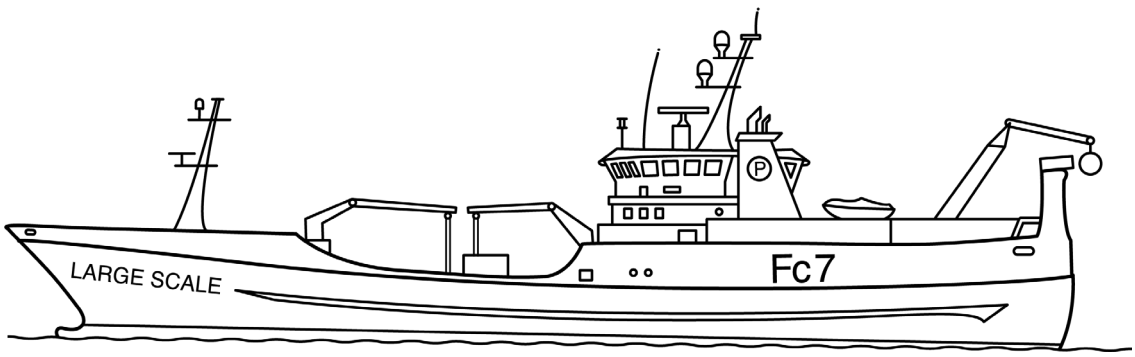

Fig. 19: *Large-scale pelagic trawler and purse-seiner equipped with refrigerated salt water (RSW) tanks to keep a sufficiently raw fish quality until the catch is landed to the harbour-based processing industry.*

3. Value chain

The value chain description comprises the first and second value chain links related to the Fishing Cultures in Skagerrak.[23]

A value chain describes the series of value adding steps from the landing of caught fish to the finished product's arrival at a customer's door (here called value chain 1), or the series of consecutive value adding steps (implements and services from sub-suppliers to fishing vessels) that go into the creation of the fishing capability and the caught fish that the fishing vessels are landing (here called value chain 2).

Value chain 1 investigates whether there are direct relations between certain Fishing Cultures and particular value adding steps at distinct fish markets. This is addressed below as the different fish value chains, following the product from landing facility to customer.

Value chain 2 investigates the (indicative) geographical and social distribution of income from the fisheries in each Fishing Culture to sub-suppliers and service providers. Based on this indication the purpose is to outline the importance of the distinct Fishing Cultures' fishing for the communities of the Jammer Bay area.

23 Sources for describing the direct value chain of fish from Jammer Bay is mainly on interviews with representatives from the auctions in Thyborøn, Hanstholm, and Hirtshals, but also comments from the interviewed fishers.

Value chain 1 – from landings to distinct seafood markets

The value chain 1 and 2 descriptions have two purposes:

The brief presentation of the Fishing Cultures above demonstrated that catches from the Jammer Bay area are landed at facilities in the harbours of Hirtshals, Hanstholm, Thyborøn, and the landing site of Thorupstrand. This is where the fish value chains begin. In the following the first-hand sales are described. The main part of the Danish catches is exported to the European market, directly from auctions or after processing or re-packaging in Denmark.

Direct sales of 'protein-fish' to processing meal- and oil industries

Industrial species are landed by demersal and pelagic trawlers directly (or sent by truck) to the meal and oil industries FF Skagen A/S (Skagen) and possibly TripleNine (Thyborøn), where they are processed into meal and oil aimed at protein-rich food in aquaculture and livestock farming or ingredients to other industries. The sale is based on contracts or in some cases day-to-day agreements.[24] The Fishing Cultures 3, 4, 7 provide the landings.

Direct sales of RSW herring and mackerel to processing industry

Herring and mackerel are landed by pelagic RSW (Refrigerated Sea Water) trawlers directly to Scandic Pelagic Skagen or Saeby Fish Canners Ltd. (Sæby Fiskeindustri), where they are processed to human consumption products. The Fishing Culture 7 provides the landings.

Direct sales of 'Norway lobster' to processing industries

80–90% of the Norway lobster landed in Hanstholm and Hirtshals are trucked directly to two industries, especially the local fisherman owned *Læsø Fiskeindustri* at the island of Læsø in Kattegat and *Seawell* processing industry in Hirtshals, or for sale at the home ports of the vessels, e.g., the fish auction in Strandby (Strandby fiskeauktion). The products are

24 Taskov et al. 2018.

generally exported to European markets (especially Italy). The Fishing Cultures 3, 4, 7 provide the landings.

Direct sales of plaice for Urk, Netherlands

Until 2021, beam trawlers from the Netherlands landed their catches directly into Dutch trucks in the Thyborøn or Hanstholm harbours, from where they were transported to landing facilities and processing industries in Urk and registered to Dutch authorities. By common agreement the Dutch fishers committed themselves to send their landings directly to their hometown. After the implementation of the EU regulation on landing registration (i.e., before the catches leave the arrival harbour), the beam trawlers during a short period landed their catches (especially plaice) from the North Sea and Skagerrak (including the Jammer Bay area) to their own landing facility (a new subsidiary company of Urk fishing industry) in Hanstholm for direct export to Urk.[25] In 2022 the direct sales stopped and since then the beam trawlers land their fish to the auction's facilities in Thyborøn, from where the landings are sent to Urk.

Sales via auctions

The remaining catches, which comprise the main part of benthic and demersal fish for human consumption, are sold via fish auctions. The next links in the value chain comprise different types of market, which can partly be linked to Fishing Cultures.

High value products to European niche markets

- Seine, gillnet, longline (and some specialized trawl) fishers provide the catch landing facilities in Thorupstrand, Hirtshals, Hanstholm, and Thyborøn with day-caught E-quality (extraordinary high quality) codfish and flatfish, which are sold at the auctions aimed at European retail and restaurant customers or Danish fishmongers. The Fishing Cultures 1, 4, 5, 6 are main providers.

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- The larger vessels, realizing the Fishing Cultures 3 and 7, can sea-pack the fish, which is landed directly to the auctions in Thyborøn, Hanstholm and Hirtshals. The fish is only handled once, fast packaged and from known vessels. Therefore, parts of the sea packed fish are also sold for the European niche markets.

- While most landings are marked with the brand Marine Stewardship Council (MSC) this does not automatically provide access to niche markets. The Danish state's *NaturSkånsom* certificate, 'Fishing with Care', which is mainly linked to The Fishing Culture 1 vessels and vessels of the Fishing Cultures 4, 5, and 6, is relatively new (2020 – see https://naturskånsom.dk/) and developed for niche markets. Via premium-price contracts with the Norwegian company Insula and its high value demanding customers this certificate and branding become still more well established on the market and therefore assignable to specific value chains for the niche variant of Fishing Culture 1 in Jammer Bay. The 'Fish caught with care' landings in Thorupstrand have since primo 2025 been sold directly to the Norwegian company Insula and via the auction in Hanstholm..

Products for the general European fresh fish markets and further industrial processing

The fish for the general European market, fresh fish market, and industrial processing for filets, consist either of sea-packaged fish from some vessels of the Fishing Cultures 3 and 7, or of iced fish from vessels operated by all Fishing Cultures, mainly 2, 3, 5 and 6, but also 1, 4 and 7. Also for these market segments, most fish are of E-quality with few of the lower A-quality. The fish is brought to catch landing facilities in Thyborøn, Hanstholm, Thorupstrand, and Hirtshals, where they are sorted, weighed, and packed in ice aimed at being sold at the auctions in batches.

From a point of departure in the fish landing facility or auction, the next step in the fish value chain may be mediated by distinct actors at the market and in two different ways:

- Traders or processing plants located in Denmark, of which a growing part are owned by foreign companies, can buy the catch directly from

the vessel. Parts of the products are sold in Denmark, but the main part is probably exported.

- Direct export mediated via buyers at the physical auctions acting on behalf of foreign companies, or direct sales at the online auction in Thyborøn. This export increased after the direct sales to Urk fish processing companies of especially plaice (and other species) was redirected to the online auction of Thyborøn due to EU legislation.

Although several Fishing Cultures contribute to the same direct value chains the quality and prices might differ in a complex pattern. The prices obtained at the auctions depend on the quality of the fish, on the quantity of landed catches (buyers prefer larger 'pots'), and on the seasons. Fish caught by gillnet and anchor seine and landed shortly after they are brought on board, can have an extraordinarily high quality, and get the highest prices during the season May – November, when the weather conditions are appropriate for these fisheries and considerable quantities of well-nourished fish from near-shore grounds are landed. This is the main source of income for the Fishing Cultures 1, 4, 5, and 6. In the autumn and winter months, weather conditions are dominated by high winds and water currents. These conditions favour the larger trawlers that obtain high prices for the large-sized plaice caught on the slope of the Norwegian trench.

Local stakeholders perceive plaice to be well-nourished at this time of year due to warmer offshore waters than close to shore. Just before Christmas, prices are always high for plaice, the quantities are limited and typically sold to fish shops, restaurants and fish counters in the supermarkets. This is an important income for the larger demersal and benthic trawlers of the Fishing Cultures 3, 4 and 7. When the gill-netters catch cod in the autumn, winter, and spring months, they land high quality fish sold at high prices. This was a highly important source of income for the Fishing Culture 1, until the cod stock in the Jammer Bay area diminished around 2000 (Fig. 20).

An example of the result of this complex price setting structure is illustrated in the table below (table 4) comparing average kilo prices for Fishing Culture 1 (gillnet and anchor seine) and Fishing Culture 3 (small and larger trawlers) landing top E-quality plaice and sole. The Fishing

Culture 1 gillnetters obtain the highest kilo price for plaice in March and June-August, whereas the trawlers obtain the highest prices during the other months. Landed sole usually obtains high prices and are caught year-round by Fishing Culture 1's gillnetters and Danish seiners, and by Fishing Culture 3's larger trawlers operating further offshore during the winter months (Nov-Feb).

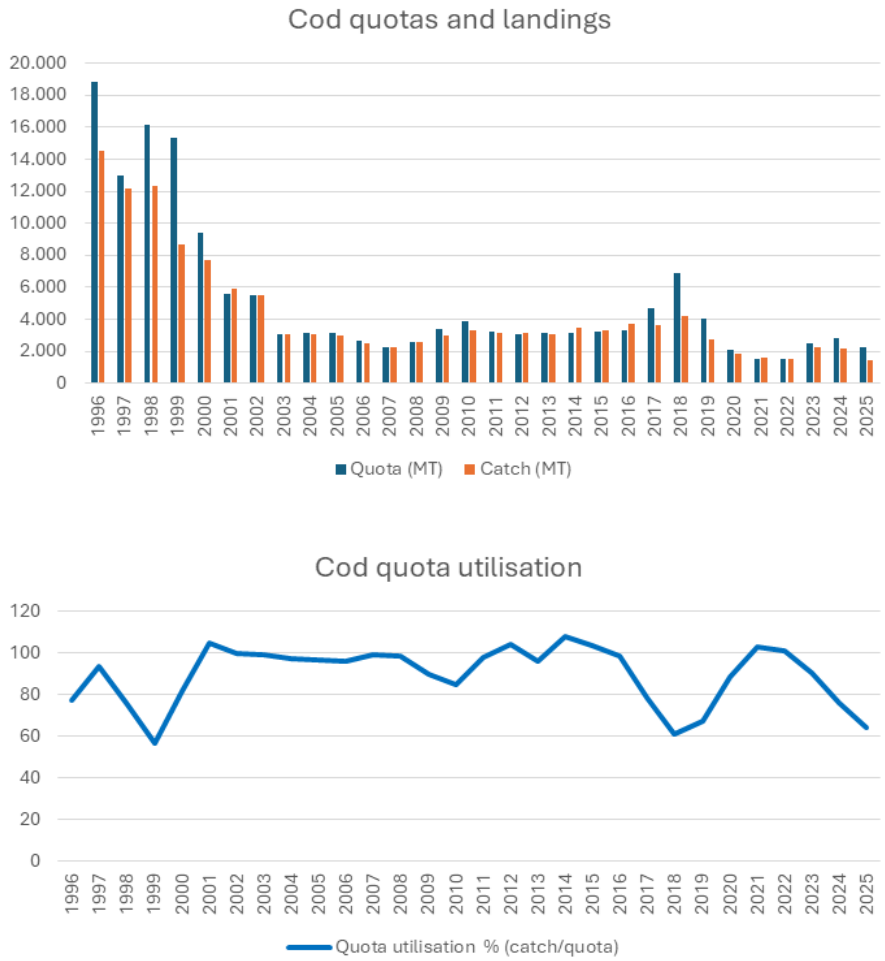


Fig. 20: *Cod fisheries statistics: a) Cod quotas and annual landings (tons) in the Skagerrak from 1996 to 2025, b) percentage utilisation of the quota. Source: The Danish Fisheries Agency, Fiskeristatistisk årbog 1996–2009. From 2010 online "Danmarks kvoter og kvoteudnyttelse".*

Table 4: Comparison of kilo prices (DKK/kilo) for plaice and sole. The Fishing Culture 1 (gillnet and Danish seine), and the Fishing Culture 3 (bottom trawl, small = 60–200 BT, and larger = 200–500 BT). Average monthly kilo price for landings over 100 kg/group/month during 2022. Red text marks the highest kilo price. Source: DTU Aqua, clt_land_kval.

Average	Kilo price Plaice_E				Kilo price sole_E			
Month, no.	The Fishing Culture 1 gillnet	The Fishing Culture 1 anchor seine	The Fishing Culture 3 trawl, small	The Fishing Culture 3 trawl, larger	The Fishing Culture 1 gillnet	The Fishing Culture 1 anchor seine	The Fishing Culture 3 trawl, small	The Fishing Culture 3 trawl, larger
1			23.12	21.22			124.18	129.82
2			32.57	33.18			139.20	163.10
3	22.20		22.12	22.05	147.68			
4	21.81	20.82	25.72	21.43	149.73			
5	23.90	19.90	24.24	20.67	152.99			
6	26.11	20.87	22.62	21.97		140.60		
7	32.36	24.74	24.07	24.49		129.34		
8	44.09	23.67	25.07	23.26		125.83		
9		23.52	25.06	26.73				
10	27.60	24.94	28.92	27.17	149.94		112.40	126.00
11		20.82	30.48	29.75			110.63	113.04
12			30.00	32.34			126.48	142.99
year	23.57	22.84	25.34	24.80	150.03	134.53	116.77	130.06

Value chain 2 – Fishing Cultures' contribution to local economy, community and welfare

The activities in and around the Fishing Cultures contribute to the local economy as well as the broader community and societal welfare. The extent of this contribution differs between the Fishing Cultures depending on the geographical dimension of the value chains supplying input for the fishing process. In this section, the general (spatial) organization of the industry and supplying value chains (backward linkages) are linked to the different Fishing Cultures. A Local Economic Effect (LEE) analysis is conducted including Direct and Indirect Economic Effects.[26] Moreover, the Induced Effects of the Fishing Cultures on other local value chains and activities are considered.

The Local Effects of the value chains are linked to the distribution of the income from the fishing activity. It is used for owner-profits and investments, skipper remunerations, and fish-workers' wages (in the Fishing Culture 7), for boat shares, gear shares and crew shares (in the Fishing Cultures 1 – 6) and it is linked to the payment of operating expenses (provisions, fuel, oil, ice, landing- and auction fees, maintenance, etc.). Watson et al. (2021) referred to these as direct and Indirect Economic Effects of the fisheries.

Depending on the spatial distribution of suppliers for these costs, they contribute to the total income of fishing communities in the Jammer Bay area, or they are channelled to communities outside the area. With the aim to evaluate how much the distinct Fishing Cultures contribute to the local economy, we assess the value that is channelled to a Jammer Bay fishing community. This assessment is based on the assumption that income related to owner profits, skipper remuneration, wages in profit-seeking vessel units, crew-share and boat-share incomes of other vessels as well as wages in companies providing fuel, maintenance, and landing related activities are local. To the extent they are local, these cost areas will contribute to the local economy. The calculation of the value of local economic effect for each Fishing Culture, as well as the relative Local Economic Effect of catch values are based on the identification of

26 See Appendix 3.

the specific vessel composition in each distinct Fishing Culture and the average account statistics for vessel categories (FIREGN2, DST). See Table 5. For the method see Appendix 3.

Table 5: Local Economic Effects (LEE) per Fishing Culture 1–7. Total landing values, LEE (i.e., income for crew and owner and income in local supplying sectors) and LEE in % of landing value. Qualitative assessment of the actual LEE level. Own calculations based on FIREGN2 and REGN1, DST. (See Appendix 3)

The Fishing Culture number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Number of vessels	10	–	54	118	14	13	25
Landing value, mill. DKK*1	14.7	**Na**	484.2	256.2	78.5	51.3	698.1
LEE, mill DKK*2	7.7	**Na**	186.9	124.9	44.1	20.8	178.9
LEE, % of landing value %	52.2	**Na**	38.6	48.8	56.3	40.5	25.6
Calculated level for Fishing Culture LEE, compared to qualitative assessed level							
Qualitative assessment of the calculated LEE for Jammer Bay[27]	LEE ≥ 52.2%	LEE very low for Jammer Bay	LEE ≤ 38,6%	LEE ≥48.8 %	LEE ≤ 56,3%	LEE ≤ 40.5%	LEE < 25,6%

In Table 5, the calculated average for the Fishing Culture 1 is probably a minimum of the Local Economic Effect of fishing in Thorupstrand, and certainly for Jammer Bay area as "the local".

27 The qualitative assessment is mainly based on interviews indicating that some of the assumptions is not fully covering. E.g. the assumption regarding direct effects that all crew and owners are local or for indirect effects that all landings take place in home port.

The calculated LEE, including the Direct and Indirect Economic Effects, is a result of the structure and degree of integration of each Fishing Culture´s vessels and crew, as well as their supply into the local economy. This is illustrated in the diagrams of the value chains for the Fishing Cultures below.

The Induced Effects describe in qualitative terms how the presence and performance of Fishing Cultures contribute to e.g., tourist business (experience economy), permanent settlement, and policies (blue growth, green transition, and sustainable management of marine nature) of the Danish state and the EU.

The value chains from the Fishing Culture 1, beach-landing coastal fisheries

Exemplified by the niche variant of the self-employed share fisher life-mode from Thorupstrand.

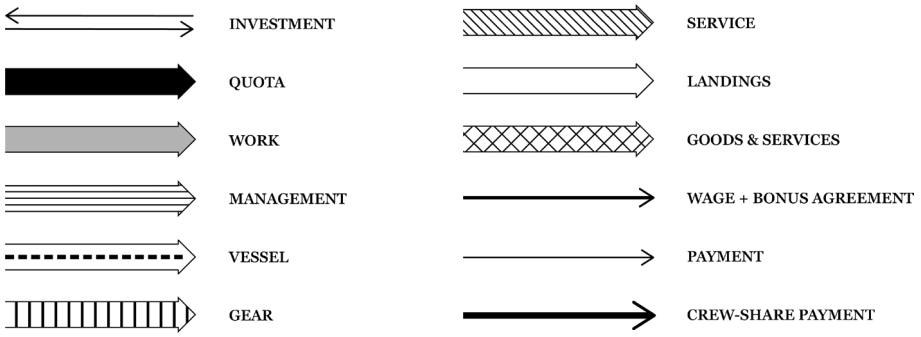


Fig. 21: *Symbols and their meaning in the value chain figures 22–25, 26 and 29–34.*[28]

The value chain is characterized by most of the effort depending on operating expenses being paid to landing site, catch landing facility, artisanal and service shops, providers of provisions, consultants, bookkeepers, cooperative quota guild and wholesale society, savings bank and similar second links in the local community.

28 The illustrations of the value chains are made by Thomas Højrup and finished by graphic designer Lise Glindvad.

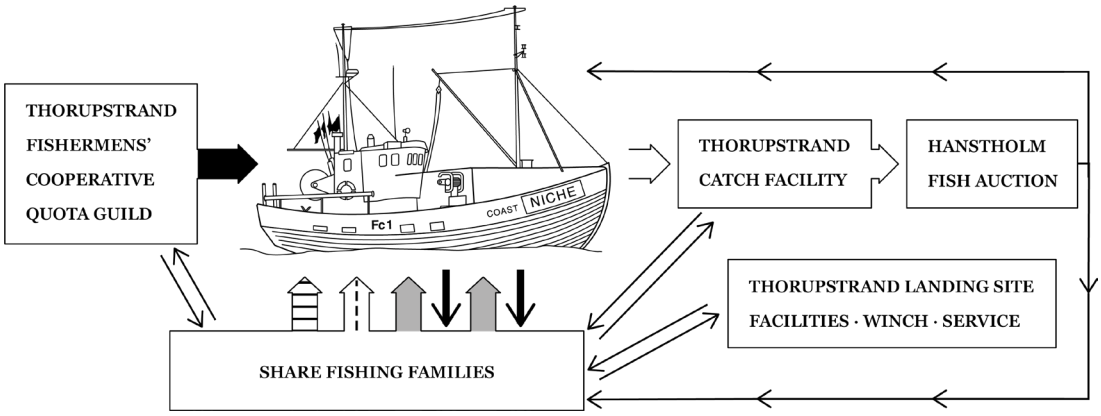


Fig. 22: *Value chain 2, step 1 for the Fishing Culture 1, the share fisher life-mode from Thorupstrand.*

The high value niche fishery is labour intensive, and the crew-share of the fishing unit's net-income is primarily used by the local share fishers to pay their families' living expenses, investments in their homes, the children's activities plus tax to the state and municipality, which in turn provide public schooling, elderly care and other parts of the welfare service.

The boat-share is used to pay the local yard, smithy, marine electrician, and other shops, who maintain the necessary back-up of local service and knowledge behind the fishing units. The fleet is an important customer of the local savings bank. Insurance fees go to national insurance companies, member fees to national fishing associations and subscription fees to international telecom companies.

The gear-share of each fishing unit go partly to family members, who maintain and renew gillnets and other gear, partly to local and regional gear providers. Seines are bought in regional dragnet factories and maintained locally. In contrast to many other Fishing Cultures and communities, the fishers in Thorupstrand conduct gill-net fishing for plaice, sole, turbot, brill, Atlantic wolffish, ling, dab, anglerfish, hake, cod, lobster, crab, and lumpsucker (lumpsucker is not allowed to be caught in 2025 and 2026) during the high seasons locally in the Jammer Bay area.

Based on 2022 account data (average for vessel categories), the Fishing Culture 1 vessels landed fish for a value of 14.7 mill DKK. The relatively labour-intensive fishing process means that up to 44% of the value of the

landings goes to the share fishing families' crew-share and boat-share incomes, and 9% of the value of the fish landings are the wage share in the used services, fuel, landing, and maintenance costs. The calculated Local Economic Effect, LEE is therefore 7.7 mill DKK, 52% of the value of fish landings. The vessels operate locally, with regards to fishing and associated services, such as provisions and banking. The possibility and ability to return home to the family every evening and to use all the natural resources (deer hunting, cultivation of kitchen gardens, constructing the families' own houses, riding on horseback in the local forest, managing the community's own landing facility and quota company, cooperating and enjoying to be together with friends from childhood to old age etc.) in the local area is a value of high esteem in this community and attracts young people realizing the self-employed share fishing life-mode. The auction is not local but situated within the Jammer Bay area. The calculated average for the Fishing Culture 1 is therefore probably a minimum of the local economic effect of fishing in Thorupstrand, and certainly for Jammer Bay area as "the local".

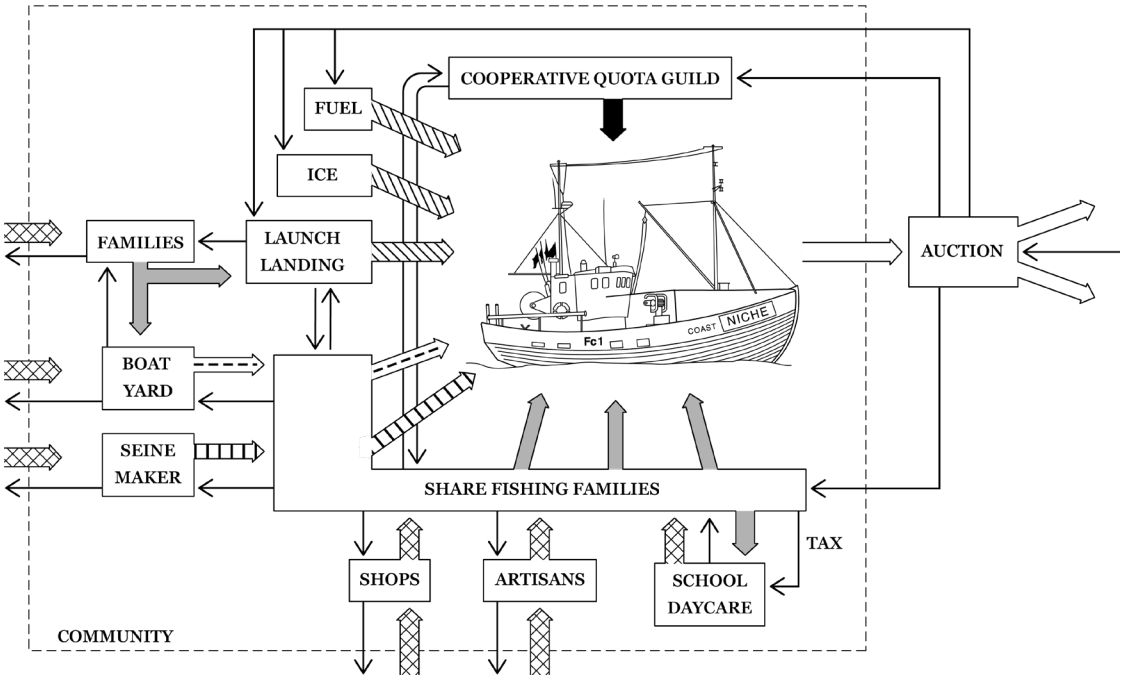


Fig. 23: *Value chain 2, step 2 from Fishing Culture 1 .*

The Induced Effects from the presence and performance of Fishing Culture 1 to tourist business are decisive for the local experience economy, because more than 100.000 guests visit the Thorupstrand landing site each year. The core attraction is to watch the fishers launch their clinker crafts and land again on the beach to unload fresh fish. Also popular is the building and repair of these beach landing 'sea boats' at the clinker craft yard in Slettestrand nearby and on the beach. The construction of clinker-boats is a 2.000 years old craft in the Nordic countries and the flexibility of the clinker-craft oak hull is well-suited for beach launching and landing because it can absorb the bumps when the boats hit the sand-banks surfing ashore at high waves. Hence, the special craftsmanship is still in use when new boats are constructed and existing ones are repaired at the landing sites on the open beach. The Nordic clinker boat traditions were inscribed in 2021 on the Representative List of the Intangible Cultural Heritage of Humanity.[29]

The fishers' cooperatively owned fish shop and restaurant serve 30.000–40.000 dining guests each year, and at least three times as many visit the landing site. These guests make up an important market for the shops in the neighbourhood and the nearby small town of Fjerritslev. The municipality counts the fishing community as its most important asset of the experience economy. This Fishing Culture 1 community is the largest of the two shore-based landing sites in Skagerrak.[30]

The value chains from Fishing Culture 2, Dutch demersal beam trawling

Exemplified by the expansive variant of the beam trawling, self-employed share fisher life-mode from Urk.

The value chains from the long-distant fishing vessels of Urk's beam trawler fleet are conditioned by the fact that they are operating far away from Urk because of their perception of increasing depletion of the habitats and stocks of sole, plaice, and cod in the southern parts of the North Sea. Besides general depletion of the stocks, the Dutch beam trawlers also

29 https://ich.unesco.org/en/RL/nordic-clinker-boat-traditions-01686

30 Hoffmann, 2016, Hoffmann 2020, Eigaard and Olsen 2020.

consider themselves under pressure from competition for space with wind turbines, which are erected in the southern North Sea. This reinforces an increased competition for sea areas. Expansion of offshore wind farms in the southern North Sea increases the displacement of beam trawlers.[31] Several families are replacing their beam trawler with a new flyshooter vessel that can be operated with a lower fuel consumption. The direct value chain of the distant-water fleet is characterized on the one hand by effort depending operating expenses being paid to North Sea ports and catch landing facilities (located outside Urk) and on the other hand by expenses regarding lubricant oil, fuel, provisions, technical service, advisory, construction and renewal of gear and spare parts of the vessels being paid to the TCD VCU cooperative production and wholesale society of Urk. The huge business of the Fisheries Cooperative of Urk employs technical and economic experts, artisans, wageworkers and sub-contractors, and deal with local banks and similar second links in the Urk community.

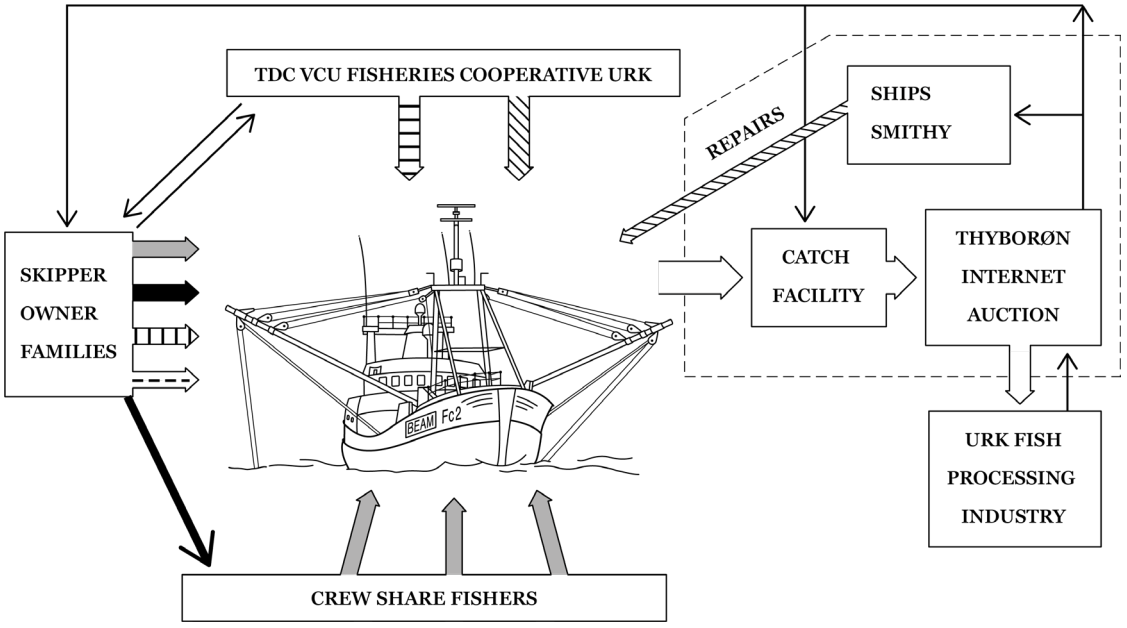


Fig. 24: *The value chain 2, step 1 from the Fishing Culture 2.*

31 A Dutch beam trawl skipper stated: "We're using the same fishing grounds. The Danish fishers have to move, the Dutch fishers have to move, because of the wind farms. So, you have to go closer and closer to each other."

The beam trawl fishery employs 7 fishers on each vessel and the crew-share of the fishing unit's net-income is used by: 1), commuting fishers from East European and Baltic countries; and 2), the local share fishers from Urk to pay their families' living expenses, investments in their homes, the children's activities as well as taxes to the Dutch state, and municipality's provision of public school, elderly care and other parts of their local welfare service.

The boat-share is appropriated by skipper-owner families, who have their vessels constructed at their local yard or one of the larger Dutch yards. The vessel owner families are important customers of the local bank. Insurance fees go to national insurance companies, member fees to the local fishing association, and subscription fees to international telecom companies.

The Local Economic Effects from the Dutch fleet are not calculated in this study due to the denial of access to quantitative data by Dutch authorities and the fact, that this fleet's economic effects of fishing in the Jammer Bay area are close to zero while the costs related to fuel, catch landings facility costs, and to some degree the repairs of folded beams are paid in the North Sea port of Thyborøn and Hanstholm where the beam trawlers are landing their catch between each week's 5 fishing days. The organization of the Urk fleet and service industry ensures relatively high Local Economic Effects in the Urk region, despite the long-distance operation in the Danish parts of the northern North Sea and Skagerrak/Jammer Bay area. The Local Economic Effect for Jammer Bay region is correspondingly low.

The two main Urk plaice processing plants purchase nearly all catches in Thyborøn and are presently readjusting their production and export to process and market Norwegian farmed salmon in order to offset decreased landings of flatfish and round fish from the North Sea. These plants employ engineers as well as technical experts and wageworkers, whose families are living in Urk, and just like the fishing families, they contribute to maintain the local Urk shops, artisans, schools and other welfare institutions.

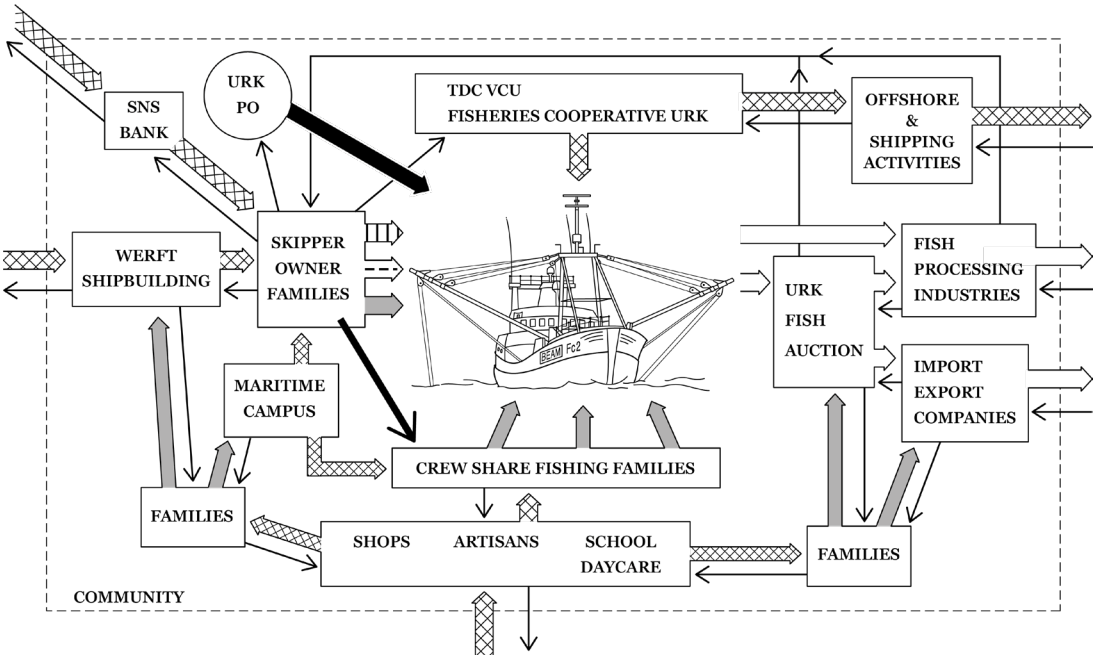


Fig. 25: *Value chain 2, step 2 from the Urk fleet.*

Until summer 2021, the long distant fishing crews who landed their catches every Friday afternoon in Thyborøn, unloaded directly into refrigerated vans from the Urk Fish Auction. The catches were weighed and registered when they arrived in Urk. After the implementation of new EU landing regulations, these vessels now unload to the Thyborøn landing facility, and the two main Urk fish processing industries then buy it on the internet-auction in Thyborøn.

The Induced Effects from the presence and performance of Urk's fishing fleet, the *VCU De Maritieme Specialist*, and the fish processing plants, consist of the development of maritime service functions to other offshore activities than the fishing industry. The widening of VCU's product portfolio of maritime services makes Urk a maritime hub that also includes *Maritime Urk* and the *Maritime Campus Urk*, where the specialists teach in beam trawling, fly-shooting etc. and educate professional fishers as well as other categories of seamen, engine operators and navigators. Specialists and their families including young people under education contribute to the community's magnitude of shops, artisans and services. Concurrent with the present decrease of crews in the fishing fleet, the young people

pursue alternative jobs and positions in the expanding maritime industry of the community.

The value chains from the Fishing Culture 3, the expansive harbour-based fishery

The expansive variant of the self-employed fisher life-mode from Hanstholm, Hirtshals, Skagen and Strandby.

The value chains from the vessels of the Fishing Culture 3 are characterized by a considerable effort, impact, and appropriation of the fish resources in the Jammer Bay area, however a minority of the vessels come from the two local ports. The catches of sand eel in the area are only occasional, and trucks drive these landings to the fishmeal and oil plant FF-Skagen. This chain developed after the local plants lost an economic power struggle and consolidation process, in which FF-Skagen concentrated Northern Jutland's processing of 'industrial fish' into protein ingredients in Skagen.

Fig. 26: *In the Fishing Cultures 3 and 7 the expansion of capability is prepared when a new ship is constructed with the aim of making it easy to enlarge the vessel subsequently. Karstensen's Shipyard elongates the trawler and flyshooter HM 227 'Myggenes of Hanstholm' in Skagen. Photo: Thomas Højrup, 2023.*

The catches of Norway lobster are for a large part sold on contract to Læsø fish industry and to Seawell Hirtshals. The vessel owning skipper families of the Fishing Culture 3 are constantly trying to improve their capability by means of new and larger boats and engines supplied with still more quotas bought up and owned by the skipper families and paid off by the gross income of the vessel. Out of 33 Fishing Culture 3 bottom trawlers between 60–200 GT, fishing in Jammer Bay (2022) only 8 come from the local ports, the rest depart to their long-distant fishery from Baltic, Kattegat and North Sea ports implying unstable landings in the Jammer Bay ports. In the class of 200–500 GT Fishing Culture 3 bottom trawlers, 3 come from the local ports, and 17 from the North Sea, Kattegat, and Baltic ports (2022). Hence, the heavy bottom trawling after Norway lobster and fish at mud sea bed and the wide edge of the Norwegian Slope, the 'Great Reef' inside this 'edge', and the 'Hirtshals Trench' is – together with the absent demand of full documented fishery – attracting expansive bottom trawlers from these vessels' distant home waters, which are plagued by environmental degradation and declining stocks of especially plaice and cod – and in Kattegat schemes of camera control aboard.

Based on 2022 account data (average for vessel categories in the Skagerrak), the Fishing Culture 3 vessels landed fish for a value of 484 mill DKK. The fishing process is less labour intensive than e.g., the Fishing Culture 1, which means that 31% of the value of the landings goes to crew-share incomes for share fishers and boat-share owners, and 7% of the value of the fish landings are the wage share in the used services, such as fuel, landing, and maintenance costs. The calculated Local Economic Effect is therefore 187 mill DKK, 39% of the value of fish landings. The vessels tend to roam, being less locally connected to the Jammer Bay area. The calculated average income share of the Fishing Culture 3 vessels' value chain is therefore probably a maximum estimate of the Local Economic Effects in the Jammer Bay area.

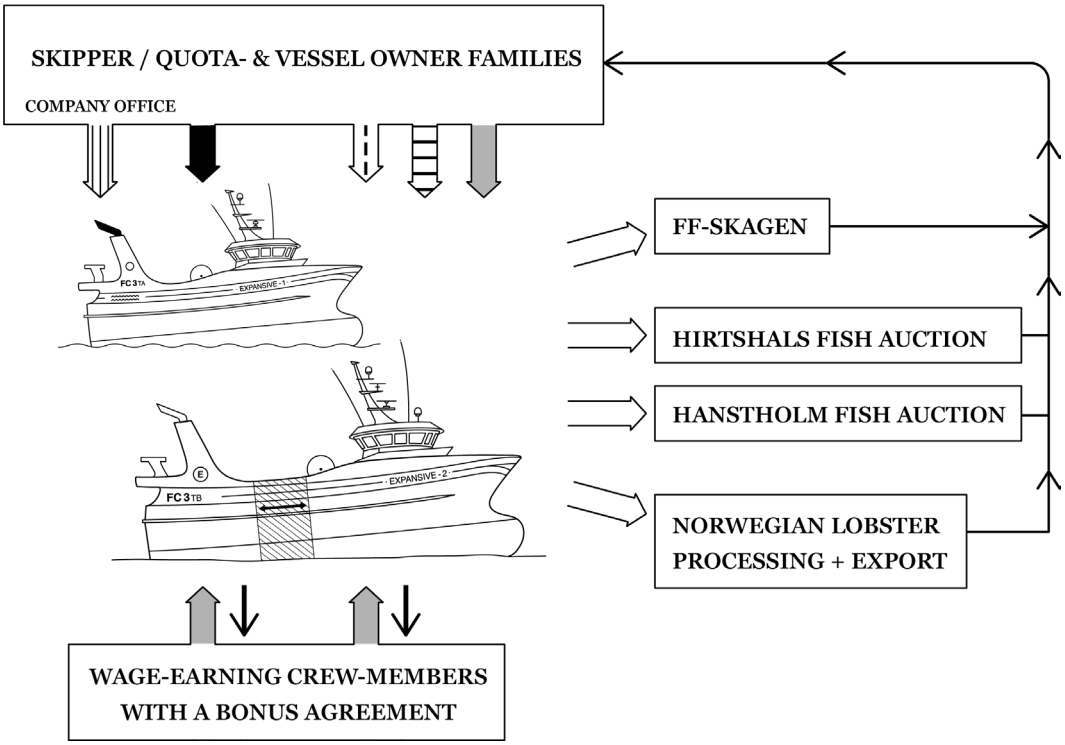


Fig. 27: *Value chain 2, step 1 from the Fishing Culture 3.*

The induced effects from the activities of the Fishing Culture 3 consist of distant fishing's contribution to the survival of expansive bottom trawler skipper companies, coming from crisis-ridden waters (the Baltic, Kattegat and Southern and Eastern part of the North Sea) and fishing harbour affiliations outside Jammer Bay area.

The Fishing Culture 3 provides seafood and income in a broader inter-regional sense and contributes to the maintenance of the profile of their fishing communities in Skagerrak, and especially outside the Jammer Bay area (North Sea, Kattegat, Baltic).

Fig. 28: *Taking advantage of the privatisation of Danish demersal and benthic fishing quotas in 2007 a team of fishing families saw the possibility to realize an expansive business plan comprising fast investments in Baltic, Skagerrak and North Sea fishing quotas as well as the construction of a typical Fishing Culture 3 multi-trawler prepared for succeeding enlargement and the introduction of a wage-system instead of the share-system. The 467 GT refrigerator and freezer trawler HM 555 'Kingfisher of Hanstholm' was launched 2008 and its crew has since combined local and long-distance multi-trawling. Photo: Thomas Højrup, 2008.*

The value chains from the Fishing Culture 4, the harbour-based coastal fishery

The thrifty and the niche variants of the self-employed share fisher life-mode from Hirtshals and Hanstholm.

The value chains from the Fishing Culture 4 vessels are important and stable supplies of fish to the two local auctions and purchases of Norway lobster. Instead of competing for increased capacity by means of new vessels, these share fishing skippers and vessel owners maintain and gradually modernize existing vessels to avoid being too dependent upon expensive bank loans and having to maintain high landing volumes. Hence, they

contribute to the local artisans, service shops and providers of instruments and equipment.

In the Fishing Culture 4, fishers prefer to be as independent as possible upon not only banks and dominant merchants, but also on 'unreliable' authorities. This loss of trust in authorities was generated by the refusal in 2023 to reduce the TAC (Total Allowabel Catch) of the North Sea and Skagerrak plaice quota, even though the fishers' organizations informed authorities about their inability since 2017 to land more than 20 – 30% of the TAC (Figs. 29 and 30). And due to the ministry's absent action against the beam trawling in Skagerrak, non-protection of spawn and juvenile fish against the use of small meshes in bottom dredging gear as e.g. the expansive trawlers' use of small meshes in their Norway lobster trawl applied in the coastal side of the Hirtshals Trench and their "massive discard" of juvenile fish.[32]

Independency, self-employment, and proximity to one's fishing grounds are much more important cultural values for these fishers than comfort like the 'luxury cabins' on the expansive and large-scale company vessels.

Of a total of 118 vessels (2022) in the Fishing Culture 4, half are registered in the two local harbours. They use a wide variety of fishing methods and fishing gears and contribute in this way to maintain a similar wide market for providers of gears and services to the local fishing fleet. This means that the value chain has an important Local Economic Effect on local families' incomes in the second link of the local value chain.

32 https://lfst.dk/alle-nyheder/meddelelser-om-fiskeri/straksreguleringer (RTC lukning)

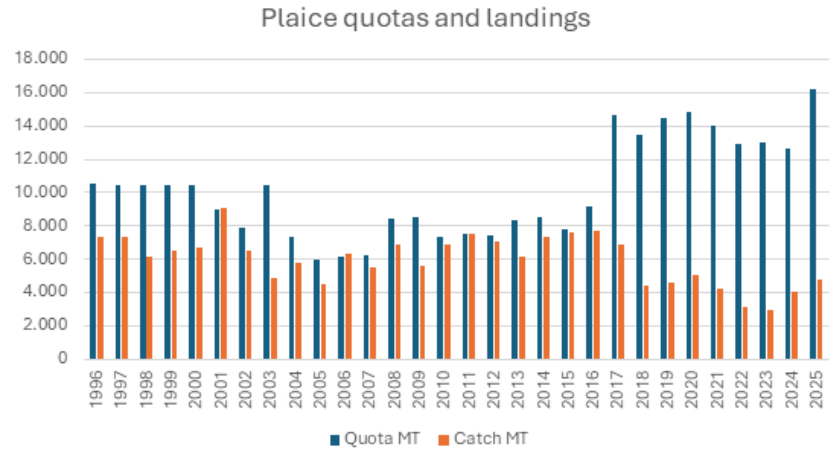


Fig. 29: *Quota and catches, Danish vessels in Skagerrak (3AN). 1996 to 2025 Source: The Danish Fisheries Agency, Fiskeristatistisk årbog 1996–2009, from 2010 online "Danmarks kvoter og kvoteudnyttelse".*

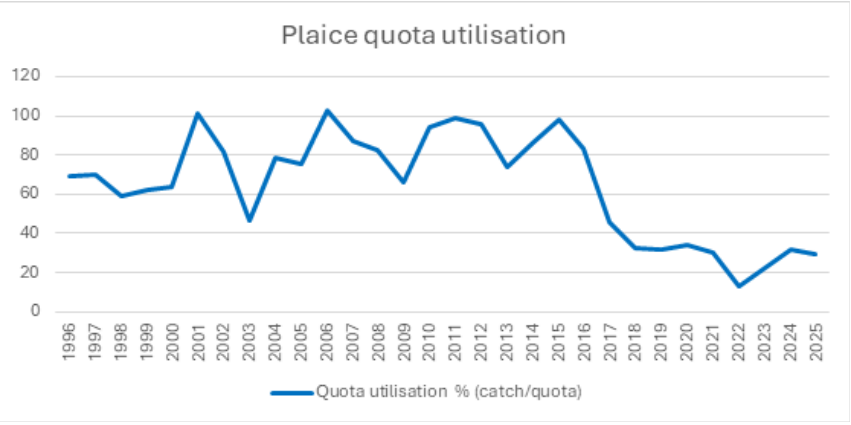


Fig. 30: *Quota utilization (%), Danish vessels in Skagerrak (3AN). 1996 to 2025. Source: The Danish Fisheries Agency, Fiskeristatistisk årbog 1996–2009, from 2010 online "Danmarks kvoter og kvoteudnyttelse").*[33]

33 Figs. 29 and 30 are based on data from Fiskeristyrelsen, data for landing statistics and quota utilization (landingsstatistik og kvoteudnyttelse) (https://lfst.dk/fiskeriet-i-tal/landinger). The appendix 5 "Alle kvoter [år] som pdf-fil" for 2013–2025. Plaice (rødspætte), 3AN, total and quota. For 1996–2009: Fiskeristatistisk årbog tabel 2.2. Danmarks kvoter og kvoteudnyttelse. Plaice 3a. on paper, from 1999 online: https://lfst.dk/fiskeriet-i-tal/fiskeristatistisk-aarbog

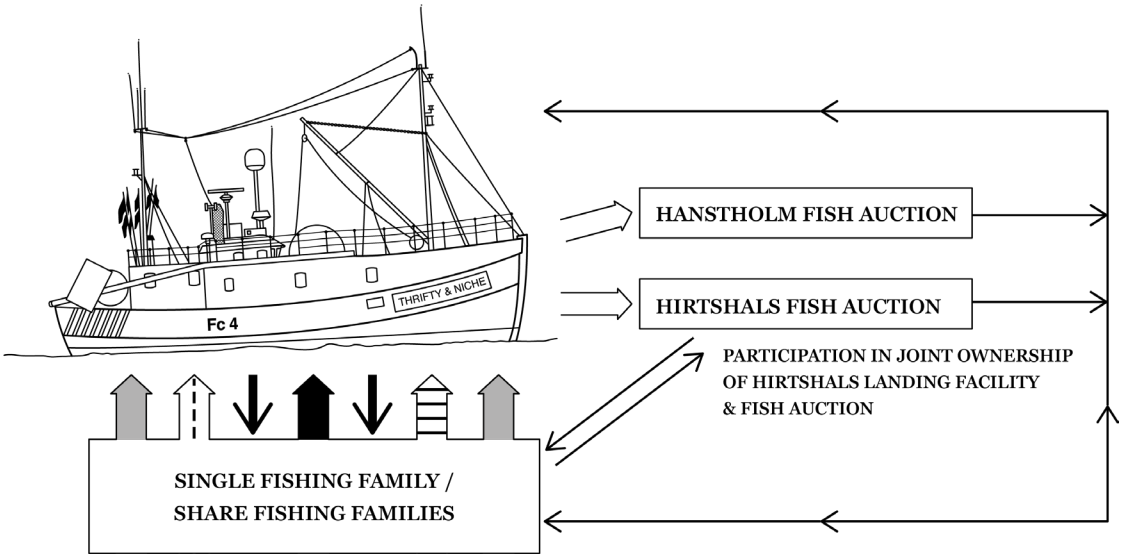


Fig. 31: *Value chain 2, step 1 from the Fishing Culture 4.*

Based on the 2022 account data (average for vessel categories), the Fishing Culture 4 vessels landed fish at a value of 256 mill DKK. The fishing process is relatively labour intensive, which means that 41% of the landings value goes to crew-share incomes for share fishers and boat-share owners, and 8% to the wage share in the used services, such as fuel, landing, and maintenance costs. The calculated Local Economic Effect is therefore 125 mill DKK, equivalent to 49% of the value of fish landings. Because vessels are very local in their field of activity, the calculated average for the Fishing Culture 4 vessels is probably a minimum of the Local Economic Effect within the Jammer Bay area.

The Induced Effects from the activities of the Fishing Culture 4 have three important features: 1), significance for the local auction; 2), significance as presupposition of a mixed household economy; and 3), significance for the local events and festivals around seafood, sustainability, and experience economy.

The first feature is illustrated by the fact, that Hirtshals and Hanstholm prefer to focus on a manned and 'handmade' auction where the buyers can inspect the quality of the fish in the boxes on the auction floor. Thyborøn, a harbour where the Fishing Cultures 2, 3 and 7 presently dominate, has changed to an internet-auction (Pefa-auction), where the byers cannot physically inspect the fish quality, but must rely on a detailed quality classification scheme filled in by the auction's employees. This feature is

underlined by the fact, that the fisher-owned catch facility in Hirtshals has bought the auction and restructured it to a 'service facility' to improve the facilitating and appropriation of the high-value landings from the Fishing Culture 4 vessels and the Fishing Culture 6 vessels. The present (2024) result of this venture is that the small vessels of the Fishing Culture 4 deliver 33% of the landed value and Danish seiners of Fishing Culture 6 another 33% of the total landed value at this auction.

The second feature is demonstrated by the fact, that 100–200 small vessels operated by part-time fishers maintain the basis for the continuation of an extensive mixed household business in the area around the port town, combining wage-work, farming, craft, liberal profession, and other occupations with coastal fishing.

The third feature is manifested by the fruitful cultural and industrial environment for events and yearly festivals such as 'Hook and Cook' arranged by Destination North-West Coast and 'The Fish Day', where guests can taste seafood, hear about fishing, sustainability, and fish quality, as well as experience a live fish auction and guided tours by friendly fishers on board fishing vessels. Similar events are also hosted in Hanstholm and Thorupstrand.

The value chains from the Fishing Culture 5, the specialized gillnet fishery

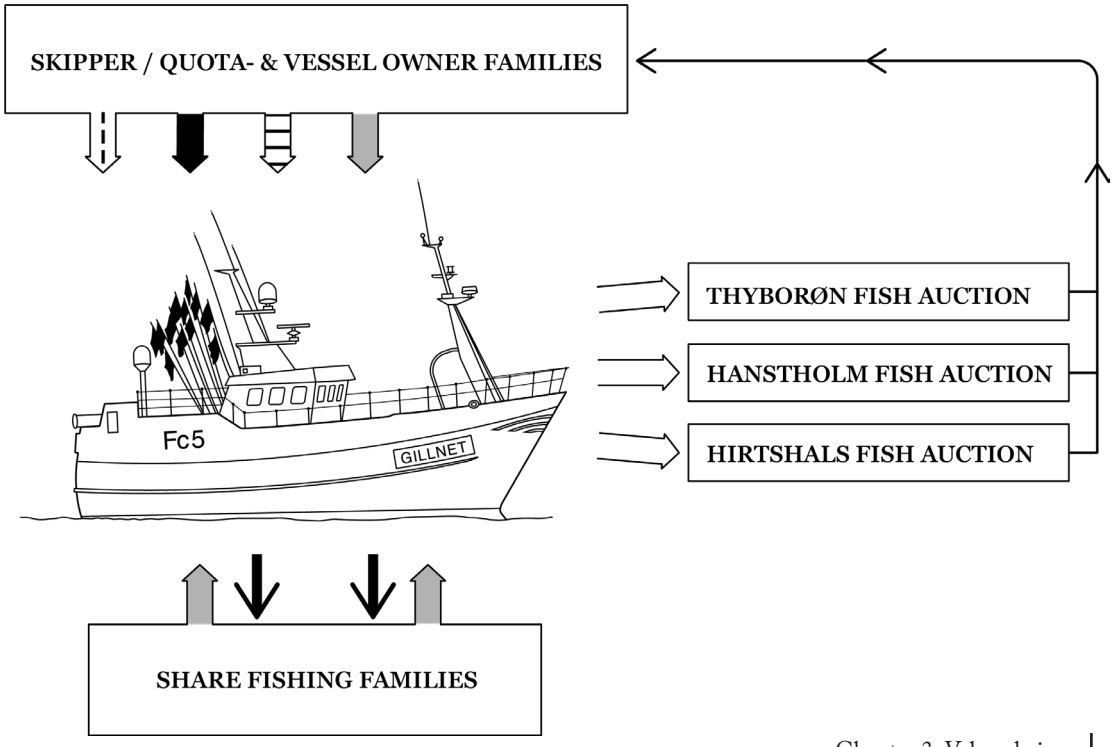
The thrifty and the expansive gill-netting variant of the self-employed fisher life-mode from Hvide Sande, Thorsminde, Thyborøn, and Hanstholm.

The value chains from the landings of the Fishing Culture 5 are characterized by the low environmental impact and work intensive mode of operation and fishing method, and by the disappearance of most of the former fleets of gill-netting vessels above 12 m length from the four Jutlandic Westcoast ports. It has been still more difficult to recruit young Danish fishers in port towns, who want to be crew-share fishers on vessels operated by another vessel and quota owning family than their own. Hence, in the little class (20–50 GT) only three vessels come from the two Jammer Bay ports and three from North Sea ports. In the large class (<100 GT), all six vessels come from North Sea ports and operate between 13 and 83 fishing days in the Jammer Bay area (2022).

These unilaterally specialized gill-net vessels are the remaining rest of the formerly large modern fleet of high value gill-netters catching sole, plaice, turbot, and cod all over the North Sea and Skagerrak from the ports of Hvide Sande, Thorsminde, and Thyborøn. Depending on the number of their days at sea the Fishing Culture 5 crews land relatively high-valued fish in Thyborøn, Hanstholm and Hirtshals, but do not contribute much further to the value chain in the Jammer Bay area ports.

Based on 2022 account data (average for vessel categories), the Fishing Culture 5 vessels landed fish for a value of 78 mill DKK. The fishing process is quite labour intensive, which means that 49% of the value of the landings goes to crew-share incomes for share fishers and boat-share owners, and 7% of the value of the fish landings are the wage share in the used services, fuel, landing, and maintenance costs. The calculated Local Economic Effect is therefore 44 mill DKK, as much as 56% of the value of fish landings. The vessels are specialized, mainly departing from fishing harbour affiliations south of Jammer Bay and operating in the North Sea as well as Jammer Bay. The calculated Local Economic effect is therefore probably a maximum or higher estimate than the actual effect in the Jammer Bay area.

Fig. 32: *Value chain 2, step 1 from Fishing Culture 5.*



The Induced Effects from the presence and performance of the Fishing Culture 5 gill-net vessels have – according to the fishers[34] – declined concurrently with their 10 years of overfishing of large cod at the North Sea shipwrecks in the 1970s, and with the subsequent displacement of the Danish gill-net fleet by the Dutch and Belgian beam trawlers, which is a conflict caused by the antagonism between the entangling and the bait-digging fishing methods. Furthermore, the gillnets are highly vulnerable where beam trawlers operate. The problems of the gill-net fleet fostered public awareness and concern about the devastating impact by the Fishing Culture 2 on the perceived environmentally low-impact fishing methods as well as on the marine habitats in the North Sea. Even before the third wave of heavy beam trawling since the 1980s hit the Jammer Bay area in Skagerrak, cod overfishing on the stone reefs by the Fishing Cultures 2 and 5 was already gaining public awareness and concern.[35]

The value chains from the Fishing Culture 6, the specialized anchor-seine fishery

The thrifty variant of the anchor-seining self-employed fisher life-mode from Thyborøn, Hanstholm and Hirtshals.

The value chains from the harbour-based anchor seine boats of the Fishing Culture 6 represent the last reminiscent of the huge Danish sea-going anchor seine fleet, that dominated North Sea fishing from Danish ports until a couple of decades after World War 2. Today, fresh caught, fast landed, and properly gutted, iced and stored 'seine plaice' reach the highest prices at the auctions, but concurrently with the collapse of the plaice stock in the Southern and Eastern areas of the North Sea and Skagerrak, which evolved from 2017 and during the next eight years most of the fleet of active anchor seiners from Thyborøn has disappeared. A large part of the remaining fleet in Hanstholm has been forced to seek the plaice stock out in the Northern part of Skagerrak's coastal sand ground and in Tannis Bay where beamtrawling is not allowed. The anchor seiners are presently landing their catch in Hirtshals, which the fleet of 3 large wooden anchor seiners presently use as their home-port, even if they

34 Tang et al. 2023.

35 Højrup & Nielsen 2024, p. 946, 1022f

are registered in Hanstholm and their crew of share fishers drive by car to Hirtshals from their homes in Thorupstrand and around Hanstholm.

Based on 2022 account data (average for vessel categories), the Fishing Culture 6 vessels landed fish for a value of 51 mill DKK. The fishing process is less labour intensive than e.g. the labour processes of Fishing Culture 5, and thus only 32% of the value of the landings goes to crew-share incomes for share fishers and boat-share owners, and 8% of the value of the fish landings are the wage share in the used services, fuel, landing, and maintenance costs. The calculated Local Economic Effect is therefore 21 mill DKK, 42% of the value of fish landings. The vessels operate mainly in the northern part of Jammer Bay and the Tannis Bay areas, and from 2022 very few landings were registered south of Jammer Bay. While the direct income share follows the crew and the boat-share owners to their home communities, the operational costs tend to stay in the landing port, at present within the Jammer Bay area. The calculated Local Economic Effect is therefore a maximum estimate for the Jammer Bay Area, distributed to the fishing harbour affiliations of the vessels.

This unilateral specialized Fishing Culture 6 fleet of seine vessels contributes 1/3 of the landed value of Hirtshals auction and, together with the broadly combined and versatile fishing units of the Fishing Culture 4, they deliver a high value portion of the auction's turnover. The appropriation of these near shore hunted fish stocks have to be caught with care, to avoid bycatch of juvenile and under-sized fish. The Hirtshals fishers proposed that the Danish Fisher Organization PO should demand that the authorities introduce stepwise increasing mesh-sizes that make it possible to avoid bycatch of small and juvenile fish, but the proposal was promptly turned down by the top management of the organization.

The Induced Effects of the presence and performance of the wooden anchor seiners consist not least in the attractive sight of the light blue vessels in the harbour of Hirtshals, where they are enjoyed by locals as well as tourists. The old-timer anchor seiner HG 159 Johs. Hejlesen is owned and operated by local organizations in Hirtshals and is used to inform visitors about anchor seining at an exhibition on the quayside where the active anchor seiner fleet is moored when the crews go home to their families between each trip on the sea. This fleet contributes to the en-

vironment of the festivals and events in Hirtshals, attracting guests and locals around debates on fishery politics, sustainability, and food qualities.

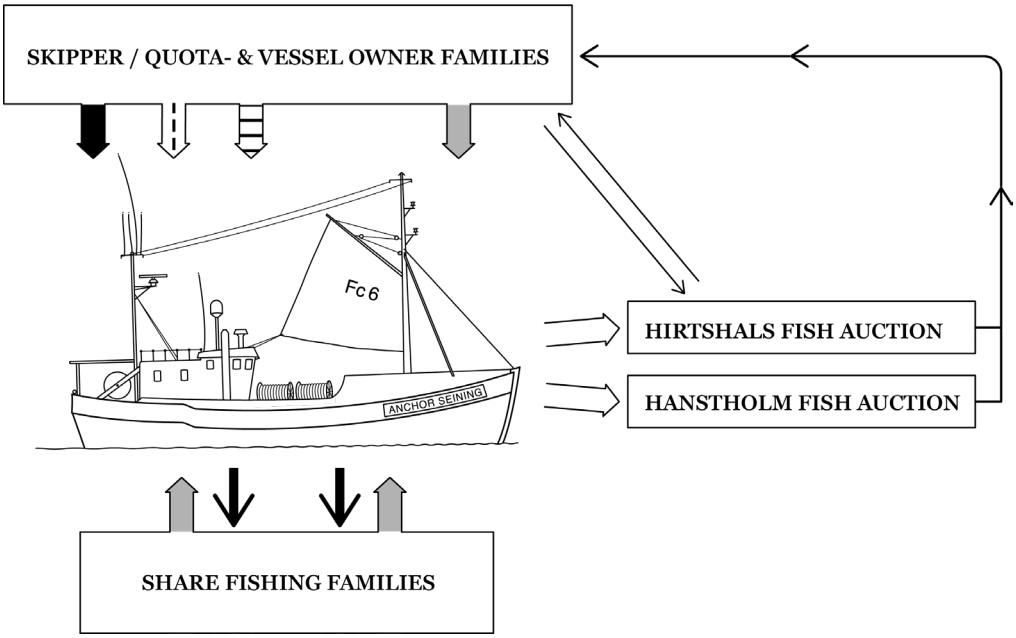


Fig. 33: *Value chain 2, step 1 from the Fishing Culture 6.*

The value chains from Fishing Culture 7, the profit-seeking large-scale fishery

The expansive variant of the entrepreneurial life-mode from Hanstholm, Hirtshals, Skagen, Nexø, Rörö, Öckerö, Fotö.

The value chains from the vessels in the Fishing Culture 7 are differentiated between the (mainly) demersal, industrial and the pelagic vessels respectively. As the unilaterally specialized pelagic vessels employ only a minor part of their yearly circle in the local waters, it is the demersal and industrial trawlers' activity in Skagerrak that delivers the largest contribution from the fishing grounds in Jammer Bay area to the direct value chains of the Fishing Culture 7. Only a few of these vessels are registered in a Jammer Bay fishing harbour affiliation, whereas twice as many come from the North Sea, Kattegat, and Baltic ports (2022–25). These distant-water fishing vessels land their catch wherever they antic-

ipate the highest prices or lowest costs of operation (use of fuel to reach a landing facility). Hence, many of them are regarded as 'unstable' by the catch landing facilities and auctions of the two Jammer Bay ports.

The crews of the Fishing Culture 7 are recruited from all parts of Denmark. The vessels are being constructed at yards in the North Sea and Kattegat harbours and most of these vessels are kept in repair by service providers in their hometowns. With its access to risk capital, this Fishing Culture is the one that accumulates most transferable quotas as company property, despite the difficulties they encounter when it comes to develop capital demanding large-scale advantages in the demersal fisheries (with absent fish shoal formation) because of their huge fuel consumption (due to the suction caused by the trawl doors and the increased catch current speed near the funnel part of the trawl).

Based on 2022 account data (average for these vessel categories in the Skagerrak), the Fishing Culture 7 vessels landed fish for a value of 698 mill DKK. The fishing process is the least labour intensive of the Fishing Cultures, with only 21% of the value of the landings for (relatively high) wages for the (relatively few) employees, and 5% of the value of the fish landings are the wage share in the used services, fuel, landing, and maintenance costs. The calculated Local Economic Effect is therefore 179 mill DKK, as low as 26% of the value of fish landings. Of the 27 vessels, 9 are owned by companies in Jammer Bay ports (even if most pelagic vessels land their catch in Skagen). A few pelagic vessel owner and skipper families are able to appropriate considerable profits when quotas and prices are favourable. Hence, the Local Economic Effect for the Jammer Bay area of Fishing Culture 7 vessels is probably significantly lower than the calculated value estimate, whereas fishing communities in e.g., Bohuslen and Bornholm might benefit more of the Local Economic Effects.

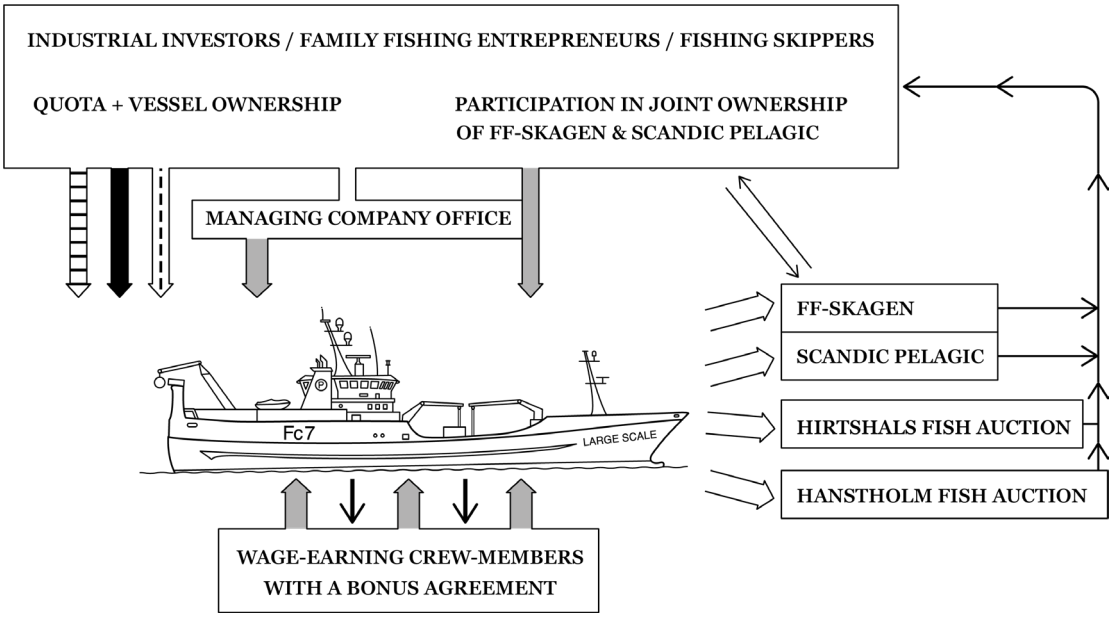


Fig. 34: *Value chain 2, step 1 from the Fishing Culture 7.*

The Induced Effects from the presence and performance of the Fishing Culture 7 are primarily located in Skagen outside the Jammer Bay area, where Karstensen's Shipyard and its many subcontractors create the employment and family incomes that make it possible to keep permanent residents in Skagen despite the disappearance of most of the local vessels of the Fishing Cultures 3, 4, 5, and 6 from this community. Furthermore, the presence of many large-scale pelagic vessels at the equipment quayside maintains the visual impression of being in a 'fishing harbour', which is an important part of the identity that tourists enjoy. Tourists visiting Skagen experience the connection between the motifs of the fisherfolks and vessels by the famous 'Skagen painters' from around 1900 (visible at the local museums) and the modern fishing fleet and industry. It is noted that only an insignificant part of these vessels' landings is caught in Jammer Bay.

4. Fishing Communities

Thorupstrand – a Jammer Bay beach landing site

Thorupstrand is a community located around a landing site on the open beach at the north facing coast of central Jammer Bay area. The fleet of beach-landing trading and fishing vessels has employed most of the families of the little community behind the dunes since ancient times. After 1900 the fish export was eased by the railway and the share fishing families modernized their crafts, installed engines and winches aimed at the operation of anchor seines.[36] Usually, the size of the fleet varies between 10 and 20 vessels. Though, since 2017 and during the next seven years of sea floor devastating and food chain destroying Dutch beam trawling on the shallow grounds of Jammer Bay, 2/3 of the local beach-landing vessels have been displaced from Jammer Bay. The local fleet will – as the fishing families see it – only rise from the ashes when the method of beam trawling is prohibited in this area, making it possible for the stocks of Abra alba mussels, plaice and cod to recover.

Each beach landing vessel can switch between and combine longlining, trap fishing, gillnetting, anchor seining, jigging and similar methods in a broad, versatile mode of operation. Around 150 days a year these fishing units catch a wide spectre of fish species that stay in or visit the mosaic of stone reefs and sand banks in the Jammer Bay area during a yearly cycle. The self-employed fishing families cooperate in share-organised crews and represent the thrifty and niche-oriented Fishing Culture 1.

36 Højrup 2022.

Fig. 35: *Operated by 3 share organised coastal fishers, the 27 GT combined gillnetter and anchor seiner HM 33 'Kikani of Thorupstrand' is returning home with gillnet-caught cod from the stone reefs in Jammer Bay a windy day in January 2023. Kikani was constructed and launched at the landing site of Slettestrand in 2017 and got its name from the boat-share owner family as a condensation of the married couple Kirsten and Karsten Nielsen. Photo: Dan Sejbjerg, 2023.*

When the demersal and benthic fishing quotas were privatised in 2006-2007, Thorupstrand's survival strategy initiated the formation of a cooperative community quota company incorporating all share fishing families, independently of their (life- and family-cycles-depending and mixed) status as boat-share owners, gear-share owners, and crew-share fishers. This quota company, or 'guild' in fishers' language, Thorupstrand Kystfiskerlaug, owns 5,3% of the cod quota and 10,37% of the plaice quota in Skagerrak plus 5,28% of the sole quota and 3% of the cod quota in the North Sea. The members have equal access to the guild's 'yearly amount' of each species of fish to be caught, and each fisher has one vote in the assembly.

Fig. 36: *The typical Fishing Culture 1 vessel HM 84 'Mette Juul of Thorupstrand' was launched 2002 as a new 22 GT combined gillnet and anchor seine vessel, able to be launched from and land at the open beach of the landing site. Its crew is catching all kinds of demersal and benthic fish species available at the distinct seasons during a full year circle. The flexibility of the boat's clinker-craft oak hull makes it well-suited for beach landing and launching in Thorupstrand and Løkken. The practice of building and using Nordic clinker-crafts is inscribed by UNESCO on the Representative List of the Intangible Cultural Heritage of Humanity. Photo: Thomas Højrup, Thorupstrand 2011.*

As a major quota owner, the guild's fishing families are self-consciously concerned about how to avoid depletion of the fish stocks and damage to the habitats in Jammer Bay area and the surrounding waters. The guild has invested 50 Mio. DKK in necessary quotas and must pay interests and instalments to the local savings-banks. These fishing families see themselves as guardians and custodians of the sea based on their experience and ecological knowledge and cooperation with marine biologists and geologists. Since 2016 they have witnessed a systematic destruction of their fishing grounds and displacement of their vessels from the central

Jammer Bay by a wave of large Dutch beam trawlers.[37] I 2023 the fleet of Thorupstrand could catch as little as 103 tons plaice out of their plaice quota's 1000 metric tons, and 56 tons cod out of their 135 metric tons cod in Skagerrak.[38] Hence, the Thorupstrand fishing families do not think it is possible for the fishing community to survive a continuing beam trawling in Jammer Bay.

Fig. 37: *The beach landing 'sea boat' HM 92 'Goliat of Thorupstrand' is unloading its high value cod, pollack, ling, and Atlantic wolffish caught in Jammer Bay with gillnet, November 2024. The 29 GT clinker-craft vessel is operated by a crew of 2 or 3 share fishers using the local cooperative quota company's fishing quotas and the common beach landing-site's catch landing facilities. Photo: Thomas Højrup 2011.*

37 See Appendix 4 and Appendix 5.

38 Dinesen et al 2025.

Fig. 38: *Thorupstrand has been a landing site for trading and fishing vessels since ancient times. Today its share organized fishing fleet conducts a diversified and broadly complex, versatile mode of operation that is certified as 'Low impact fishing' by the biologists of the Danish state's 'Fishing with Care' scheme. All common facilities at the landing site are cooperatively organised. Photo: Thomas Højrup 2017.*

Hirtshals harbour

Hirtshals is a Jammer Bay harbour with a variable fishing fleet.

A large fleet of smaller vessels, which accounts for 1/3 of the turnover measured by value at the auction are affiliated to Hirtshals harbour. Many of these vessels are so small that they do not have Automatic Identification System (AIS) on board. This means that when planning the marine spatial area, the large fishing area south of Hirtshals along the coast does not appear in the available data. Many of those who fish with smaller boats either with gillnet or small trawlers are partly commercial fishers, which means that they have another job on shore. The group deliver daily mixed fish of high quality. They land plaice, sole, monkfish, haddock and hake when they are in season. In addition, 'round fish' species that thrive in the areas with deep as well as shallow grounds such as pollack, coalfish and ling, are landed, in addition to cod. The small boats constitute the most continuous basis of the auction.

Fig. 39: *The share organised crews of RS 166 'Nette-Marie' (47 GT) and RS 64 'Else' (24 GT) from Bønnerup in Kattegat are operating their specialised anchor seining in Skagerrak during the summer season for plaice fishing from Hirtshals. The Danish fleet of anchor seiners meeting in Hirtshals is generating around 1/3 of the total value landed at the auction in Hirtshals. Thomas Højrup, 2015.*

Another 1/3 of the turnover comes from the Danish seine vessels. Both groups are weather-dependent, which is why the harbour is extra important. Several Danish seine vessels from Hanstholm and Thyborøn now have Hirtshals as their landing port, as the last of the plaice stock (in 2022) inhabit the sea area between the northern end of Jammer Bay and Skagen Reef.

The larger vessels including foreigners, apart from the Fishing Culture 2, most often land in the port closest to their fishing grounds. For the smaller vessels, the transport time is decisive. This means that many land in Hirtshals, as most of the fishing takes place in that area. The very largest vessels – the pelagic ones – sail to Skagen regardless of where they catch the fish to land at FF Skagen A/S.

Although many vessels land Norway lobster in Hirtshals, only a small part comes to the auction. Most often, they are driven directly to Strandby.

Cooperative fish auction

Historically, auctions were privately owned. In preparation of a generation change, the Hirtshals auction entered cooperation with the auction in Strandby to form Fish Auction Nord. In relation to Strandby, Hirtshals became the weakest part. Fish Auction Nord split up after five years and the Fishers' Catch Landing Facility in Hirtshals, which is a cooperative with limited liability owned by the fishers, bought the auction and a director was hired for both the Hirtshals auction and the fish landing facility.

It is crucial that the auction is owned by the local fishermen, because it gives the small fishers good conditions to land their fish and at the same time take advantage of the high quality and value that can be achieved thereby. The auction picks up the landed fish for their members free of charge in Løkken, Hals and Skagen – even if there is only one box – and at the same time delivers the empty boxes to the fishers. They also pick up landings in fish boxes during the weekends, as this is often when the part-time fishers land, in order to get the best quality for the auction. The auction is always 'open', so fish can be landed, and boxes delivered 24/7, which requires employees willing to work flexible hours.

The auction considers itself as a service business in contrast to a pure profit-seeking business. It is important that the auction supports both the fishers and the buyers (some have businesses in Hirtshals). 'Everything with fish is about trust', so it is important for the auction to create trust both to the fishers and to the buyers, and between them. It is important for buyers to know what they are getting. Hence, it is important that these buyers also know the boats and know who the skipper and crew are on the individual trips – i.e. how carefully they are handling the caught fish onboard – when it comes to vessels that have multiple crews.

By attracting as much fish as possible, the auction supports the fishing industry with processing and sales, the service industry, and logistics in the city. From the auction's point of view, it is crucial that it is a 'floor auction' and not a 'pefa auction' that only takes place online and where the buyers are not physically present.

Port-related companies

A variety of port-related craft businesses means that the harbour attracts many ships. When they land in Hirtshals, they can have a wide range of repairs done. Absolutely crucial is the 24/7 service provided and that quality is assured. Fishing must take place when the fish are there, so the boats cannot afford to lie still.

The large fleet of the thrifty and niche Fishing Cultures has since 2016 been seriously affected by the Dutch beam trawlers' long-distance fishery (Fishing Culture 2) in the shallow waters along the coast in Jammer Bay area. The beam trawlers with their heavy gear move larger stones around on the seabed, negatively affecting the habitat and the fishing grounds and negatively influencing the activity of the small thrifty and niche trawlers and seiners. This activity from Fishing Culture 2 is threatening 1/3 of the landings to the auction. Hence, the community is exposed to this antagonist co-existence between the two Fishing Cultures.

Hanstholm – a North Sea and Jammer Bay harbour

In contrast to Hirtshals, Hanstholm Fish Auction is a private profit-seeking business, and the auction in Hanstholm is important for local boats belonging to all Fishing Cultures as well as expansive and large-scale bottom trawlers and fly-shooters from other North Sea countries (German, Belgian, French, English, Scottish). Like Hirtshals, Hanstholm is a centre for landing and distribution of fresh fish for human consumption at the national and international level (especially southern European markets). Hanstholm has lost its pelagic fleet and its fish processing industry to competitors in Hirtshals and Skagen with only a few large demersal trawlers representing Fishing Culture 7 left. Its diminished anchor seine fleet is operating from Hirtshals outside the reach of the beam trawlers and its gillnetting fleet is similarly diminished. Fishing Culture 3 is dominating the community even if it is declining. The Fishing Culture 4 still exists but the operation of the Fishing Culture 2 on the vulnerable stone grounds and sand banks around Hanstholm hurts the local niche and thrifty fleet.

Fig. 40: *The 2022 version of the family owned 4750 GT pelagic trawler and purse seiner HG 333 'Isafold of Hirtshals' is landing its catch to Scandic Pelagic in Skagen. In contrast to the Dutch pelagic factory trawlers, the Danish pelagic fishing vessels store and transport the catch in Refrigerated Salt Water tanks abord the boats aiming to land it in a hurry to the fishing companies' processing factories in Skagen and other Nordic fishing harbours. Photo: Thomas Højrup, Skagen 2022.*

Thyborøn – North Sea harbour

Thyborøn is a North Sea port, the closest larger port South of Jammer Bay. Since 2015 official registrations record that between 2% and 5% of the total landings of fish for consumption in Thyborøn originate from Skagerrak. Thyborøn is mainly of interest as a landing place for most of the Dutch beam trawlers.

In 2022 Thyborøn was the second largest Danish port in volume of landings. As industrial species dominate, Thyborøn is the fourth largest port for fish for consumption. Most important consumption species were plaice followed by herring, and cod (in value plaice, cod, and monkfish respectively).

The fleet has, as in most other ports, been reduced over a period of years. According to the official statistics (Fiskeristyrelsen.dk)[39], there are 83 registered vessels in 2022 of which 65% are gillnetters and vessels below 12 meters. Most of these are no longer active and have disappeared concurrently with the diminishing fish stocks in the coastal waters. The tonnage is primarily on the expansive trawlers and fly-shooters of the Fishing Culture 3 and the little fleet of specialised anchor seine vessels of Fishing Culture 6, which also account for the majority of the landings by Danish boats in Thyborøn. The Fishing Culture 7 operates Thyborøn's fleet of large scale pelagic and industrial trawlers. The Urk's fleet of beam trawlers is usually landing their catches in Thyborøn every Friday and the Dutch crews return from Urk after having enjoyed the weekend at home.

The fish auction of Thyborøn, 'Danske Fiskeauktioner', is a privately owned profit-seeking business. The auction takes place online only. A few buyers are present at the auction, buying on behalf of a range of industries and fish mongers. The online buyers depend on precise classification of the quality made by the auction. The auction offers logistics and fast transportation of the fresh fish to the whole of Europe. Thyborøn has traditionally been the main port for landings from the Northern North Sea by Dutch vessels. After the regulatory tightening the main part of Dutch landings is sorted and sold via the Thyborøn auction. The main part of plaice and cod at the auction are bought by Dutch buyers and trucked directly to Holland/Urk. Up to 20% of the landings are sold for fish processing in Hanstholm – another 5% for processing abroad.

There are a few small processors of fish for human consumption in Thyborøn. One of the two large processors of industrial species for fish meal and oil, TripleNine, is located at the port of Thyborøn and attracts direct landings from Danish and foreign vessels.

39 Fiskeristyrelsen (Danish Fisheries Management) Registred vessels: 2022.

Fig. 41: *The family companies of the Profit-seeking Large Scale Fishing Culture in Scandinavia are competing with the huge fleet of factory trawlers managed by the Dutch corporation Parlevliet & Van Der Plas. One of these freezing, factory stern trawlers is the 7.000 GT Helen Mary owned by Oderbank Hochseefishery GmpH in Rostock. Photo: Thomas Højrup, Ejmuiden 2013.*

Thyborøn is dominated by the fish landing facilities and other marine industries. The port has expanded in the last years both with better facilities for the huge pelagic vessels for TripleNine, and facilities for cargo and service for the offshore wind industry. The port offers 24/7 services for fishing and other vessels, as well as a floating dock, shipyards, and craft businesses, which are oriented towards the fisheries while also servicing other sectors.

Urk – Dutch harbour, southern North Sea

The city of Urk was originally located on an island in the Zuiderzee. Characteristic of the city are the families with many sons, who have formed the basis for large family businesses. Fishing traditionally took place with static gear as pound-net, gillnet and longline in the large inshore sea area that made up the Zuiderzee and from the islands of Zeeland in the north of the Netherlands. Some also sailed their large boats to the North Sea and fished.

When the large dike, 'Afsluitdijk', which is 32 km long, was completed in 1933, 3/4 of the area was cut off from the North Sea. The Urk fishers thereby lost their main fishery as the local inshore fish stocks diminished and changed.

In the 1950s, the Dutch and especially the fishers from Urk developed beam trawl fishing, inspired by the German beam trawlers. The sole is hiding relatively deep in the seabed and the Dutch fishers found out, that using modern engine powered beam trawling with heavy tickler chains could be revitalised as an effective way to dig up the soles from the sea-floor. The crew on the ships from Urk were traditionally family members or people from the town. About 10–15 years ago, they started recruiting crew members from, e.g., Poland, due to cheap Central European wage levels. Otherwise, the fishing is conducted as share fishing.

Several family businesses have many beam trawlers – for example 7 – and Urk is the place in the Netherlands that in legal terms has changed the largest part of their beam trawlers into foreign registered vessels ('flag vessels'), which are still operated by Fishing Culture 2. These are vessels that never visit their (mainly UK and German) registered fishing harbour affiliations, but fish on the foreign country's quotas. Several family businesses are joint stock companies, but it is exclusively members of the family that own the shares.

Fig. 42: *The 549 GT Dutch beamtrawler ARM 22 'Klaas Adriana of Arnemuiden' berthed in Hanstholm harbour, December 2022. The typical Fishing Culture 2 vessel was built in 1994, measuring 44 meters in length and 9 meters in width. It has 7 crew members and uses 32000 litres of diesel on a 5-day trip. Photo: Thomas Højrup, 2022.*

To overcome rising fuel prices, an experimental fishery with pulse fishing was stepwise developed from the 1970's to 1992.[40] Pulse fishery sends electricity down to the seabed, "this makes the muscles of the fish contract, whereupon the fish detach from the seabed and land in the net".[41] In 2007, 5% of the beam trawl fleet of all Member States got a temporary dispensation to take part in a scientific experimenting pulse fishery in the southern North Sea with the aim to clarify its impact. Subsequently, the Netherlands got a dispensation for experimental fishing with pulse for 42 vessels and a further 42 vessels in 2014. But, provoked by this commercial rather than scientific knowledge-seeking expansion, pulse fishing – also as 'experimental fishing' – was banned by the EU in 1988, 2018 and 2021, and thereafter the beam trawler fishers choose to return to and revitalize the traditional seabed dredging, benthic fauna churning and crushing, and fish attracting beam trawl fishing method in spite of its heavy fuel consumption.

Catches of plaice have fallen sharply in recent years. At the same time, the beam trawlers use 30–35,000 litres of diesel in 5 days of fishing. The Netherlands did therefore carry out a beam trawler scrapping round.

Since landings of all types of fish have reduced significantly in Holland, important logistics have collapsed, and some auctions are closing. Several beam trawlers are currently being re-rigged to combined 'beamers and twin riggers' or to fly shooters. With the enlargement of their beam trawler with a twin-rig the crew becomes able to dig up Norway lobster at the eastern side of Dogger Bank in seasons of the year to compensate for the expansion of wind farming and the decrease of sole, plaice and cod in the southern part of the North Sea.

There have been around 75 large beam trawlers in Holland, a part of those was scrapped in 2023. This means that the fishing industry loses both expertise and the youth to other maritime sectors or fishing cultures than that based on pure beam trawling. Some have suggested downscaling the vessels and restructuring the fishery into a Dutch variant of Fishing Cultures 3 and 4. Important is, that this transformation find a balance

40 Hasnoot et al. 2006.

41 LEI Wagening UR 2014.

between the need of a fast removal of the method with most impact on the marine habitats and the need of a transition term long enough to avoid that the entire infrastructure collapses.

Parlevliet & Van der Plas B.V. is the largest company representing a Dutch variant of Fishing Culture 7. Other fishermen call it a company run by 'traders' in contrast to 'fishermen'. Parlevliet & Van der Plas works worldwide and buys up quotas and ships including beam trawlers and their fishing rights.[42] On their big supertrawlers only a minor part of the crew has experience with fishing, the rest are technical engineers and factory workers. The career-professional skippers seek an individual negotiated part of the surplus profit, the rest of the crew gets a basic salary and a bonus at the end of the year – "But the company owns the whole line from catch, processing, freezing, transport until the super-market and its owners decide where the profit is registered".[43]

The auction in Urk was founded in 1905, and as the Urk North Sea fleet experienced great growth during the 1950s, the Urk North Sea fishers decided in 1962 to drive their catches to hometown and auction their fish at the Urk fish auction. It created a basis for fish traders, and the following year *Urk-Export* was founded, with the aim to market the fish in Europe. They were also involved in the development of a market for plaice fillets.

In 1922 *Urk Fisheries Cooperative VCU* was founded and according to its own statement, it has since then been a leading name in the Dutch fishing industry. It was founded by the fishers who, by joining forces to purchase gas, oil and lubricants, allowed them as an organization to purchase these wares collectively and cost-effectively. Today they also target coastal and inland shipping, the dredging industry, and industrial companies besides the fishing industry. VCU does not only deliver service in Urk but drives out to the North Sea ports in several countries where their fishers land. They cover virtually all service areas, also making and repairing fishing gear. At home and abroad the cooperative pursues 24/6 service (VCU n.d.).

42 https://pp-group.nl/en-us/about-parlevliet-van-der-plas

43 Personal interviews with Dutch fishers, June 2023.

Fig. 43: *A beam trawl with 10 heavy steel chains is lifted onto the deck before departure to the fishing banks. The boat drags two of these beam trawls, one on each side of the vessel. Photo: Thomas Højrup, Ijmuiden 2023.*

The companies at Urk used to live by processing fish from the North Sea and Skagerrak, especially plaice. In 2025 90% of their production consisted of processing other fish, largely imported cod and farmed salmon from Norway. The city has a very large industrial area in relation to its size where fish processing and trade is the main industry. Urk is also known for its *Maritime Campus*, its shipping industry and several shipyards. The city's fishing fleet has Urk as their fishing harbour affiliation, but the large vessels rarely come to the city anymore.

5. Fishing Cultures as a framework for development of diversity and co-existence of commercial fisheries

Above, we have identified and described the diversity of distinct kinds of fisheries operating in the Jammer Bay area. We have organised the many fisheries elements and modalities, such as vessel lengths, engine sizes, gear types, profitability measures, crew sizes, quota and ownership, into four core features, and provide an operational framework that can be applied to identify cooperation, contribution, competition and extraction of ecosystem resources and economic and societal sustenance at the local, national and international level. This enables an alternative perspective to the well-known focus solely on economic maximisation that is neglecting the social, cultural, and ecological components of the system, which are decisive for the development of long-term sustainable management solutions. The Fishing Culture framework is based on a theoretical concept of what we specify as the four dimensions of a Fishing Culture explicated by detailed descriptions of the conceptual models of 7 uniquely distinct Fishing Cultures, which we find realised empirically in the Jammer Bay area fisheries. Each Fishing Culture is identified and specified as a particular unity of life-mode(s), mode of operation, fishing method(s) and community (fishing harbour affiliation). This framework can be further developed for other geographic areas by encompassing additional Fishing Cultures operating in those areas.

The empirically realized Fishing Cultures operating in the 4 ICES squares of the Jammer Bay area exploit and impact the marine environment in different ways and contribute to the sustainability of fishing communities and the general society at quite different levels and magnitudes.

Specifying the four dimensions of each Fishing Culture makes it possible to shed light on the ways the 7 Fishing Cultures co-exist and impact each other in Jammer Bay. The actual forms of co-existence appear to be either unproblematic or antagonistic, depending on where they are operating in the area and how each of them impacts the seafloor, the marine species composition, the mode of operation, and the fishing methods of each other.

Co-existence and competition between Fishing Cultures

The co-existence between *the modes of operation* of some vessels with a unilaterally specialised mode of operation and other vessels with a broadly complex, versatile mode of operation is possible and well known, but can also be utterly problematic in the Jammer Bay area. The versatile mode of operation is especially seen in the Fishing Cultures 1 and 4. The unilateral specialised mode characterises the Fishing Cultures 3, 5, 6 and 7, and especially the Fishing Culture 2.

The potential conflict between the two opposite modes of operation becomes serious, where unilateral, larger, and very mobile vessels can harvest the areas each time the target species is in high season (in volume or value).[44] As a competitor of this kind, they can displace the more local, versatile vessels during important seasons from the areas they fish year-round for a broad range of species also outside the high seasons.

44 Dinesen et al 2025.

Fig. 44: *In 2017–2018 the Hakvoort Brothers from Urk got the new beam trawler UK 46 constructed by the Damen Maaskant Shipyards Stellendam. The picture was posted by Michelle Howard May 11, 2017, at the shipyard's homepage to illustrate the well proven Damen Maaskant design. The vessel is 41 meters in length and propelled by a type 12 DZC main engine from ABC, delivering 1999 hp. Photo: Damen Shipyards.*

This problematic co-existence is especially clear in the shallow and narrow grounds along the shores of Jammer Bay between the Fishing Cultures 1 and 2. The large mobile vessels of the Fishing Culture 2 can roam around a wide range of fishing grounds in the EU-waters. Since 1970, a fleet of 500 GT long-distance vessels from the Netherlands, operating unilaterally specialised beam trawls in the North Sea and adjacent waters, have entered the shallow grounds of the central Jammer Bay area several times and stayed there in the high season for plaice during several years in a row each time, until the fishing grounds were exhausted. Each time this migrating unilaterally specialised beam trawling has – according to local single-trawler, longliner, gillnetting and anchor seining fishers in this study - undermined major parts of the year cycle of the local vessels' broadly complex, versatile mode of operation and the unilaterally specialised mode of operation with gillnets and anchor seine.[45]

45 See also: Højrup & Nielsen 2024, p. 880ff.

The co-existence between *the fishing methods* of the Fishing Culture 2 and the Fishing Cultures 1, 4, 5, 6 turns out to be antagonistic in the Jammer Bay area.

The antagonism between catching methods arises when opposite methods cannot be used in the same fishing area at the same time. In the Jammer Bay area this is the case because: 1) beam trawling tears the stone reefs apart doing permanent damage, 2) beam trawling destroys the biodiversity, resilience, durableness and continuity of the biotopes, 3) beam trawling with heavy gear and high speed obstructs the use of gillnets and anchor seines and 4) gillnetting and anchor seining (with each boat's several km long net-chains and seine-lines) restrict the beam trawlers' free operation in the same area, which is the reason why the vulnerable gillnet and seine fishers fear the entrance and power of the fleet of large foreign beam trawlers. Hence, one Fishing Culture may limit or prohibit other Fishing Cultures directly by its fishing gear's impact on the seafloor biotopes or access to core fishing grounds, and indirectly due to the potential time-lag in recovery ecosystem provisioning (e.g., of fish stocks and seabed habitats) – if recovery is at all possible.[46]

Because the audio-visual herding (anchor seining), the gill-seizing/entangling (gillnetting) and the hook baited fish attracting (longlining) methods catch their target species implying an extremely low impact on the habitat and 'food-web' (that is feeding the fish species), these fishing gear types and methods are able to exploit a wide spectre of fish species in Jammer Bay area's local biotopes all year round and year after year, i.e., without exhausting the marine food-chains feeding the fish stocks and without concentrating the fishing effort on one type of habitat and a few species of fish. Hence, from the perspective of stakeholders from the Fishing Cultures 1, 4, 5, and 6, their fishery cannot coexist with beam trawling due to severe impacts on Skagerrak's seabed.[47] According to stakeholders from the Fishing Culture 2, deploying beam trawls 'open the ground' with their gear and attract fish, a method they conceive as

46 Examples are described in Højrup & Nielsen 2024, p. 879, 885ff, 913ff, 1037ff.

47 See also Bylow 2023. In the light of the present transgression of planetary bounderies in Richardson 2023, the destruction of habitats in one of Europes most productive marine ecosystems calls upon political attention and solutions.

an advantage for gillnetters, anchor seiners and long liners too, if these are willing to fish sufficiently close to the tracks of the beam trawlers.

The antagonism between the fishing methods and viewpoints becomes exaggerated by the fact, that beam trawling is forced to operate on relatively shallow grounds (where anchor seining and gillnetting is going on) because towing the heavy tickle chains and chain matts becomes too fuel consuming if it must operate at the deeper grounds (> 30 m depth) in the Jammer Bay area.

Fig. 45: *The function of the steel chains is to 'open the bottom', digging mollusks and plants out of the seabed with the aim of creating and maintaining a large cloud of crushed flora and fauna in the water, that as bait attracts fish to the area, where the trawlers are dragging their heavy chains underneath the trawl back and forth digging still deeper into the ground and catching the fish. At the picture the tickler-chains is connected across in what is called a 'chain-mat' with which it is possible to dredge the heavy chains up and down even big boulders of stone reefs. Photo: Seafish.org .*[48]

To get rid of this conflict it is necessary to choose which of the two groups of methods will be allowed to operate in Jammer Bay area.[49]

48 Sea Fish 2011

49 See also: Højrup & Nielsen 2024, p. 1036ff.

Interview information sheds light on oppositions between Fishing Cultures in the Jammer Bay. The contribution from the Fishing Cultures to the local communities differs, as described in Chapter 3, the Value chain section, page 55ff and Appendix 3, and will be discussed below. In this regard especially Fishing Culture 2 has a very low (close to zero) contribution in the Jammer Bay area, as the vessels are channelizing the caught fish from the Jammer Bay area to North Sea auctions and further to processing industries in the Dutch fishing harbour affiliations and fish processing hub (in Urk) of Fishing Culture 2.

The registration and official statistical catch and landings data are not reliable enough to shed light over the real quantity of fish caught by vessels from the Fishing Culture 2. Concurrently with the reduced presence of the plaice stock (in 2022 only 25% of the total Skagerrak plaice quota was caught, see Figs. 29 and 30) and the EU authorities' continually raising of the Total Allowable Catch of plaice, the fisheries management did and does not protect the plaice stock and its feeding grounds in Jammer Bay against a too high fishing pressure. Despite the low quota percent belonging to Dutch fleet in Skagerrak, the Fishing Culture 2 has met no restrictions to intensify the time used for fishing after plaice in Jammer Bay. This development and its impact are reflected visually in a) the diagrams (Figs. 30 and 31 below) showing the development of TAC[50] on plaice, b) the amount of plaice landed by the Fishing Culture 1 and caught the central part of Jammer Bay, at the same time entered by the beam trawler fleet of Fishing Culture 2, and c) the maps showing the officially registered presence of the Fishing Culture 2 in central Jammer Bay (even if this registration is incomplete).

The above-mentioned interviewed fishers' descriptions of antagonist practices and viewpoints related to modes of operation and catching methods turn out to be very clear when put into perspective by the combined dimensions of each Fishing Culture. The niche variant of the self-employed share fishing family life-mode (the Fishing Cultures 1 and 4) operates with vessels < 25 GT and has a limited field of activity and range of action (< 30 miles from the coast). Hence, these Fishing Cultures are particularly vulnerable to the long-distance beam trawler fleet

50 TAC: Total Allowable Catch.

(vessels around 500 GT) of the expansive variant of the family business life-mode (the Fishing Culture 2) from the Dutch fishing communities (primarily Urk). As the fishers from the Fishing Cultures 1 and 4 explain, the Fishing Culture 2 vessels move constantly from one area to another in the shallow parts of the North Sea basin, alternately entering, exhausting and leaving these areas more or less depleted and degraded.

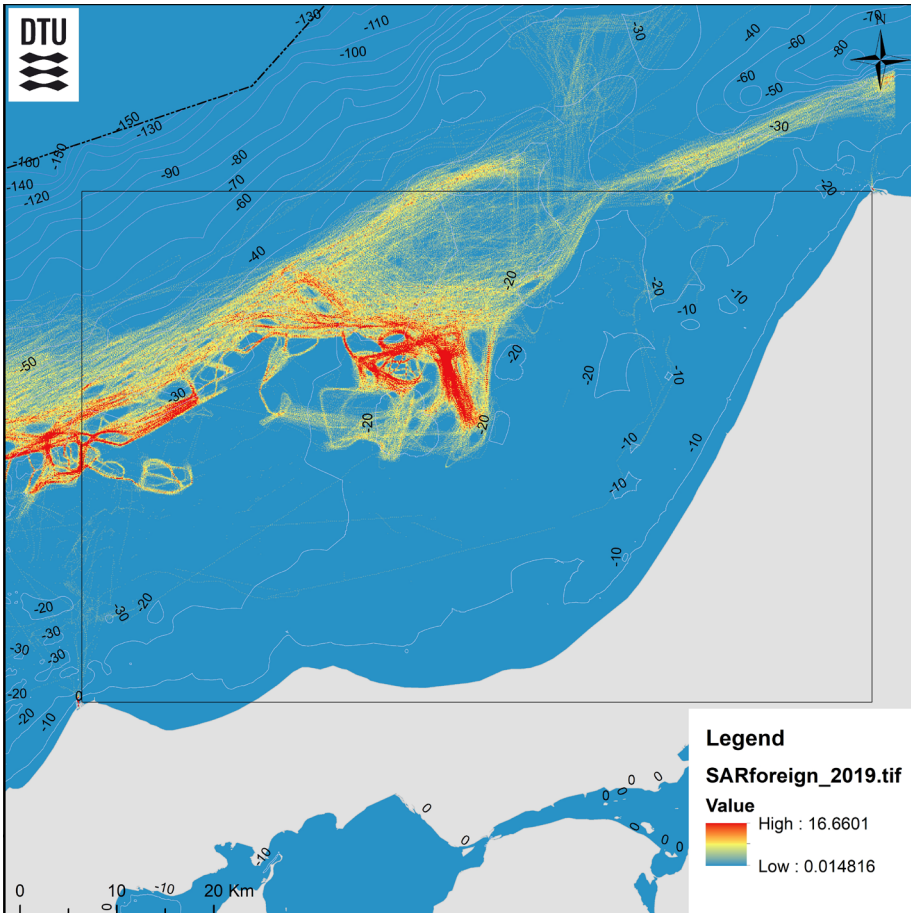


Fig. 46: *Map showing the distribution and intensity of fishing for plaice by Dutch beam trawlers. The intensity of the fishing is assessed as a swept area ratio (SAR) in squares of 100 x 100 m, which correspond to an estimate for, how many times the seabed is impacted by the gear during 1 year. The intensity is shown on individual scales of colour with values varying from 0,015 to 32. These values are extremes and a more centrist or gradual reading is needed. DTU-Aqua.*

The latest wave of beam trawlers entering the central part of Jammer Bay reached the area in 2016–17 with the result that the presence of *Abra alba* mussels, plaice and cod almost disappeared from the coastal and central part of Jammer Bay. Fishers realizing the Fishing Cultures 1, 4, 5, and 6 find themselves caught in an antagonistic relation to large beam trawlers realizing the Fishing Culture 2 due to different use of area and not least due to opposite worldviews. The local stakeholders realizing the Fishing Cultures 1, 4, 5, 6 consider the beam trawlers perception of their impact as far too short-sighted and not considering the long-term degradation of the seabed.

Beam trawling digs up and crushes the food web's molluscs to attract more fish while trawling. Small anchor seines and gillnets are light-weight gear intended to affect the food webs as little as possible in order to preserve the fish's habitat. The two ways of fishing on the seabed are incompatible with each other.

Stakeholders realizing the Fishing Culture 2 find that their colleagues from the Fishing Cultures 1, 4, 5 and 6 have to adapt to a longer ranging fishery, that allows the exploitation of alternate fishing areas, while local grounds recover. These contrasting points of view are at the core of the antagonist character of this coexistence, because in the conceptual universe of both parts the fishing practice is not a pure means (to income), but a means that is its own end, i.e., a self-employed share-fisher life-mode and fishing community. Hence, it is a conflict between the survival of share-fishing communities based on similar life-modes but opposite Fishing Cultures.

To survive the privatization of demersal and benthic quotas (2006/7) the fishing families of Thorupstrand created the Guild of Coastal fishers and invested in 10% of the plaice quota and 5% of the cod quota in the Skagerrak. From 2013 to 2017 the Thorupstrand crews caught their common plaice quota from May to December and delivered between >1/2 and 1/3 of the total amount of plaice landed to Hanstholm auction (Fig. 47). From 2017 the Thorupstrand fishers lost still more of their plaice and cod fishery, which in 2018 fell to 30% of the Guild's yearly amount of plaice-quota and in 2023 the catches were diminished to below 10% of the yearly amount of the Guild's plaice-quota. This development seriously

threatens the survival of the Thorupstrand fishing community because it undermines its economic foundation and sustainability.

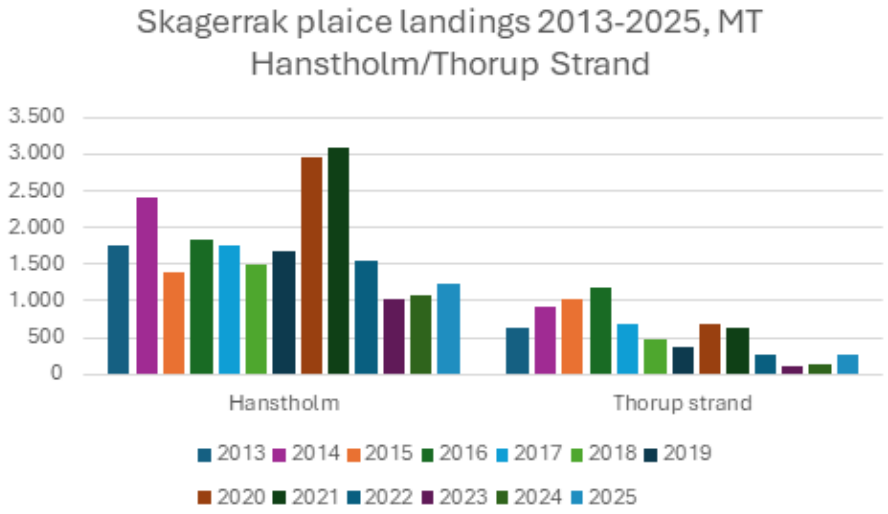


Fig. 47: *Landings of plaice from Skagerrak 2013–2025, Hanstholm and Thorupstrand. For all landings of plaice from Skagerrak, see Appendix 5. Source: Fiskeristyrelsen, dynamic table for landings. https://lfst.dk/fiskeriet-i-tal/landinger.*[51]

According to stakeholders from Hirtshals' large fleet of the thrifty/niche boats, the Fishing Culture 4 has since 2016 been seriously affected by the Dutch beam trawling (Fishing Culture 2) in the shallow waters (between 15 and 24 miles from the shore) along the coast in the Jammer Bay area.[52] Stakeholders from gillnetting, seining, and single trawling boats state, that the large beam trawlers move big stones around on the seabed causing the small thrifty/niche fishing trawlers and seiners to be unable to use the impacted fishing grounds and preventing anchor seining on the shallow grounds by Fishing Culture 6. Since the activity of Fishing Culture 2 is perceived to directly or indirectly negatively affect the landings to Hirtshals auction, threatening its viability, the community is exposed to what the local fishers to this study describe as an antagonist coexistence.

51 Landed weight, plaice, all conditions, from Skagerrak, all nations, landings in Danish ports only.

52 This is confirmed in Dinesen et al 2025.

The local stakeholders from all Fishing Cultures fear the consequences of the high, constant, and still increasing fishing pressure in the outer part of Jammer Bay.[53] They point at the combination of an extraordinary high fishing pressure in Skagerrak and Jammer Bay based on attraction of vessels from other devastated sea areas in the North Sea, the Baltic Sea, and Kattegat and unregistered catches and discard due to 'too small' trawl and seine mesh-sizes, and lack of implementation of full documented fishery.[54]

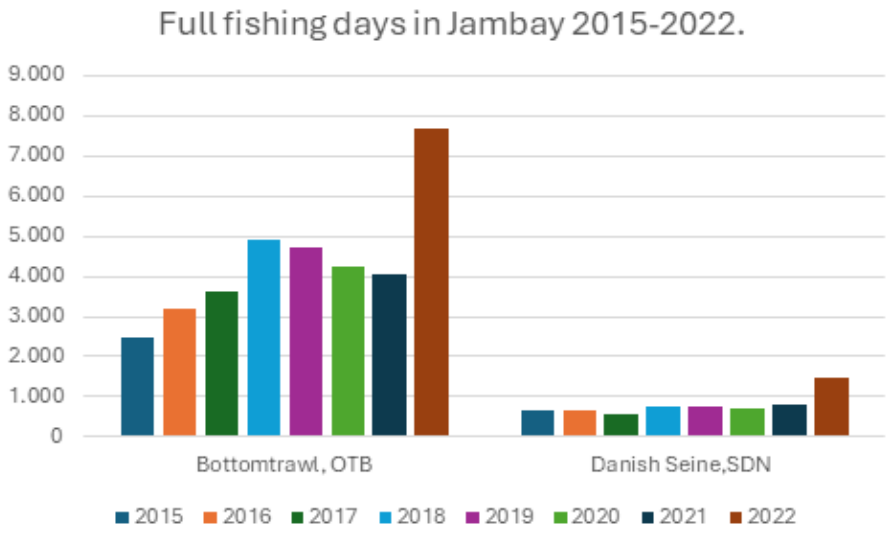


Fig. 48: *Number of fishing days (24 hours) in Jammer Bay 2015–2022, Danish seine and bottom trawl. Source: DTU-A, Shiplist. The increase in Danish Seine reflects that the Fishing Culture 6 anchor seiners have moved to the northern part of Jammer Bay.*

The experiences of the local stakeholders of this study and the frequent closures by the fisheries authorities of particular areas because of intensive

53 The intensity of this fishery and the discard of juvenile fish is described in Dinesen et al 2025. The consequenses of the overfishing and food web destruction in Skagerrak demonstrates the warnings made in Richardson 2023.

54 The stakeholders do not mention gillnet mesh sizes because gillnetters usually use large sizes with the intent to avoid wasting time on entangling by hand too many under-sizes fish.

presence of juvenile fish[55] indicate that it is impossible to avoid bycatch of juvenile fish in the trawl and in the seine fishery when the mesh size is too small and the trawl-net becomes too loaded with fish.[56] The high fishing pressure (fishing time) (Fig. 48) at the reefs and banksides in the outer parts of Jammer Bay area[57] and the use of Norway lobster trawl with small meshes in the Hirshals Trench (the nursery of juvenile fish) is by stakeholders across the Fishing Cultures perceived as the second and third most serious conditions behind the decreasing number of plaice and cod entering the sand eel and sprat rich feeding grounds in the central and coastal parts of Jammer Bay as part of their yearly cycle. Hence, this is perceived by local stakeholders as an untenable situation, the impact of which is to reduce (and to hinder the restoring of) the foundation of high value, niche, and thrifty coastal fishing from the landing sites on the open beach (Fishing Culture 1) and from local harbours (Fishing Culture 4, 5, and 6).

Fishing Cultures' contribution to the local economy of fishing communities

Apart from the large pelagic vessels of the Fishing Culture 7, there is no permanent relation between Fishing Cultures and the size of crew members' income. The income-level varies with the conjunctures and changing conditions for the distinct fisheries and species in Jammer Bay. The levelling of income is partly due to the constant flux of individual fishers between the different Fishing Cultures.[58] It is often presupposed, that a large expansive trawler yields a larger or more convenient income to the fishing families than a small line or gill-net boat. An illustrating example of the opposite is demonstrated by two (Fishing Culture 3) boat-share owners of a modern and extended 297 GT twin-trawler in Hanstholm who sold their ship and replaced it with a 10 GT longline

55 https://fiskeristyrelsen.dk/nyheder/straksregulering-tidl-bilag-6-meddelelser/maalgruppe/generelt

56 This is documented concerning the Norway Lobster trawling in Skagerrak, as described in the section 5.7, p. 68 of the JAMBAY Executive Report. https://www.aqua.dtu.dk/-/media/institutter/aqua/publikationer/rapporter-451-500/445-2024-jambay-executive-report.pdf

57 Dinesen et al 2025.

58 See Appendix 2.

boat. From the perspective of the families this shift (in our terminology: from Fishing Culture 3 to Fishing Culture 4) was a preferable solution instead of 'struggling to make ends meet' by expansive trawl fishery.

Another example is the young man, who after having bought a house, married and settled down in his native fishing village did return from his well waged position on a large-scale pelagic trawler registered in a North Sea port town to the self-employed role as share-fishing skipper of a beach landing gillnet and anchor seine boat. Fishing from his native village makes it possible for him to optimize his family life values and cultivate his own kitchen garden. The question is, if he can make a living out of beach landing fishery in Jammer Bay as long as the heavy beam trawling fishery is still impacting the seabed and food-web in the Jammer Bay area. In 2024 he did not succeed and his wife asked him to take yet another year of work on a harbour based deep-water fishing vessel, waiting for the hoped and long-awaited prohibition of beam trawling in Jammer Bay, before trying his beach landing high-value fishing again.

Fig. 49: *To utilize the local sea area as the prime field of fishing activity all year long and conduct sea trips on less than 48 hours is a value of high esteem of Fishing Culture 1. Even if a landing site as Thorupstrand has 200 potential 'sea days' in a year, the relatively short trips improve a family life in which it is possible to eat dinner together most evenings and have time to go hunting, dig the garden, visit friends and neighbours, engage the children in meaningful activities at the landing site, take part in community life, and put up an annex in ones back yard. Photo: Thomas Højrup, Thorupstrand 2023.*

The actors of the Fishing Cultures contribute in various ways to the fishing communities. The presence of the vessels and the activities of their maintenance, the local management of fishing rights, the preparations of each new trip at sea, the launch and landing of vessels and the handling of landings. The activities at meeting places in the community where fishermen, women, and youngsters confabulate their stories and deliberate the condition of the sea and their fishery may – unless the local fish stocks are brought into a miserable condition, the fishing families cannot earn enough to innovation and investments, and the everyday talks are loaded with pessimism – all contribute to a vivid community, with social and cultural activities linked to the fisheries. The role of these features for the recruitment of new generations to the fishery is decisive for the continuation and future of the Fishing Cultures and the durableness of their communities as the home ports or landing sites for fleets of fishing vessels and crews who do not transgress the functional biosphere integrity.[59] These processes are decisive for the continuous regional reconfiguration of survival and extinction of fishing communities.

The fisheries also contribute in more narrow economic terms to the community. Generally, economic analyses focus on profitability from a company, investor and wage-earner income perspective, or from a national economic perspective. This thinking is aimed to improve the allocation of labour and capital to the most profitable activities, but not to avoid a human pressure on marine ecosystems that transgress the planetary boundaries.[60] The focus of this study is the Local Economic Effects and the sustainability of the Fishing Cultures. The analysis therefore focuses on the spatial distribution of the income generated by fisheries rather than the private business and narrow economic profitability. This is central for the local communities and regions that hold the natural resources, which are extracted, and therefore bear the burdens of the 'externalities' (e.g., the decreasing durableness of productive marine habitats and fish stocks caused by highly 'profitable' fishing business models). From the local community's economic, cultural, and ecosystem sustainability perspective, the individual business economy of the most profitable vessels may be of less interest than the community's totality of integrated value chains, especially if the (negative) externalities are local and the profit is

59 https://www.science.org/doi/10.1126/sciadv.adh2458

60 ibid.

appropriated elsewhere (i.e., outside the community, the region, or the country). Following this perspective, it is interesting, that Fishing Cultures with a high level of income contribution to the local economy are found in the segments normally (in business and national economics without an integrated socio-cultural and ecological sustainability perspective) regarded as less valuable because they are primarily seen as low productive and low profitable fisheries.

Fig. 50: *L 486 'Selena-Christina' of Thyborøn is a typical 48 GT specialised gillnet vessel fishing in the North Sea and Skagerrak. The vessel is constructed in 1977 and operates in the high-value niche fishery conducted by fishing families realizing the features of Fishing Culture 5. The vessel is also able to conduct autoline fishing in seasons when hook-caught cod are expensive at the European market and the bait sufficient cheap to allow a sustainable fishery. At the picture the vessel is careened for maintenance on stocks in Hanstholm 2023, where the crew most often is landing the catch. Photo: Thomas Højrup, 2023.*

For the Local Economic Effect (LEE) analysis, focus has been on the income generated by the vessel, income for the owners and employees or share fishers (the Direct Effect) as well as in the sectors supplying the fishing activity, which is assumed mainly local (storing and delivering of fuel, maintenance and landing related costs) (the Indirect Effect).[61] The share of costs for wages and local supply-costs differs considerably between the Fishing Cultures. The LEE therefore also differs considerably between the Fishing Cultures. The calculated LEE-level is further qualified based on qualitative knowledge for an assessment of the calculation to be a maximum or minimum of the actual Local Economic Effect of the Fishing Cultures.

*The Fishing Cultures 1, 4 and 5 have the highest Local Economic Effec*t, calculated to 49–56% of the catch value. These Fishing Cultures land most of their catch in a permanent home port/landing-site and get local service. Hence, the LEE counts in the fishing communities where they have their fishing harbour affiliation. Based on the qualitative knowledge of the behaviour and geographical location of the vessels of the Fishing Cultures, the calculated LEE is assessed to be the maximum estimate for the Fishing Culture 5, but a minimum estimate for the Fishing Cultures 1 and 4. The latter because these Fishing Cultures also source other services and supplies locally, although in the calculation these were regarded as non-local.

The Fishing Cultures 3 and 6 have a middle Local Economic Effect, calculated to be around 40% of the catch value. The unilaterally specialized mode of operation characterizes these Fishing Cultures. They are forced to be less home port oriented because they must move to the northern grounds (of Jammer Bay and Tannis Bay), where most of the remaining plaice are still to be found. Hence, most of Fishing Culture 6 vessels land in Hirtshals, a couple in Hanstholm, and a couple did in 2025 still land in Thyborøn. The Fishing Culture 3 vessels also land their catch outside the local area. Based on the qualitative knowledge of the large operation range, the calculated LEE is assessed to be the maximum estimated level for both Fishing Cultures.

61 See Appendix 3 for the applied LEE method.

The Fishing Cultures 2 and 7 have the lowest Local Economic Effect. No data are available for the Dutch beam trawlers, but – employing Dutch crew and receiving most services via home companies and the landing facilities in Thyborøn – they contribute very little to the Jammer Bay area. The calculated LEE for Fishing Culture 7 is 25%. These vessels operate over larger areas, employ many crew members from all over Denmark and from Sweden. The qualitative assessment therefore points at the calculated LEE to be significantly higher than the actual LEE for the Jammer Bay area.

The differences between the Fishing Cultures in relative LEE (the contribution to the local economy/fish value) is an important aspect in the discussion of the importance of fisheries for the coastal fishing communities. The business economic focus on profitability tends to favour Fishing Cultures with highly efficient larger trawlers and high individual profitability (independently of their externalities). The Fishing Cultures comprising the feature of mainly minor and medium-sized, labour-intensive vessels tend to be regarded as economic unimportant, but with a secondary importance in social and cultural terms, as cultural heritage, and as an attractive cultural background for the tourism industry. If instead the local and regional Economic Effects of this fishery are addressed, these Fishing Cultures demonstrate a high economic importance relative to their turnover at the local scale. Therefore, the absolute Economic Effects on the specific fishing community, depends on how the fishing rights are distributed between Fishing Cultures – which Fishing Cultures have most of the rights and opportunities to catch, land and sell the fish.

6. Summary, discussion and perspectives

This study identifies and describes, in a systematic way, the diversity of distinct kinds of fisheries operating in the Jammer Bay area. The many relevant features of the fishery are condensed into four core features, which provide an operational framework of conceptual models, called Fishing Cultures. These models are applied to identify distinct types of internal connections between cultural life-modes and modes of operation in the fishery, their competition on ecosystem resources and their contribution to value chains, economic and socio-cultural sustenance at the local, national, and international level. This enables the shift from a primary economic focus on the profitability of companies and investments (that tends to neglect the social, cultural and ecosystemic components of the fishery and development of long-term sustainable management solutions) to a primary focus on different coexisting Fishing Cultures and their contribution to value chains, community, and sustainability.

The present Fishing Cultures found in Jammer Bay

This study elaborates each Fishing Culture concept as a particular unity of 1) life-mode, 2) mode of operation, 3) fishing method, and 4) community (home port). For the Jammer Bay area, seven uniquely distinct Fishing Cultures are identified. The Fishing Culture framework can be further developed for other geographic areas by elaborating additional Fishing Culture concepts and studying the empirical realization of their conditions of existence, operation, and co-existence in those areas.

The empirically realized Fishing Cultures of Jammer Bay area are: Fishing Culture 1: Beach landing coastal fishery; Fishing Culture 2: Dutch

demersal beam-trawling; Fishing Culture 3: Expansive harbour-based fishery; Fishing Culture 4: Harbour based coastal fishery; Fishing Culture 5: Specialised gillnet fishery; Fishing Culture 6: Specialised anchor-seine fishery, and Fishing Culture 7: Profit-seeking large-scale fishery.

The empirically realized Fishing Cultures operating in the 4 ICES squares of the Jammer Bay area exploit and impact the marine environment in different ways and contribute to the sustainability of fishing communities and the general society at quite different levels and magnitudes, socially, cultural, and economic. This study identifies the direct value chains via sales to processing plants and via auctions. There is no one-to-one relation between Fishing Cultures and direct value chains, though the main fishing-culture-specific contributors to each of the direct value chains are identified.

Fig. 51: *Father, son, and a third share fisher is a typically crew size when a GT 20 coastal vessel combining single trawling and gillnetting is conducting inshore fishery in Skagerrak. HM 86 'Julie Diremo' was constructed in 1982 for coastal fishing from a harbour. The boat underwent succeeding modernizations, became bought and reshaped by a fishing family in Thorupstrand and operated from Hanstholm, where the picture of this typical Fishing Culture 4 vessel was taken in 2015. Photo: Thomas Højrup.*

The Local Economic Effects of the Fishing Cultures

Generally, economic analysis focuses on profitability from an investor and wage-earner perspective, or from a national economic perspective. This thinking is aimed to improve the allocation of labour and capital to the most profitable activities. This study focuses on the Local Economic Effects (LEE). A model for assessing the LEE of each Fishing Culture is developed based on the Direct Effects (wages and income for crew and owners) and Indirect Effects (wage part for services purchased locally). The latter adds another specific feature to each Fishing Culture, the LEE, measured in absolute terms and relative LEE/landing value. LEE is assessed for the fishing communities in Jammer Bay, where Hanstholm, Thorupstrand, Løkken and Hirtshals are characterised as the 'local' communities, even if Hanstholm and Hirtshals receive considerable parts of the landings from other sea areas than Jammer Bay. The analysis therefore focuses on the spatial distribution of the income generated by fisheries rather than the private business or national economic profitability. This is essential for the local communities and regions that hold the natural resources, which are extracted, and therefore bear the burdens of the 'externalities' (e.g., the decreasing durableness of productive marine habitats and fish stocks caused by highly 'profitable' fishing business models).

From the local community's cultural, environmental, and economic sustainability perspective, the business economy of the most profitable vessels may be of less interest than the community's totality of integrated value chains, especially if the (negative) externalities are local and the profit is appropriated elsewhere (i.e., outside the community, the region, or the country).[62] Following this perspective, it is interesting, that the Fishing Cultures with a high level of income contribution to the local economy are found in the segments normally (in business and national economics without an integrated socio-cultural and organic sustainability perspective) regarded as less valuable because they are primarily seen as low productive and low profitable fisheries.

The large vessels of Fishing Culture 2: *Dutch demersal beam-trawling*, operate a downright long-distance fishery without any economic contribution of significance to the local fishing communities in the Jammer

62 Dinesen et al 2025.

Bay area. This is reflected in the considerable differences in the Local Economic Effect (LEE) between the Fishing Cultures and highlights another pattern than would otherwise be obtained from calculations of company profitability in business economic practice. The Fishing Culture 1: *Beach landing coastal fisheries*, the Fishing Culture 4: *Harbour based coastal fisheries* and the Fishing Culture 5: *Specialised gillnet fisheries* have the highest LEE, calculated to 49%–56% of the catch value. There is a middle LEE for the Fishing Culture 3: *Expansive harbour-based fisheries* and the Fishing Culture 6: *Specialised anchor-seine fisheries*, calculated to around 40%. While the lowest LEE is delivered by the Fishing Culture 2: *Dutch demersal beam-trawling* and the Fishing Culture 7: *Profit-seeking large-scale fisheries*. For the large-scale fisheries of Fishing Culture 7, the calculated LEE is 25%.[63] The *Dutch beam trawlers* of Fishing Culture 2 generally does not land fish in any of the Jammer Bay harbours. Thus, the absolute as well as the relative LEE of this Fishing Culture is almost zero.

The disastrous struggle and environmental destruction that have to find a solution

Specifying the dimensions of each Fishing Culture makes it possible to shed light on the ways the seven Fishing Cultures co-exist and impact each other in the Jammer Bay area. Several of the actual forms of co-existence appear to be unproblematic between Fishing Cultures with activities in different areas of the Jammer Bay area, as long as the impact of their catch technology and field of fishing activity allows competitive sharing of common fishing grounds, habitats, and fish stocks, that is without discarding fish and damaging the seabed, the benthic flora and fauna, the food webs, the spawn and the juvenile fish.[64] When this prerequisite is

63 Because 1) most of the large pelagic new ships are designed, furnished, equipped, and fit out at Karstensen Shipyard in Skagen and subsequently kept in repair at the same yard, 2) the pelagic catches are landed and processed in Skagen, the LEE of Fishing Culture 7 (with home ports in Skagerrak) is very high for the region of North Jutland as a whole.

64 This presupposition of a non-problematic coexistence can be impossible to fulfill, as long as limitations on intensive trawl fishing in Skagerrak, operated by crews realizing Fishing Culture 3, are absent. As long as skippers decide what they report as caught in Skagerrak versus the North Sea, and there is no fully documented fishery, the intensity will remain too high, resulting in 'overfishing'. The impact of high intensity and discard, combined with increasing water temperatures affecting cod stocks, is described in Dinesen et al. 2025.

not fulfilled, we find several kinds of asymmetrical competition and even struggle between vessels realizing a broadly composed, versatile mode of operation (mostly found in the Fishing Cultures 1 and 4) and larger vessels realizing a unilateral specialized mode of operating (mostly found in the Fishing Cultures 3, 5, 6 and 7). The larger and more mobile vessels of the last categories may be able to displace the more local, versatile vessels from their year-round grounds and resources during a high season.

Fig. 52: *HM 862 'Christina Paulsen of Hanstholm' is one of the unilaterally specialized 100 GT anchor seiners operated by the Fishing Culture 6 crew of 3 or 4 share fishers. The wooden boat is constructed in Hvide Sande in 1986 and has been owned and operated as 'Ralima of Hanstholm' by a family and its local crew from Thorupstrand until 2025. At that time it was bought by two young fishing families, who sold their shares in the 123 GT Flyshooter and trawler L 654 'Pia Glanz of Thorsminde' with the aim 'to get more freedom' and less fuel consumption by fishing with anchor seine in Skagerrak. Photo: Thomas Højrup, Hanstholm 2016.*

Fishers (among the interviewed stakeholders) realizing the Fishing Cultures 1, 4, 5, and 6 find themselves caught in an antagonistic relation to large beam trawlers realizing the Fishing Culture 2 who operate a long-distance fishery in the Jammer Bay, among other places. Their presence in the Jammer Bay conflicts with local fishers realizing the Fishing Cultures 1, 4, 5 and 6 because of the beam trawlers' inability

to share common fishing grounds and fish stocks with other Fishing Cultures in sustainable and durable ways. The impact generated by the heavy beam trawls on the seabed, marine food webs, and juvenile fish puts hard pressure on all fishing opportunities at the shallow grounds of the Jammer Bay while the beam trawlers are operating in the area – and during a considerable time afterwards.[65] In terms of sustainability the fishing method of 'opening the bottom' represents the exact opposite of the 'audio-visual' fishing method.

Stakeholders realizing the mobile beam trawling Fishing Culture argue, that their own endeavour to 'open the ground' by means of beam trawls is, from their point of view, advantageous for other fishers too, if they dare to fish nearby the ground that has been opened by the beam trawler vessels, because the clouds in the water of crushed molluscs generated by the tickler chains attract more fish to the spots and tracks. The local stakeholders realizing the Fishing Cultures 1, 4, 5, 6 conceive this point of view as far too short-sighted and missing the long-term negative impact of heavy beam trawling on the biodiversity and resilience of habitats, food web and fish stocks in the Jammer Bay.

From the point of view of the conceptual universe of beam trawl fishers, the local fishers in Jammer Bay (realizing the Fishing Cultures 1, 4, 5 and 6) need to adopt a longer ranging fishery, exploiting alternative sea areas and thereby allowing local fishing areas in Jammer Bay to recover after having been 'opened up'. From the beam trawler culture's perspective only the too high fuel prices are preventing such a development. The response of the coastal fishers to this argument is that it is neither sustainable nor necessary to 'destroy' the seabed applying heavy gear and much fuel. These contrasting points of view bear the fishers' witness about the antagonistic character of this coexistence.

In a sea area like Jammer Bay, where the local fishers spread their long chains of gillnets and the long drag lines of their anchor seines, it is not easy to drag beam trawls back and forth in high speed over long stretches across the attractive fishing grounds, because an advancing vessel have to give way for a vessel connected to its fishing gear in the sea – unless the

65 Dinesen et al 2025.

skipper chooses to violate the law of navigation. That is a practice that frighten the coastal fishers, because a 500 GT beam trawler is 25 times larger than a coastal anchor seining and gillnet fishing vessel. When you risk that the beam trawlers are on the way to the local fishing grounds, it is a question if you dare to put your drag lines, seine or gillnet into the water because you risk to lose the gear, and when a fleet of beam trawlers are already trawling in the local waters, it is not possible to put gillnets or seine gear into the water. The opposition between the mobile beam trawling and the stationary and semi-stationary audio-visual fishing methods implies, that the large beam trawlers take over the fishing grounds, when they are in the majority, or when windy weather, sea current and waves force the local boats to stay ashore or to go ashore and the beam trawlers occupy the area. The result is that the local gillnet fishing and anchor seining vessels are displaced from the fishing grounds, which are the foundation of their fisheries' annual circle.

Fig. 53: *The 10 heavy tickle-chains of the beam-trawl are able to sink down in the seafloor, dig out the demersal fauna of the seabed in high speed and crush the wounded molluscs into attractive bait for several species of fish. Dragging a beam-trawl of this kind demands a successful volume-fishery to be economically sustainable, because of its heavy consumption of fuel, and a large field of fishing activity because the biotopes of the sea bed have to recover after 'the bottom has been opened'. Several species of flora and fauna do not withstand being ploughed and crushed, and when the biodiversity is shrinking, the resilience of the biotope is disappearing. Photo: Thomas Højrup, Ijmuiden 2023.*

The problematic coexistence of: 1) opposite modes of operation and 2) opposite fishing methods aggravate each other when the Dutch fleet of large beam trawlers (the present wave came in 2016) arrives at the shallow grounds of the central Jammer Bay searching for sole and plaice and subsequently return to 'the Danish Goldmine' in Jammer Bay year after year, because these target species are no longer available in their home waters of the southern North Sea. Only the decrease of plaice in Jammer Bay can keep the beam trawler fleet away, but the local fishers know, that they return as soon as the habitats and stocks of plaice and sole show the 'sign' of recovering. Only an agreement between Holland and Denmark mediated by negotiations and a decision in EU can end this disastrous struggle and environmental destruction of a productive and vulnerable marine ecosystem.

Fig. 54: *P 224 Miranda of Portsmouth is a Dutch so called 'flagship' that is fishing on British quotas and because of that it is registered in the British port affiliation of Portsmouth. It is equipped with two rigs, one for beam-trawling and one for multi-trawling at the sea floor. The typical beam-trawler vessel is now supplementing the shrinking season for beam-trawling with a season for Norway lobster trawling with two or more trawls side by side at the eastern side of Dogger Bank. Photo Thomas Højrup, Harlingen 2013.*

Fig. 55: *HG 236 Milton of Hirtshals is a harbour based coastal fishing vessel, measuring 17-meter length and 93 GT. The fishing family got the hull constructed in Poland at request and design of Vestværftet in the North Sea harbour Hvide Sande in 2017. It became equipped with machines, winches, cooling system, navigation instruments etc. by the local marine shops in Hirtshals, fit out for longlining, demersal trawling, pelagic trawling, gillnetting and other fishing methods, which might show up as relevant for a variable and full annual cycle of share-organised fishing in Skagerrak. The skipper's ambition was to develop a small-scale vessel to the broadly complex, versatile mode of operation, that could inspire other share-fishermen to order similar boats in order to strengthen the harbour based coastal fishing fleet in Hirtshals and recruit new generations for this kind of fisheries. In March 2026, the vessel was bought by a younger fisherman in Hanstholm, who sold his boat share in the 50 m long and 1.306 GT pelagic trawler Lingbank: "It is a completely different ship than the old Lingbank, much smaller and thus far less financial pressure, says Jonas Rasmussen, who is delighted to have his foot on his own deck again." https://ligeher.nu/thy-mors/nyheder/aktuelt 19. marts 2026. Photo: Jens Kranen Photography.*

The Fishing Culture 2, which is delivering no Local Economic Effect to the Jammer Bay area is at the same time that Fishing Culture, which is systematically destroying the environmental and navigational foundations of fishing opportunities in the coastal sea of Jammer Bay. In this way Fishing Culture 2 displaces the local Fishing Cultures with low environmental impact, which have the largest Local Economic Effect in the Jammer Bay area, and among whom we find the Fishing Culture 1 that

maintains the Nordic clinker-boat traditions inscribed by UNESCO as Intangible Cultural Heritage of Humanity.

The Fishing Cultures' contributions to the local community have different characters. The fishing activity is basis for cooperation, income, and jobs in the communities, which ensure a permanent residence based on fishing families' conceptions on what is a 'good life' in the community. In the fishing communities, the families' history of seafaring and fishery, and their recent (with sea faring connected) life also contribute to the identity and local culture. This is documented in this study's interviews and the description of Fishing Cultures and coastal communities in the Jammer Bay and the Netherlands. The local fishing communities of Jammer Bay as well as the fishing community of Urk are struggling for their survival as fishing centres and as long as this struggle is going on in the Jammer Bay far away from Urk and destroy the seafloor and biotopes in this local sea area, the Jammer Bay fishing communities are losing their foundation.

The further perspectives of the mode of analysis and synthesis

In the longer run, the Fishing Culture framework makes it possible to identify how every vessel in a fishing fleet is realizing the necessarily connected features of one or more distinct Fishing Culture concepts. Hence, it becomes possible to map when and where the Fishing Culture-specific parts of the fleet make use of the distinct fishing grounds in a sea area. It becomes possible too, to measure the intensity of the distinct ways, in which the individual fishing grounds are used and evaluate the impact on the habitats and fish stocks. When the fish prices obtained by the individual vessels are registered, it furthermore becomes possible to compare the economic results and Local Economic Effects of distinct Fishing Cultures' use of the specific types of habitats and concrete fishing grounds. This includes the analysis of how the Fishing Cultures impact and change the conditions of existence of each other. This method improves the ability to calculate the economic effects of management initiatives to regulate the activity of the distinct Fishing Cultures.

Elaborating our knowledge on the dependence and impact of different Fishing Cultures on the ecosystem and the conditions of each other makes it possible to evaluate the economic, social and cultural consequences and results of regulations aiming to improve the ecosystemic sustainability. Hence, the perspective becomes that of entering a kind of fisheries management, where the considerations for habitats, fishing communities and fishing families of different kinds can be connected and combined in more appropriate ways than fisheries politics and management are able to do without this structural knowledge about the decisive connections between the systemic ecological, social, and cultural features and their foundation in a concrete sea area. To develop this perspective is the aim and purpose of the ongoing Danish research project ECOSPACE.[66]

66 The ECOSPACE project (covering Kattegat and Skagerrak) follows up on the research project 'Mapping of seabed habitats and impacts of beam trawling and other demersal fisheries for spatial ecosystem-based management of the Jammer Bay (JAMBAY)' headed by DTU-AQUA, Copenhagen, in which the authors (from The Centre for Sustainable Lifemodes) of this study are developing the Fishing Culture models and mode of analysis.

Acknowledgements

We would like to thank all the fishers, skippers, fishing association chairmen and employees at the auctions in Hirtshals, Thorupstrand, Hanstholm, Thyborøn in Denmark as well as in Urk, Ijmuiden, Lawerzoog and Katwijk in the Netherlands. We would also like to thank Danish Fishers PO (DFPO) and Danish Pelagic Producers Organisation (DPPO).

The work was funded in the project 'Mapping of seabed habitats and impacts of beam trawling and other demersal fisheries for spatial ecosystem-based management of the Jammer Bay (JAMBAY)' (Grant Agreement No 33113-B-23-189) by the European Maritime and Fisheries Fund (EMFF) and the Ministry of Food, Agriculture and Fisheries of Denmark.

APPENDIXES

1. Applied qualitative methods – observations and interviews

The qualitative data are collected by use of personal interviews and in this relation observations.

The interviewed persons are selected as stakeholders representing central employees at the relevant auctions, chairmen of the local fisheries associations, fishers, and skippers of different types of vessels. In the Danish context, most of the stakeholders are chosen based on the authors' experience and knowledge of the sector. In a few cases, stakeholders proposed other interview persons in a snowballing process. For the interviews in the Netherlands, a local contact person is the entrance for the next choices of more interview persons. The input from interviews is supplemented by observations in the relevant ports. A structured observation of the ports, vessels, and catch technologies is documented in notes and pictures and provide a hands-on understanding of the technologies as well as the general situation in the ports. This is supplemented by a more unstructured observation (urban drifting) in the local communities including shorter conversations with inhabitants. The structured and unstructured observations all contribute to a deeper understanding of the local communities and the role of fisheries in social and cultural terms.

The interviews are conducted by 1–3 persons. The themes are loosely agreed on in advance, and the interviews have taken place on location (auction, vessel, company office) and in a few situations in the fisher's home. The interviews are semi-structured with themes to cover defined in advance but often developed in other directions depending on what seemed relevant in the situation. See examples of general interview guides for auctions and fishers below.

General interview guide for auctions

- Tell us about the auction – physical frameworks, how does the trade work?
  - Relation to and competition with online/onsite auctions?
  - What is the difference and advantages here?

- Which vessels land here?
  - Do you know where they have caught the fish?
  - Can you identify the catches from Jammer Bay area?

- For the Jammer Bay project, we should seek to identify vessels of different types that fish in Jammer Bay and land here (nn port)
  - Can you come up with suggestions? – e.g.:
    - Nets – small/large
    - Trawlers small/large
    - Danish seine

- Please describe how the fish reaches the final market from the auction. Who are buying, for which markets in first and second link?
  - Local buyers for companies with fresh export or processing
  - Directly to the end-user – or another short value chain locally?
  - Direct export of the fresh fish?

- Can you give examples of – or maybe even a list of the different types of vessels landing for the auction?

- What about vessels under 10 m – and those without AIS – are there any in the "white" areas of misleading activity when only AIS data is used?

General interview guide for fishers

- Please tell us about your fisheries.
  - Vessel and gear
  - What are you catching and how/where is the catch sold?
  - How is the organization aboard – share-part fishers/employees? How many

- Tell us a little about yourself.
  - History and family background
  - The fishing history/career – experiences from different vessel/ gear types and locations?

- Describe the annual cycle in the present fishery,
  - Where are you fishing and which species?
  - Where are the catches landed?
    - Illustrate on a map
  - Have this changed over the years?
    - How has it changed?
    - Why has it changed? (his understanding of reasons)

- We are trying to map the value chains of the fisheries. If you are willing to – and can, please give an insight in the accounts of the vessel, in form of percentage of expenses for:
  - oil,
  - catch expenses (oil, ice, fish boxes, packing, auction),
  - tools, other maintenance,
  - wages
    - fixed or shares (of what?)
    - are costs first deducted for operation or for boat and leasing of quotas etc.?
  - possibly: insurance, memberships – possibly leasing of quotas?
  - [Could we – in all confidentiality – have a copy of your accounts?]

- For the Jammer Bay project, we should seek to identify vessels fishing in Jammer Bay and to see if we can group them in a reasonable way.
  - Can you point at other vessels like you? Who would you compare your vessel with – and why? – which parameters?

2. Possible shift of Fishing Culture to maintain life-mode

A 'life-mode' implies a conceptual world structuring what is conceived as 'the good life' and therefore a mode of living whose conditions of existence people defend and try to improve.

A 'fishing culture' also comprises a mode of operation, distinct technical methods (fishing gear) and a geographical setting – community (fishing harbour affiliation).

It is possible to change, shift, or replace a Fishing Culture in order to improve the conditions and survival of the life-mode. These kinds of choices and changes, in which people are shifting gear, replacing one mode of operation with another or are moving from one homeport to another as a means to replace or improve the conditions of existence of their life-mode, exemplify the so-called 'neoculturation' processes,[67] which are constantly changing the society.

Hence, in Jammer Bay we often find fishers who are shifting gear types and methods, modes of operation and sometimes even their fishing harbour affiliation – and in this sense are changing their Fishing Culture or are moving from one Fishing Culture to another. Presently we see crews who (e.g., to survive the worsened conditions in the North Sea fishing after Brexit) are selling their large pelagic or bottom trawler and buying a little longliner (e.g., in Hanstholm) and shift from trawl gear to longlines. We also see anchor-seining crews moving from Hanstholm to Hirtshals to compensate for the disappearing of plaice in the western and central part of Jammer Bay and the remaining presence of plaice in the north-eastern part of Jammer Bay and Tannis Bay, and fishers employed by large pelagic trawlers and purse-seiners who return to the landing sites, where they grew up, to be hired on a local seiner or gillnetting boat. For some fishers the growing consciousness about the connection between economic and organic sustainability and the need to fish with

67 Højrup 2013 p. 260-447. Højrup & Nielsen 2024.

care, protect and maintain the habitats and fish stocks, motivates them to shift gear and mode of operation.

The last two examples may also illustrate a life-cycle change (instead of a neoculturation), where you e.g., can start in a local small scale fishing team and learn your métier from fellow villagers, then shift to employment on a large vessel with the aim to earn more money and save up for your own house and boat-share, and subsequently leaving the company because you are ready to move home and start for your-self. A third variant of life-cycle change we find in Jammer Bay presently, are the entrepreneurial owners of huge pelagic vessels who sell or hand over their stocks and practice in the large-scale company, retire and buy a little boat to fish with gillnets, seines or hooks as aged senior fishers.

The conclusion is that whereas people use to maintain their life-mode, they may be ready to shift or move from one fishing culture to another, which is the reason why we find a flow of individuals between the distinct fishing cultures, even if these cultures are maintained as different modes of fishing and thinking in the area.

3. Value chains, method for calculation of Local Economic Effects (LEE)

The Local Economic Effects (LEE) of the fisheries and the fish value chains

The local communities' economic family incomes comprise crew-shares, gear-shares, boat-shares, wages, and profits from the fisheries and from the suppliers of energy, goods and service to the fisheries.

Using a simple causal language to describe the fisheries' and suppliers' *Local Economic Effect* on the fishing-community's family incomes, the so-called *Direct Effects* come from the fishing activity, whereas the *Indirect Effects* come from suppliers and their related industries/workshops. The economic effect of income that is spent on food, clothes, housing etc. by the local families is called the *Induced Effects*. Unintended consequences and changes in the 'value chains' that arise from the practices producing the Direct, Indirect, and Induced Effects are in this terminology called the *Derivative Effects*. Applying this terminology it is possible to elaborate an empirical model aimed to select relevant data, and use it to calculate, describe and evaluate the economic significance of the productive practice of distinct, empirically realized and co-existing Fishing Cultures for the fishing communities (if relevant: for regions, states or EU), which depend on one or more distinct sea areas, where their fishery takes place. This proto-type study focusses its calculations on the local economic effects.

The applied model of Local Economic Effect (LEE) analysis is inspired by Cowi (2013), Jordal-Jørgensen et al. (2014), and Watson et al. (2021). The model focuses on *revenues* generated by the fisheries (the Direct Effects) and the suppliers and related industries (the Indirect Effects), which are either local or non-local. The focus of the LEE analysis is the Local Direct and Indirect Effects of the fisheries, and, measured in revenue, the potential for Induced Effects (Table A3.1). The Local Induced Effect of the fishing activity is not measured in the Local Economic Effect analysis.

The estimation of the Induced and Derived Effects on the community where the vessels are affiliated are discussed in the qualitative description of the seven fishing cultures and the selected local fishing communities.

Table A3.1: Economic Effects discussed in the analysis. Direct and Indirect Effects are handled in the LEE. Induced and Derived Effects are briefly mentioned in the description of Fishing Cultures and Fishing communities.

Economic Effects	LEE	Data
Direct	Crew share of income and remuneration of owners	Stat-DK. Account statistics, vessel categories
Indirect	Selected: wage-to-cost rate for fuel, landing costs and maintenance, assumed to be local services/supply	Stat-DK. Account statistics, industries
Induced	Not included: Qualitatively mentioned in description of Fishing Cultures and Fishing communities.	Interviews and vessel accounts
Derived	Not included: Qualitatively mentioned in description of Fishing Cultures and Fishing communities.	Interviews and observations

To assess the revenue generated for the LEE, a range of assumptions are made:

The Direct Effect on local community of the fisheries is the salaries and revenues in the fisheries, based on accounts statistics for vessel categories, defined by main type of gear and vessel length (Statistics Denmark, FIREGN2).

- Crew and owners are assumed to be local to the registered affiliated port of the vessel. For some Fishing Cultures the qualitative analysis points to the fact, that not all crew members and owners are local.

- Each vessel is linked to a vessel category (according to the account statistics) and assumed to be operating at average economic terms according to the statistics.

The Indirect Effect on local community of the fisheries is the salaries and revenues for local supplier and service industries, based on the relevant operating costs in the fisheries (the account statistics for vessel types).

- A link between the operational cost types in the fisheries and the supplier and service industries is established by a detailed cost analysis below (including Fig. A3.1).

- Three types of operation costs for the vessels are assumed to be linked to local companies:
  - Energy (the cost E.1) assuming that bunkering takes place locally.
  - Landing, sale, and distribution (E.3), assuming that the first-hand operation is local.
  - Maintenance (E.5), assuming the main part of maintenance is local, though central parts of maintenance (yard etc.) tend to be specialised and centralised.

- For each cost type, account statistics for one or more typical supplying sectors are used for assessing the relation between turnover = Gross output (D.) and wage share (E.8). This indicates the rate of operational cost (E.1, E.3 or E.5) to salaries in supplying companies and thereby the Indirect Effect.

The main part of the calculations is based on accounts received from a sample of fishing companies in Jammer Bay, and account statistics from Statistics Denmark (FIREGN2). The account statistics are based on accounts from representative vessels and presented as average data for 17 vessel categories defined by main type of gear and vessel length. For the calculation of the Indirect Effects, a rate between fisheries cost of operation and local salaries in the assumed local supplier and service industries are calculated based on aggregated account statistics at 5-digit industry level, Statistics Denmark (REGN1).

Calculation of the Local Economic Effects of fisheries

The Direct Effect of the fisheries is expressed in the income generated by the fisheries. In the standardised accounts statistics, the "wage expenses" is the payment of the crew. This covers wages for the crew in the Fishing Culture 7, and income for the share fishers in the share (part) organized vessels in the Fishing Cultures 1–6. This does not include payment to the official owner. In the account statistics, remuneration for the owner is not seen as a cost but as a part of the profit. For the small vessels the registered owner might be a part of the share crew or might even be the only crew member (1-person vessels). Therefore, in this relation remuneration for the owner (H.3 in the account statistics) is included as a cost with the same LEE as income for the crew.

The direct LEE of the fisheries is thus the sum of a) Crew share of income (E.8) and b) Remuneration of the owner (H.3) for the vessels in the Fishing Culture.

Calculation of the Indirect Local Economic Effect of fisheries

The calculation of the Indirect Local Economic Effect of fisheries goes over three steps.

1. An analysis of the operating costs for the vessels,[68] linked to points in the account statistics for Statistics Denmark and the typical supplier/service provider, and a discussion of which operational costs are supplied locally.

2. An analysis of which industry groups (5-digit level) typically contain the supplying/servicing companies – to thereby calculate a rate of wage-to-turnover (= cost of operation in the fisheries) for the type of cost.

3. A calculation of the indirect local economic impact of the Fishing Culture based on the sum of the wage-to-cost rate for the selected local operational costs of the vessel category.

68 The concept of basic operational costs is clarified in Højrup & Nielsen, pp. 796.

The first step in the Indirect LEE analysis is to analyse the operational costs of the vessel.[69] In the account statistics (FIREGN2), the different cost types in the operation are grouped in E.1 to E.9 (some broken further down), as illustrated in the list below.

- Fuel and lubricant oil – (E.1)
- Quota rent – (E.2)
- Landing costs: (E.3): Ice, Fish boxes, Packing of catch, Auction fee
- Maintenance: (E.5): Of the vessel, of the gear and of equipment
- Administration (E.6): Membership fees, Subscription fees
- Insurance fees: (E.7)
- Crew share of income (or salaries) (E.8)
- Other, e.g., Rent and use of cares (E.4) and Depreciations (E.9)

The different types of operational costs for the vessel are illustrated in Fig. A3.1 below. The costs are specified in the first blue and orange boxes (indication respectively fixed and effort dependent costs). The green stars indicate how this cost is linked to the account statistics for the vessel categories. For each of the cost type a typical supplier/service provider is mentioned.

69 In this version of the assessment, financial expenditures (interest expenditure for ship financing and mortgage and bank loans) or quota rent are not included in the statistical measures. These might be reflected on in the qualitative assessment.

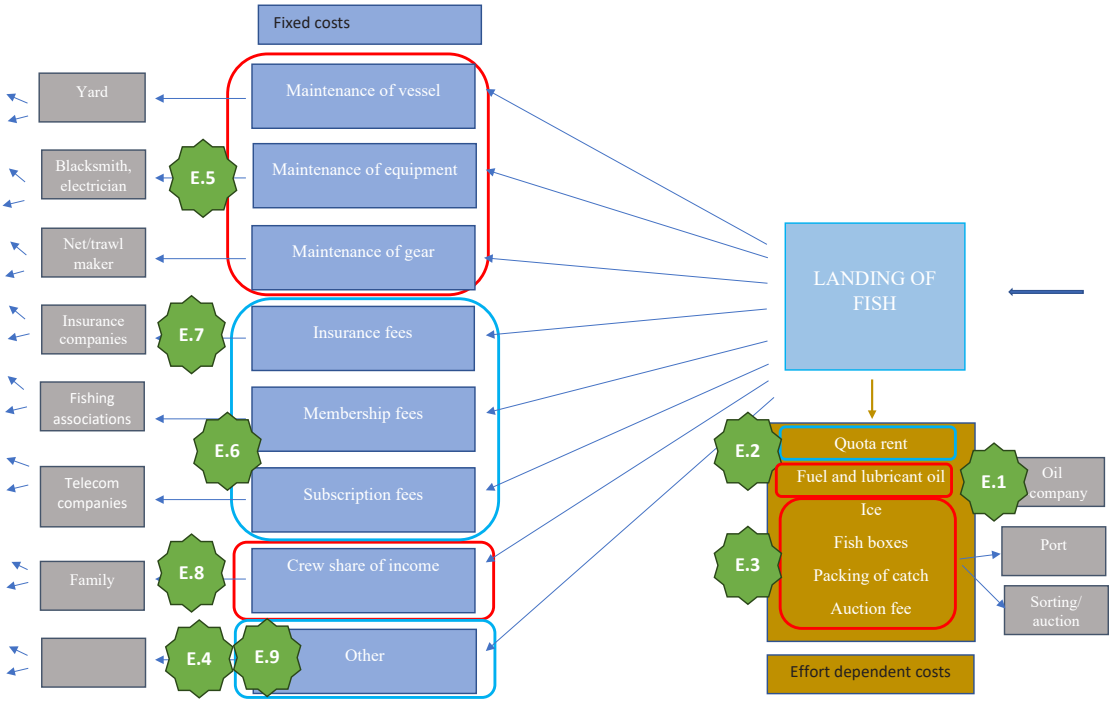


Fig. A3.1: *Operating cost for the fishing operation. Green stars indicate the cost types in account statistics. Boxes with a red ring (E.1, E.3, E. 5 and E.8) are regarded as costs taking place in the local area. Boxes with blue rings (E.2, E. 4, E.6, E.7 and E.9) are regarded as costs taking place elsewhere and not included in the Local Economic Effect assessment. Own model and FIREGN2.*

The service providers and suppliers can be located locally or within a larger distance to the affiliated port of the vessel. For the model, we assume that some types of activities (linked to costs) are typically local, while others are typically handled by companies located outside the local area. In Fig. A3.1, the local costs are marked by a red frame, non-local costs are marked by a blue frame. Typically, the direct handling of the fish is mainly local based (registered in the accounts as E.3). Fuel is in this regard seen as provided locally, though bunkering can also take place where the vessel lands. Finally, we assume that maintenance is mainly local, though yard maintenance takes place in the few ports with relevant yards.

The second step of assessing the Indirect LEE of the fisheries is to assess the wage-to-turnover (cost in fisheries accounts) in the local based service and supplying companies. The wage-to-cost rate (secondary effects) for

the three types of costs (Energy (E.1), Landing, sale, and distribution (E.3), and Maintenance (E:5)) are argued below.[70]

E.1 Energy: Although not local produced, fuel must be provided locally – either in harbour or landing site. The industry code representing the providers of energy is "19000 Oil refinery etc.". There is no data available on the relation between turnover = Gross output (D.) and wage share (E.8) for this branch. Knowing that the price of energy is based on the price for the oil/fuel, energy-taxes for the state, and general handling costs including wages, the wage share of the energy costs is assessed to be small. The wage-to-turnover rate is therefore assumed to be 0,1 – meaning that the Indirect LEE (wages) of the energy costs is assumed to be 10% (of what the vessel has paid for energy).

E.3 Landing, sale, and distribution: These activities will necessarily take place in the landing port, or in the port of the fish auction if the landing is trucked elsewhere for auction. Several types of companies are involved in this activity. To assess the wage share in these, the accounts for three branches are analysed, and the average share cost of wages (E.8) to gross output (D.) (E.8/D) is regarded as the indirect LEE of the cost for landings, etc. for the fishing vessel. The account data is at a very general level, as account data for e.g. auctions is not available. Three industries selected include central service providers but not necessarily representative for all supply and service providers. The three branches are 49003: Freight transport by road and via pipeline, 52000: Support activities for transportation (e.g., cooling stores), and 82000: Other business service activities (e.g., packaging) (Table A3.2).

70 Data for the calculation of the wage-to-turnover ratio for the companies providing services and supply for the fishing vessels is based on Statistics Denmark, REGN1 Accounts statistics by industry and items. This is Accounts Statistics for Non-Agricultural Private Sector at 5-digit level of DB07. The latest data, 2021, is used for the mentioned industries. For each industry, the calculation is based on wages, salaries, pensions etc./turnover.

Table A3.2: Wage-to-turnover rate in three industries (49003, 52000, 82000, 5-digit level), comprising companies with landing, sale and distribution of fish. Source: Statistics Denmark, REGN1.

	49003 Freight transport by road and via pipeline	52000 Support activities for trans-portation	82000 Other business service activities	The three industries
Enterprises (No.)	4702	1487	3352	9541
Turnover (DKK million)	54062	117959	30068	202089
Wages, salaries, pensions, etc. (DKK million)	14390	15801	7679	37870
Rate: wages-to-turnover	27%	13%	26%	19%

The average wage share of gross output for the three branches is 0,2. This means that the Indirect LEE (wages) of the landing costs is assumed to be 20% (of the landing costs).

E.5 Maintenance: Maintenance will in general (apart from the large pelagic vessels) often take place in the home port (fishing harbour affiliation). Emergency maintenance will take place where the damage occurs and periodic maintenance and checks can take place at nearby shipyards, not necessarily in the home port. Nevertheless, the input from interviewees indicates that as much maintenance as possible is placed locally. Several types of companies are involved in this activity. To assess the wage share in these, the accounts for three branches are analysed, and the average share cost of wages (E.8) to gross output (D) (E.8/D) is regarded as the indirect LEE of the cost for maintenance for the fish vessel. The branches are 30000: Manufacture of ships and other transport equipment,

33000: Repair and installation of machinery and equipment and 43002: Building completion and finishing (painters etc.) (Table A3.3).

Table A3.3: Wage-to-turnover rate in three industries (30000, 33000, 43002, 5-digit level), with companies withing maintenance of fishing vessels. Source: Statistics Denmark, REGN1.

	30000 Manufacture of ships and other transport equipment	33000 Repair and installation of machinery and equipment	43002 Building completion and finishing	The three industries
Enterprises (No.)	153	2501	16227	18881
Turnover (DKK million)	6323	22004	70910	99237
Wages, salaries, pensions, etc. (DKK million)	1442	5878	19974	27294
Rate: wages-to-turnover	23%	27%	28%	28%

The average wage-to-turnover rate for the three industries branches is assessed to be 0,3. This means that the indirect LEE (wages) of the maintenance is assumed to be 30% (of the maintenance costs).

To assess the LEE of the Fishing Cultures, four calculations are made. This is based on the assumptions mentioned above, including that the vessels in each Fishing Culture are operating at average economic terms according to the account statistics for vessel categories. The basis is account statistics for 2022, in the table FIREGN2 at Statistics Denmark (Table A3.4).

1. The direct LEE is calculated for each Fishing Culture, based on the number of vessels in each of the vessel categories of Statistics Denmark. For each of the vessels in the Fishing Culture, the (assumed average) wages (E.8) and the remuneration for the owner (H.3) is calculated and summed.

2. The indirect LEE is calculated for each Fishing Culture, based on the number of vessels in each of the vessel categories of Statistics Denmark. For each of the vessels in the Fishing Culture, the (assumed average) wage share of the costs for Energy (10% of E.1), Landing, sale, and distribution (20% of E.3), and Maintenance (30% of E.5) are calculated and summed.

The size and number of vessels differ considerably between the Fishing Cultures. In order to assess the relative LEE per fish (value) for the Fishing Culture, the LEE (Direct and Indirect) is related to the fish gross output for each vessel in the Fishing Culture, and an average level is calculated.

3. The direct LEE of the fish catch value per Fishing Culture is calculated as the value of Direct LEE for (1 above) as share of the gross output value of landings of D.1: Fish for consumption + D.2: crustaceans and molluscs and D.3: Industrial fish. This is expressed as percentage of fish value contributing to the local economy.

4. The indirect LEE of the fish catch value per Fishing Culture is calculated as the value of Indirect LEE for the Fishing Culture (2 above) as share of the gross output value of landings of D.1: Fish for consumption + D.2: crustaceans and molluscs and D.3: Industrial fish. This is expressed as percentage of fish value contributing to the local economy.

5. Finally, the LEE (Direct and Indirect Effect on the Local Economy) is calculated as the sum of 3) and 4).

Table A3.4: Local Economic Effects (LEEs) of the Fishing Cultures, 2022. Landing values, direct and indirect LEE, and direct and indirect LEE per fish value. Own calculations based on Statistics Denmark, FIREGN2, REGN1 and own identification of the Fishing Culture vessels in Jammer Bay. *Due to discretion, there is no economic data available for industrial trawlers 24-39 m.

Fishing Culture no.	1	3	4	5	6	7
Net/hook under 12 m	4		40			
Trap setters under 12 m						
Trawlers under 12 m			21			
Net/hook from 12 to 14,9 m	1		3	4		
Danish seiners from 12 to 14,9 m	5				3	
Trawlers from 12 to 14,9 m		1	15			
Danish seiners from 15 to 17,9 m					5	
Net/hook from 15 to 17,9 m			1	6		
Trawlers from 15 to 17,9 m		12	31			3
Net/hook from 18 to 23,9 m				4		
Danish seiners from 18 to 23,9 m					5	
Trawlers from 18 to 23,9 m		19	7			3
Industrial trawlers from 24 to 39,9 m		*				*
Other trawlers from 24 to 39,9 m		22				7
Industrial trawlers 40,0 m and over						8
Purse seiners & trawlers 40,0 m and over						4

Fishing Culture no.	1	3	4	5	6	7
No. of vessels in each Fishing Culture	**10**	**54**	**118**	**14**	**13**	**25**
Landing value, mill DKK	14,7	484,2	256,2	78,5	51,3	698,1
Direct and Indirect Local Economic Effect, mill DKK	7,7	186,9	124,9	44,1	20,8	178,9
Direct Local Economic Effect, % of landing value	43,5	31,3	40,9	49,1	32,2	21,0
Indirect Local Economic Effect, % of landing value	8,8	7,3	7,9	7,2	8,3	4,6
Local Economic Effect (LEE), % of landing value	**52,4**	**38,6**	**48,8**	**56,2**	**40,5**	**25,6**

4. Development of of Dutch beam trawl activity 2016 – 2019

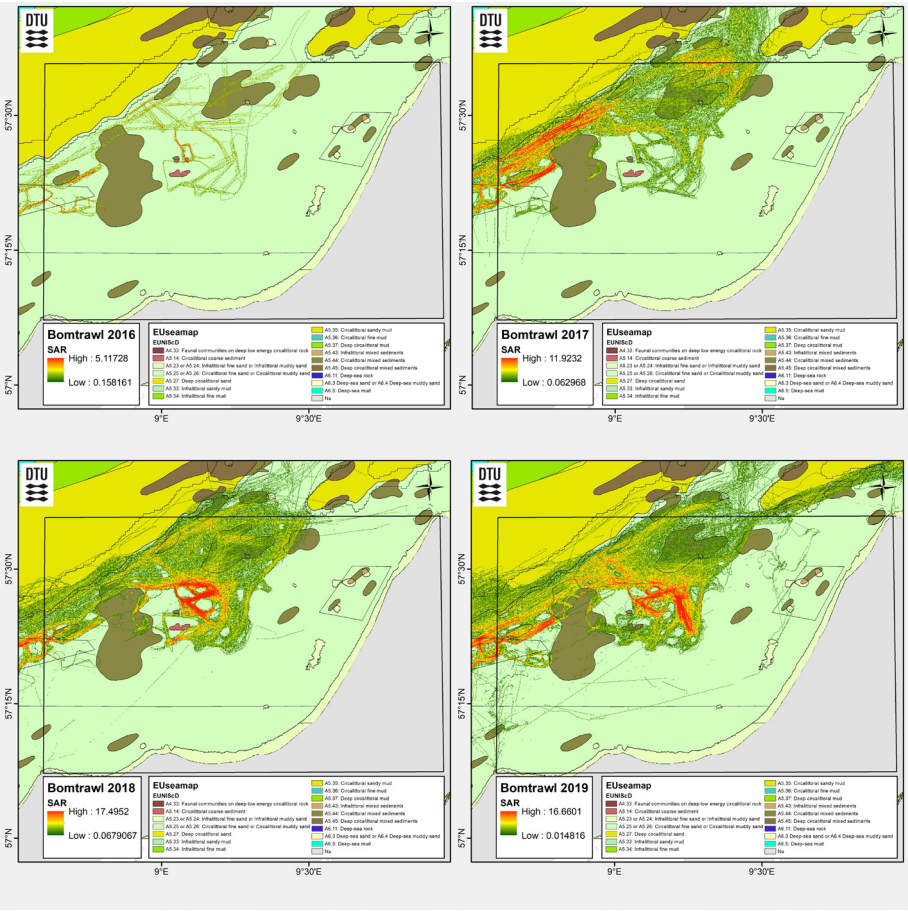
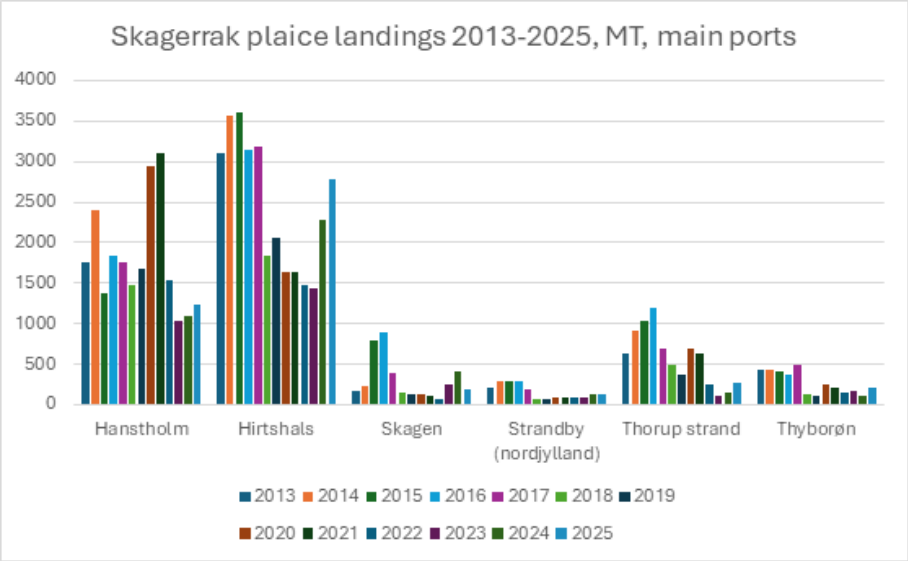


Fig. A4.1.: *Maps of the distribution and intensity of Dutch beam trawling for each of the years 2016, 2017, 2018, 2019. The intensity of fishing is calculated as a swept area ratio (SAR based on AIS data). From: Eigaard & Olsen, 2020, Bilag 1e, p. 13).*

It is clear from Figure A4.1. that the Dutch beam trawlers fish exactly in the area just outside the 12 nautical mile limit, where the Thorupstrand fishers had their main fishing ground before they were displaced.

5. Landings of plaice in Skagerrak 2013 – 2025



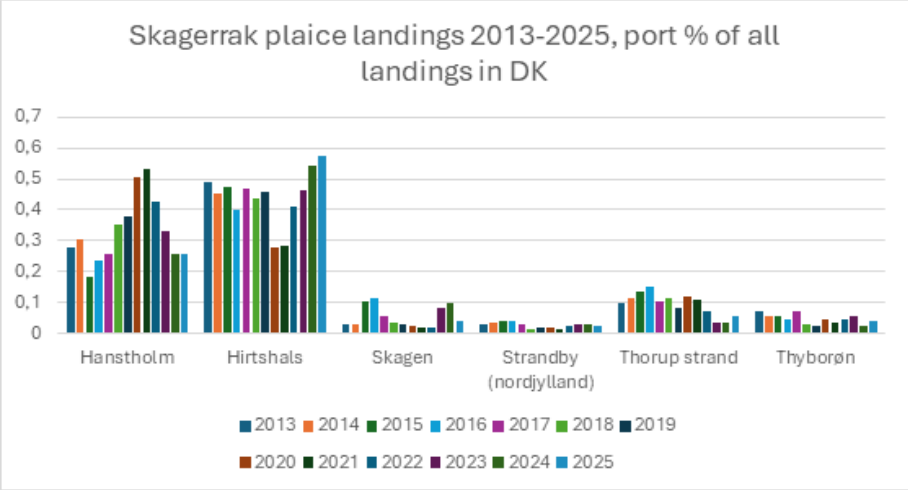


Fig. A5.1.: *Landings of plaice from Skagerrak 2013–2025, Danish ports with +2 % of landings. A) % of landed weight, B) tons landed weight. Source: Fiskeristyrelsen, dynamic table for landings, https://lfst.dk/fiskeriet-i-tal/landinger, (Landed weight, plaice, all conditions, from Skagerrak, all nations, landings in Danish ports only).*

6. Materials and methods

Method

The first approximation of an applicable conceptual model of Fishing Cultures was developed on the basis of two scientific concepts, the life-mode theory and mode of operation theory[71] and preliminary interview data collection. The following procedures were applied: 1), The relevant data about all aspects of the conceptual model's distinct fishing methods, modes of operation and life-modes were collected; 2), A second data collection allowed for realized features of distinct Fishing Cultures to be empirically identified; 3), The relevant features of the distinct Fishing Cultures were correlated and quantified by means of statistical data and controlled by means of qualitative data and 4), The explicated and documented Fishing Cultures in Jammer Bay area were applied in analyses of relevant fishing communities and their value chains and co-existence of distinct fishing activities at specified locations in the Jammer Bay area.

Data collecting techniques and sources

The qualitative data was collected by applying 10 in-depth stakeholder interviews with fishers individually representing the different, investigated fisheries' life-modes, supplemented with in-depth key-informant interviews and participant observation[72] (see Appendix 1).

All 241 Danish vessels (of which a few are owned by Swedish companies) and the Dutch vessels operating in Jammer Bay area during 2022 were analysed and classified individually at the basis of a systematic collection of all publicly available data in the Danish Vessel Register(Søfartssty-

71 Højrup & Nielsen 2024.

72 Participant observation is a qualitative ethnographic data collecting technique comprising observing and participating in the social life of a group. In this study we apply the variant called 'moderate participant observation' conducting a balance between an 'insider' and an 'outsider' role in relation to the informants (Spradley, 1980).

relsen n.y.), the Danish Register of Companies (Det Centrale virksomhedsregister n.y.), the Fish auctions' statistics (Styrelsen for Landbrug og Fiskeri n.y., dynamic tables for landings and fish auctions), the AIS vessel tracks Vesselfinder n.y.), the Danish Register on Quota Ownership (Styrelsen for Landbrug og Fiskeri n.y., vessels quota shares and landings), Fisher Forums vessel register (Fiskerforum n.y.), and qualitative data from fieldwork in the relevant Danish as well as Dutch fishing communities.

The quantitative data was collected from official databases of Statistics Denmark (Statistics Denmark 2023. FIREGN2) and the Danish Fisheries Agency (Styrelsen for Landbrug og Fiskeri n.y., dynamic tables for landings and fish auctions). The main part of the more detailed quantitative data for Jammer Bay area, such as fishing time and intensity, was provided by DTU-Aqua after anonymization of logbook data, AIS data, etc.[73]

Materials

The *in-depth interviews with fishers* deliver data on:
1) the year-cycles of distinct vessels and modes of operation;
2) the use of fishing gear and applied catching methods;
3) the fishing grounds inside and outside their present reach;
4) the organization and work of the crews;
5) investment strategies, running costs and operating economies;
6) family and generation-cycles;
7) conceptions of 'the good life' as fisher and fisher family;
8) recruitment of new generations and income-sharing or wage tariffs and working conditions;
9) the fishers' personal experiences and attitudes, their view on different kinds of fishing and other occupations, their economic thinking, and their perspective on their own life-course;
10) the state management of the fisheries;
11) how to stay and survive in the markets
12) their plans and goals and reasons to stay or leave the fishing industry.

73 More specific use of statistics is mentioned in relation to the specific use throughout the report. Link and data can be found in the reference list.

The *in-depth interviews with key-stakeholders other than fishers* deliver data on;
1) the distribution of different kinds of fishing and fishers in the three main and analysed harbours and landing sites;
2) the situation and conditions of the fishing industry and fishing families in each place;
3) the service companies, auctions, and export.

The *applied register data* (as listed above in "Data collecting techniques and sources") deliver data on all vessels relating to their individual size, tonnage, kilowatt, home port, gear complex, years of construction and reconstruction, ownership, annual accounts, transferable quota, loans, and field of activity at sea. For the assessment of value chains, selected vessels provided original account data supplemented with account data from Statistics Denmark.

Structured and unstructured observations were conducted in the locations of the personal interviews. A structured observation was conducted in the visited port for seeing the vessels and catch technologies as well as the general situation in the ports. Furthermore, unstructured observations (urban drifting) were conducted in the local communities including shorter conversations with inhabitants. The observations contributed to a deeper understanding of the different types of fishing technology as well as of the local communities and the role of fisheries in social and cultural terms.

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