Supplementary Material

An Interdisciplinary Insight into the Human Dimension in Fisheries Models. A Systematic Literature Review.

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# Appendix S1.

Scopus Search String:

*(TITLE-ABS-KEY(fisheries) AND TITLE-ABS-KEY(model\*)AND ALL("Common Fisheries Policy")) AND ( LIMIT-TO(LANGUAGE,"English" ) ) AND ( LIMIT-TO(DOCTYPE,"ar" ) OR LIMIT-TO(DOCTYPE,"cp" ) )*

# **Appendix S2.**

PRISMA Flow Diagram, adapted from (Moher et al., 2009), containing all steps and short explanations for the process of document exclusion during the process of selecting the publications suitable for analysis.

Records identified through database searching   
(n = 211)

Screening

Included

Eligibility

Identification

Additional records identified through other sources   
(n = 0)

Records after duplicates removed   
(n = 211)

Records screened   
(n = 211)

Records excluded  
(n = 0)

Full-text articles assessed for eligibility   
(n = 211)

Full-text articles excluded, based on inclusion/exclusion criteria  
(n = 131)

Studies eligible for qualitative synthesis   
(n = 80)

Studies included for in-depth qualitative analysis and synthesis   
(n = 31)

Full-text articles excluded, no human dimension aspect modelled   
(n = 49)

# Appendix S3

# Visualizations of the human dimension aspects

The creation and use of displays (i.e. visualisations—the organised, compressed assembly of information that permits the drawing of conclusions and subsequent actions) is an important part of qualitative data analysis (Miles & Huberman, 1994). In order to be able to design relevant visualisations for this study, the qualitative data (i.e. the HDAs and their corresponding variables) were exported from NVivo 11 to Microsoft Excel 2016. They were transformed using Python into a data format (source-to-target) adequate for import into Gephi (Version 0.9.1), which is an open source visualisation tool for graph and network analysis (Bastian, Heymann, & Jacomy, 2009). This program allows for visual analytics and functions as a complementary tool to perform enumeration, to enable visual thinking, and to facilitate reasoning. In particular, Gephi was used for qualitative and quantitative visualisation of the hierarchy and the connections between the HDAs and the variables, as shown in Figure 1.

To give a qualitative representation of how the HDAs were modelled, the HDAs and variables were represented as nodes and the connections between them as edges, while the colour of each node was set according to the dimension that was assigned to the variable. The colours were assigned as follows: pink: human; blue: economic; green: environmental; white: other (e.g. time) or more than one dimension (e.g. sustainability). To include a quantitative representation of the results, the size of the nodes was set according to the publication count (i.e. the overall number of sources that featured this variable), which gives an impression of the relative importance of each. Each HDA in the study was treated separately, and a visual representation was created for each. The network algorithm used in Gephi was ForceAtlas2 (Jacomy, Venturini, Heymann, & Bastian, 2014).

# Appendix S4.

List of all publications included in the analysis and synthesis phase. In alphabetical order based on first author.

|  |  |  |  |
| --- | --- | --- | --- |
| **Authors** | **Title** | **Year** | **Journal** |
| Aanesen, M; Armstrong, C | Stakeholder influence and optimal regulations: A common-agency analysis of ecosystem-based fisheries regulations | 2013 | Journal of Institutional and Theoretical Economics |
| Aanesen, M; Armstrong, C W | The implications of environmental NGO involvement in fisheries management | 2014 | Land Economics |
| Amigo-Dobaño, Lucy; Dolores Garza-Gil, M.; Varela-Lafuente, Manuel | The perceptions of fisheries management options by Spain's Atlantic fishermen | 2012 | Marine Policy |
| Andersen, B S; Ulrich, C; Eigaard, O R; Christensen, A S | Short-term choice behaviour in a mixed fishery: Investigating métier selection in the Danish gillnet fishery | 2012 | ICES Journal of Marine Science |
| Astorkiza, K; del Valle, I | Changing the total allowable catch (TAC) decision-making framework: A central bank of fishes? | 2013 | Panoeconomicus |
| Bastardie, Francois; Nielsen, J Rasmus; Miethe, Tanja | DISPLACE: a dynamic, individual-based model for spatial fishing planning and effort displacement — integrating underlying fish population models | 2014 | Canadian Journal of Fisheries and Aquatic Sciences |
| Batsleer, J; Poos, J J; Marchal, P; Vermard, Y; Rijnsdorp, A D | Mixed fisheries management: Protecting the weakest link | 2013 | Marine Ecology Progress Series |
| Britton, E; Coulthard, S | Assessing the social wellbeing of Northern Ireland's fishing society using a three-dimensional approach | 2013 | Marine Policy |
| Burns, T R; Stöhr, C | Power, knowledge, and conflict in the shaping of commons governance. The case of EU Baltic fisheries | 2011 | International Journal of the Commons |
| Da Rocha, J M; Cerviño, S; Villasante, S | The Common Fisheries Policy: An enforcement problem | 2012 | Marine Policy |
| Da Rocha, J M; Villasante, S; González, R T | Credible enforcement policies under illegal fishing: Does individual transferable quotas induce to reduce the gap between approved and proposed allowable catches? | 2013 | Ambio |
| Gezelius, S S; Raakjær, J; Hegland, T J | Reform drivers and reform obstacles in natural resource management: The Northeast Atlantic fisheries from 1945 to the present | 2010 | Human Ecology |
| Haapasaari, P; Michielsens, C G J; Karjalainen, T P; Reinikainen, K; Kuikka, S | Management measures and fishers' commitment to sustainable exploitation: A case study of Atlantic salmon fisheries in the Baltic Sea | 2007 | ICES Journal of Marine Science |
| Haapasaari, P; Mäntyniemi, S; Kuikka, S | Baltic herring fisheries management: Stakeholder views to frame the problem | 2012 | Ecology and Society |
| Hatcher, A; Jaffry, S; Thebaud, O; Bennett, E | Normative and social influences affecting compliance with fishery regulations | 2000 | Land Economics |
| Jensen, C L; Aarset, B | Explaining noncompliance in the Norwegian coastal cod fishery: An application of the multinomial logit | 2008 | Applied Economics |
| Levontin, P; Kulmala, S; Haapasaari, P; Kuikka, S | Integration of biological, economic, and sociological knowledge by Bayesian belief networks: The interdisciplinary evaluation of potential management plans for Baltic salmon | 2011 | ICES Journal of Marine Science |
| Martins, J H; Camanho, A S; Oliveira, M M; Gaspar, M B | A system dynamics model to support the management of artisanal dredge fisheries in the south coast of Portugal | 2015 | International Transactions in Operational Research |
| McCausland, W D; Mente, E; Pierce, G J; Theodossiou, I | A simulation model of sustainability of coastal communities: Aquaculture, fishing, environment and labour markets | 2006 | Ecological Modelling |
| Miethe, T; Bastardie, F; von Dorrien, C; Nielsen, J R | Impact assessment of a fisheries closure with effort and landings spatial analyses: A case study in the Western Baltic Sea | 2014 | Fisheries Research |
| Natale, F; Carvalho, N; Harrop, M; Guillen, J; Frangoudes, K | Identifying fisheries dependent communities in EU coastal areas | 2013 | Marine Policy |
| Nielsen, K N; Holm, P | A brief catalogue of failures: Framing evaluation and learning in fisheries resource management | 2007 | Marine Policy |
| Parés, C; Dresdner, J; Salgado, H | Who should set the total allowable catch? Social preferences and legitimacy in fisheries management institutions | 2015 | Marine Policy |
| Pita, C; Pierce, G J; Theodossiou, I | Stakeholders' participation in the fisheries management decision-making process: Fishers' perceptions of participation | 2010 | Marine Policy |
| Pita, C; Theodossiou, I; Pierce, G J | The perceptions of Scottish inshore fishers about marine protected areas | 2013 | Marine Policy |
| Rätz, H J; Charef, A; Abella, A J; Colloca, F; Ligas, A; Mannini, A; Lloret, J | A medium-term, stochastic forecast model to support sustainable, mixed fisheries management in the Mediterranean Seaa | 2013 | Journal of Fish Biology |
| Thorpe, R B; Le Quesne, W J F; Luxford, F; Collie, J S; Jennings, S | Evaluation and management implications of uncertainty in a multispecies size-structured model of population and community responses to fishing | 2015 | Methods in Ecology and Evolution |
| Tidd, A N | Effective fishing effort indicators and their application to spatial management of mixed demersal fisheries | 2013 | Fisheries Management and Ecology |
| Trenkel, V M; Rochet, M J; Rice, J C | A framework for evaluating management plans comprehensively | 2015 | Fish and Fisheries |
| Trondsen, T; Matthiasson, T; Young, J A | Towards a market-oriented management model for straddling fish stocks | 2006 | Marine Policy |
| Van Putten, I E; Quillérou, E; Guyader, O | How constrained? Entry into the French Atlantic fishery through second-hand vessel purchase | 2012 | Ocean and Coastal Management |

# Appendix S5.

Table of all Level 2 variables and their frequency (count).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | **Level 2** | **Count** | | Acceptance Of Management Regime | 1 | | Attitudes On Regulatory Options | 1 | | Central Bank-Like Of Fishery Resources | 1 | | Change In TAC Level | 1 | | Closed Areas | 1 | | Commitment | 1 | | Compliance | 2 | | Components and Interrelationships Of Fishery | 1 | | Conflicts | 1 | | Diagnostics | 1 | | DPSIR Indicators | 1 | | Employment Opportunities | 1 | | Fleet | 1 | | Fleet Adaptation | 1 | | Impact of Shocks to Aquaculture | 1 | | Implementation Uncertainty | 1 | | Interests | 1 | | Intervention | 1 | | ITQs | 1 | | Management Decision | 1 | | Management Measures | 4 | | Management Option | 2 | | Material Wellbeing | 1 | | Motives For Non-Compliance | 1 | | MOVA | 1 | | Normative-Cognitive Configuration | 1 | | Objectives | 1 | | Objectives For Society | 1 | | Participation In Decision-Making Processes | 2 | | Policy Making | 1 | | Preferences | 2 | | Preferred Management Measures | 1 | | Quota Allocation | 1 | | Regulation | 1 | | Relational Wellbeing | 1 | | Social Organizational Configuration | 1 | | Stock Dynamics | 1 | | Subjective Wellbeing | 1 | | Sustainability | 1 | | TAC | 1 | | Tactical Choices | 1 | | Utility | 4 | | Vessel Behaviour | 1 | |  |

# Appendix S6.

Table of all Level 3 variables and their frequency (count).

|  |  |
| --- | --- |
| **Level 3** | **Count** |
|  |  |
| Accessibility | 1 |
| Administration Body | 1 |
| Aquaculture Escapes | 1 |
| Aquaculture Production | 1 |
| Area | 6 |
| Atmospheric Pressure | 1 |
| Authority And Responsibility | 1 |
| Believes | 2 |
| Biomass | 2 |
| Bureaucracy | 1 |
| Business Characteristics | 2 |
| Capacity | 3 |
| Capital | 1 |
| Catches | 6 |
| Closed Area Or Season | 1 |
| Compliance | 2 |
| Conceptualization Of Situation | 1 |
| Confidence In Management | 1 |
| Conservation Systems | 1 |
| Consulted | 1 |
| Cost | 13 |
| CPUE | 1 |
| Crew | 1 |
| Days At Sea | 1 |
| Decision Variables | 1 |
| Decision-Making Procedure | 1 |
| Decommissioning Grant | 1 |
| Demand | 3 |
| Demographics | 4 |
| Discards | 2 |
| Distance | 1 |
| Distribution System | 1 |
| Earnings | 2 |
| Economic Rent | 2 |
| Education | 1 |
| Effort | 13 |
| Employment | 3 |
| Existing Wealth | 1 |
| Experience | 2 |
| Expertise | 1 |
| Family Connections | 1 |
| Feed | 1 |
| Fine | 3 |
| Fish Abundance | 1 |
| Fishing Gear | 1 |
| Fishing Mortality | 4 |
| Fishing Operation Characteristics | 1 |
| Fishing Points | 1 |
| Fleet | 2 |
| Fuel | 5 |
| GDP | 1 |
| Go Out Fishing Or Stay In Port | 1 |
| Goals And Priorities | 1 |
| Government | 1 |
| Government Support | 2 |
| Harvest | 2 |
| Holistic View | 1 |
| Immigration Flows | 1 |
| Implementation | 1 |
| Income | 2 |
| Industry Support | 1 |
| Info From Other Fishers | 1 |
| Informed | 1 |
| Involved | 1 |
| Labour | 1 |
| Landings | 8 |
| Legitimacy | 1 |
| Local Fishing Interests | 1 |
| Market Trader Network Structure And Dynamics | 1 |
| Material Resources | 1 |
| Metier | 4 |
| Monetary Return | 1 |
| Monitoring Programme | 1 |
| Moral Norm | 1 |
| Mortality Reduction | 1 |
| Multispecies | 1 |
| Natural Resources | 1 |
| Needs For A Good Life | 1 |
| Network Integration | 1 |
| Number Of Participants Or Fishers | 1 |
| Number Of Vessels | 5 |
| Others Are Cheating | 1 |
| Performance Indicators | 1 |
| Policy | 1 |
| Pollution | 1 |
| Ports, Harbours | 1 |
| Prices | 12 |
| Probability Of Being Caught | 1 |
| Probability Of Making A Choice | 1 |
| Problems | 2 |
| Production | 1 |
| Profit | 3 |
| Profitability | 1 |
| Quota | 6 |
| Regulation | 4 |
| Regulatory Preferences | 1 |
| Relationships Influencing Fishing | 1 |
| Resource Rent | 1 |
| Revenue | 7 |
| Risk | 1 |
| River Abundance | 1 |
| Rules | 1 |
| Sense Of Justice | 1 |
| Sharing Scientific Information | 1 |
| Social Preferences | 1 |
| Social Pressure | 1 |
| Social Resources | 1 |
| Solutions | 1 |
| Species | 2 |
| Spawning Stock Biomass | 1 |
| Stakeholders | 1 |
| State Of Nature | 1 |
| Stock | 13 |
| Strength Of Relationship Between Variables | 1 |
| Subsidies | 1 |
| Supply | 1 |
| TAC | 7 |
| TAE | 1 |
| Tax | 3 |
| Technological Parameters | 1 |
| Time | 3 |
| Trip | 1 |
| Trust | 1 |
| Uncertain Variables Of Fishery | 1 |
| Utility, Loss, Preference Variables | 1 |
| Value | 2 |
| Vessel | 4 |
| Veto Right | 1 |
| VPA | 1 |
| VPUE | 1 |
| Waste | 1 |
| Way Of Fishing | 1 |
| Ways Of Increasing Trust | 1 |
| Weather | 1 |
| Weight | 2 |
| Willingness To Cheat | 1 |
| Yield | 3 |

# Appendix S7.

Individual visualizations of all human dimension aspects and their level 2 and level 3 variables. Human dimension aspects are listed in alphabetical order. The colour of the node indicates the dimension it belongs to, with pink = human, blue = economic, green = environmental, and white = other / more than one dimension; Size of the node shows relative importance, i.e. the number of publications that used this node; hierarchy of the nodes is displayed by order from left to write, where nodes on the very left are level 1 human dimension aspects, nodes in the middle are level 2 variables, and nodes on the very right are level 3 variables.

































