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Transparent and consistent? Aquaculture impact assessments and trade-offs in coastal zone planning in Norway

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ABSTRACT

Strategic environmental assessments (SEAs) are used in coastal zone planning in Norway to assess how changed area-use can impact a variety of uses and interests and make recommendations for trade-off decisions between them. The transparency and consistency of the SEAs are important for their throughput legitimacy. This paper analyses how the set up and practices of SEA processes affect their transparency and consistency, how they can be improved, and what trade-offs there may be between the two. This is based on cases studies of SEAs in two intermunicipal planning processes involving 143 proposed aquaculture areas in 18 municipalities in Northern Norway. Marine aquaculture in the form of salmon farming has grown into a major industry on the Norwegian coast, and there are ambitions for further growth. Salmon farming is a major driver for coastal zone planning in Norway as many municipalities hope it will provide jobs and income and fish farms must be placed in accordance with municipal coastal zone plans. The paper specifically analyses how proposed aquaculture areas were handled in the SEAs, including their knowledge base, assessment methods used and actual trade-offs, and how this impact transparency and consistency. Consistency is considered both across geographies and SEA processes and through the individual SEA processes.

1. Introduction

Increased pressure on the world's coastal zones seems inevitable, so also in Norway. For the use and management of these areas to be environmentally sustainable and socially equitable (Bennett et al., 2019), legitimate governance processes are of fundamental importance. Recognizing that coastal governance includes a wide range of multi-actor and multi-level policy processes, in this paper we focus on coastal zone planning and specifically the use of strategic environmental assessments (**SEAs**) related to this.

Having evolved from its more expert-driven and technocratic post war-roots, planning has over the latter decades become strongly associated with democratic norms such as participation, equity, openness and dialogue (Bäcklund and Mäntysalo, 2011; Mäntysalo et al., 2011). This is strongly linked to the legitimacy of the planning and overall governance processes. Van Tatenhove (2011: 91) explains legitimacy in marine governance as the acceptance of the political system by citizens, the outcome of policy processes and the quality of policy making, and then goes on to distinguish four forms of legitimacy: input, throughput, output, and feedback legitimacy. Of these four, throughput legitimacy alone is concerned with the quality and procedure of decision-making *processes* and asks how decisions are taken, who is responsible for them, and which issues are at stake (ibid.). More specifically, throughput legitimacy is seen as underpinned by the accountability of those that make decisions, the transparency of the processes and their inclusiveness and openness to civil society (Schmidt 2013), as well as fairness - that rules apply equally and appropriately to all (Franck 1995; Schmidt and Wood 2019).

In Norway, municipal spatial planning is one of the most central coastal governance mechanisms. This is where consequences of increased coastal pressures are assessed, various uses are debated, and trade-offs between different interests and activities are made, not least regarding aquaculture, which is an important yet controversial industry along most of the Norwegian coastline. Municipal politicians must, based on the recommendations of planners or impact assessment practitioners, consider a wide range of interests and make trade-offs between them. SEAs are important tools for doing this in practice. They allow for judging the value or importance of an area's use and qualities, the impact of changed area use, and the consequence, i.e. the effects of an establishment on an area or theme weighted against its importance.

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SEAs can be an important instrument for meeting the criteria that underpin legitimacy in public decision-making processes (Bonifazi et al., 2010). While no clear conceptualisation of legitimacy in impact assessments exists (Bond et al., 2018), the same criteria of transparency, accountability and participation as for general governance processes are recognised as important (Bonifazi et al., 2010; Bond et al., 2018; Morrison-Saunders and Bailey 2000). The importance of consistency in ensuring quality in the decisions made in SEAs has also been highlighted (Noble 2004) and conversely, how a lack of consistency can lead to unclear understanding of the SEAs and lessen their credibility (Fidélis et al., 2016; Noble and Storey 2001). This is also evident in the Norwegian Guideline for Impact Assessments (Anon 2020), which states that impact assessments are important democratic tools that should be transparent, verifiable, fact based and independent (authors' translation). However, a lack of clear guidelines in Norway on how to conduct impact assessments means that SEAs vary much between municipalities, including the scope, knowledge foundation, practices and format (Sørdahl et al., 2017).

As the design of assessments and procedures followed can have great implications for the trade-offs made, varying SEA practice might also lead to varying trade-offs (Morrison-Saunders and Pope 2013). While much of the work on impact assessments might base itself on the belief that use of scientific knowledge will lead to more rational decision making (Kørnøv and Thissen 2000), many underlying aspects might influence the decision made. These include the norms, values and "bounded rationality" of the practitioners and decision makers, their proximity to the process and potential outcomes, perceived risk and uncertainty, and the goal of the process (Retief et al., 2013; Aksamit et al., 2019; Tzioutziou and Xenidis, 2020). As planning is highly connected to politics, the political process can also shape parts of the process, such as the indicators used to predict and measure impacts (Gao et al., 2013). While it is recognised that planning cannot base itself on fully objective and value-free knowledge or decisions made without political influence (Zhang et al., 2018), the rationale for the decisions made should still be transparent.

Aquaculture has been important for employment and income in many rural areas in Norway, and also for national income and export (Aanesen and Mikkelsen, 2019, Johansen et al., 2019; Johnsen et al., 2020) As production sites must be placed in accordance with municipal spatial plans, aquaculture is a major driver for and premise setter for coastal zone planning. Conversely, municipal spatial planning is considered key for growth of aquaculture in Norway (Kvalvik and Robertsen 2017). However, negative environmental impacts of aquaculture (Taranger et al., 2015; Olaussen 2018) and a more uneven distribution of benefits has led to controversies around aquaculture development, access to sea space and the future distribution of direct and indirect benefits and burdens from the industry (Osmundsen and Olsen 2017; Young et al., 2019; Hersoug et al., 2021). This has also led to questions about how aquaculture is handled in municipal planning, and whether both the industry and its consequences are adequately and consistently assessed across the different planning processes, in other words, questions related to the throughput legitimacy of planning for aquaculture. In this paper, we study how proposed areas for marine aquaculture have been dealt with in two coastal zone planning processes in Norway and assess how transparent and consistent the impact assessment methods and trade-off decisions are, and how this relates to the set up and practices in the SEAs.

The trade-offs we investigate were performed in two different intermunicipal planning processes, comprising in total 18 municipalities and 143 proposed aquaculture areas. We consider to what degree the knowledge base and assessment methods used in the SEAs are transparent and verifiable, and if the trade-offs seem to be consistent across the proposed aquaculture areas in each of the two SEAs. Whether steps in the assessment processes are consistent with previous steps is also analysed. Specifically, the paper addresses the following research questions: 1) How are transparency and consistency affected by SEA set-up and practice, including selection of the knowledge base, how value and impacts are assessed and how trade-offs are done? 2) How can transparency and consistency in the SEAs be improved, and what may be the trade-offs involved?

Even though our study covers only two cases in Norway and is concentrated on the SEAs and trade-offs associated with proposed aquaculture areas, we still believe lessons from it are relevant and can help improve planning and SEAs elsewhere in Norway and also in other settings. The Tromsø region case, where the coastal zone planning process was led by a consultant, is likely representative of many such processes across Norway. The Mid and South Troms case has been recognised by national and regional planning authorities and other municipalities as a good example of how such process could be run. Thus, any suggested improvements based on these processes could also be relevant elsewhere.

In the following section we briefly describe central provisions in the Norwegian coastal zone planning and aquaculture management before we provide a more detailed description of our two case processes and the related SEAs. Following that, we present our methods and how we categorised and coded the SEAs to perform our analysis. Finally, we present the results, before we discuss what lessons can be drawn regarding the transparency and consistency of SEAs and trade-offs.

2. Planning for aquaculture

Marine aquaculture has over the last 50 years grown into a major industry in Norway, dominated by the farming of Atlantic salmon. With a production of more than 1,3 million tonnes in 2019 at around 1000 approved sites along the Norwegian coast (Directorate of Fisheries 2020), Norway is the world's largest producer of this species (Iversen et al., 2020). Both the industry and the government express ambitions for considerable further growth (DKNVS, NTVA. 2012; NFD 2015), even though the production volume was virtually unchanged between 2012 and 2019, mainly due to challenges related to sea lice and escaped farmed salmon (Hersoug et al., 2019).

The Aquaculture Act (LOV-2005-06-17-79) states that site licenses may not be granted in contravention of adopted conservation measures relating to nature conservation, cultural heritage, or adopted land use plans pursuant to the Planning and Building Act, unless the conservation or planning authority gives its consent. This is what gives the Norwegian local municipalities an important role in siting aquaculture, as they are the planning authority for near shore sea space (within 1 nautical mile from the base lines).

The Planning and Building Act regulates planning through both content and process requirements. For instance, the content requirements define the spatial categories that will allow salmon farming in an area and require that these be depicted as zones in a map, while the process requirements aim to i.a. ensure transparency, predictability and public participation for all affected interests and authorities. Further, there is emphasis on long-term solutions, and environmental and social impacts shall be described (LOV-2008-06-27-71). Knowledge-based management, use of the precautionary approach, ecosystem-based management, and consideration of cumulative environmental effects are required pertaining to the Nature Diversity Act. Important to note is that while the plan is produced by the administration (or by consultants hired by the administration), the final decision is political, as the plan needs to be approved by the Municipal Council.

The question of prioritizing aquaculture or not in municipal spatial planning is largely a local political issue. The local authorities are in principle free to facilitate aquaculture or to not do it (Myklebust et al., 2016). Still, the municipalities' autonomy in spatial planning is limited to some degree. During the mandatory hearing of a proposed spatial plan, certain actors such as sector agencies can make formal objections if there are conflicts with their sector's legislation and priorities (Kvalvik and Robertsen 2017). This is to ensure that the plans are not in conflict with important national or regional interests. Such objections must be

resolved before a plan can be passed. If the parties cannot resolve the objections, the Ministry of Local Government and Modernisation makes a final decision. Other parties such as NGOs or individuals can provide comments to the proposed plan, but these do not have the status of a formal objection.

Strategic environmental assessments (SEA) in line with the EU Directive on this are mandatory when making municipal spatial plans (FOR-2017-06-21-854). This is where the environmental and social impacts of a plan are described. The Norwegian regulation on impact assessments requires that the assessments should be tailored to the specific context, and lists 18 topics that may be considered, including nature diversity, ecosystem services, cultural heritage, recreation, landscape, and effects of climate change. Impacts on each of these topics will be discussed for each proposed new aquaculture area. The assessments are usually carried out by municipal planners or external consultants, and their assessment of consequences and recommendations form the basis for the political decision-making process.

Certain guidelines for conducting impact assessments exist, e.g. the often-used Norwegian Public Roads Administration Impact Assessment Guidelines (Anon 2018), the Norwegian Environment Agency's guide on recommended methods and databases (Anon 2019), and the Guideline for Impact Assessments after the Planning- and Building Act from the Ministry of Local Government and Modernisation (Anon 2020). However, the regulations and guidelines are general in nature, including the topics to be assessed, possible methods to assess values and impacts, and how to present results. Further, none of the regulations or guidelines are targeted to planning for aquaculture and coastal space, leaving the actors with ample room for deciding how to actually conduct the impact assessments (Sørdahl et al., 2017).

In summary, the Norwegian planning system provides the local communities with quite a lot of influence in siting aquaculture facilities. However, while municipal planning plays an important role in setting aside space for aquaculture, it is only the first step. Achieving a site licence pursuant to the Aquaculture Act requires permissions from state sector authorities responsible for pollution, food safety and marine traffic. Other interests, such as fisheries, wildlife, recreation and biodiversity, as well as other uses of the sea space, should also be considered before a licence is granted (Anon. 2005). Thus, even though municipal spatial planning must assess and make trade-offs between different interests, further trade-offs will take place in the subsequent site licencing process, where the licencing authority must also consider the need for an environmental impact assessment (EIA) (FOR-2017-06-21-854). EIAs are rarely made (Robertsen et al., 2016), as the site licence applications are generally considered to provide enough information together with the SEA from the spatial planning process. This underlines the importance of the SEAs when considering the impacts of aquaculture.

3. Case studies

The regional authorities in Troms county initiated a project in 2012 to facilitate municipal planning in the region. This resulted in four intermunicipal planning processes undertaken during the years 2013–2016, involving 22 of the county's 23 coastal municipalities (see Fig. 1). Troms is thus an interesting case for comparing different planning processes, as they were performed simultaneously with the same regional goals, guidelines and support, yet with different practical approaches, including when it comes to the SEA. We have chosen to focus on the two largest processes in terms of the number of involved municipalities, sea space and aquaculture sites: the Mid and South Troms and Tromsø region planning processes.

Together, these processes demonstrate different aspects of planning practices in Norway. The Mid and South Troms process has been hailed as very good and effective. Central actors in the organisation and administration of the process have been invited to conferences around the country to share their experiences, and new coastal zone planning processes are based on their approaches and methods. The Ministry responsible for the Planning and Building Act have called it a "good example of how municipalities can cooperate on a plan and solve joint planning challenges in an area needing high competence and good plan capacity" (our translation) (KMD 2020), and it is thus considered "state of the art" in Norwegian coastal zone planning. The Tromsø region SEAs, plan descriptions and maps were done by a consulting firm that has conducted many SEAs around Norway, meaning that their approach and praxis are likely found in many coastal planning processes around

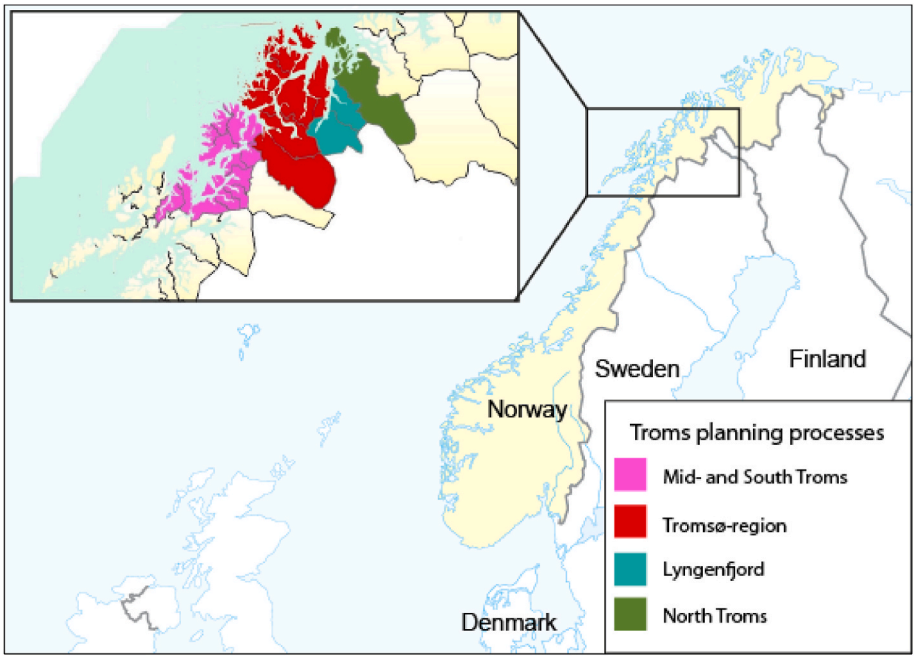

Fig. 1. Case Area. Four intermunicipal planning processes were undertaken in Troms County during the years 2013–2016. Our selected case studies, the Mid and South Troms and the Tromsø region are depicted in pink and red, respectively. Map sources: Geonorge and Nofima. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Norway.

3.1. Case 1: Mid and South Troms

The Mid and South Troms (MST) planning process consisted of 13 municipalities with a total population of around 55 000. While most municipalities had around 3000 inhabitants, two had less than 1000 and the two largest 25 000 and 11 000. The total size of the planned sea area was around 3800 km^2, of which more than 25% belonged to one municipality. At the start of the planning process, 70 000 tonnes, or around 50% of the salmon produced in the county, came from these 13 municipalities. They had 85 approved aquaculture localities, of which 61 were for salmon. Aquaculture directly employed 391 people in the core activity, and there were 490 registered fishers.

The background for the intermunicipal plan was described as the increasing use of sea space and resulting rise in conflict levels. This was not only limited to marine industries such as aquaculture and fisheries, which are both prominent in this area, but also included recreational use. The stated purpose of the plan was to provide marine industries with opportunities to increase value creation following the principle of sustainable development (Kystplan MST, 2015). Aquaculture was expected to increase, and 109 aquaculture areas were proposed as established or expanded. Of these, 101 were for salmon (41 new and 60 expansions/adjustments of existing localities), and the rest for cod (6), shellfish (1) or other species (1). The average number of aquaculture areas proposed per municipality was 8.5, ranging from 23 to 2 for individual municipalities (standard deviation 5.5).

The SEAs of individual aquaculture areas were conducted by individual planners in each municipality, based on an agreed-upon method developed during the planning process. In interviews it was told how the planners had several meetings concerning the methodology and how to apply it, to achieve high consistency in how the assessments were done across the municipalities. The SEA covered 22 different themes, organised under four main categories: nature's diversity, environment and pollution, cultural heritage, and society. For every proposed aquaculture area, the SEA assessed each of the 22 themes, estimating the associated value, the potential impact of a proposed initiative, and the overall consequence. Value, impact and consequence were assessed based on ordinal scales, ranging from 0 to 3 (i.e. "non-relevant" to "very high or high") for value and −3 to +3 ("large or very large negative" to "large or very large positive") for impact, while consequence was determined as a function of value and impact. However, as Table 1 shows, not all themes were evaluated on the same scale. The scores for each theme were set based on either subjective evaluation, e.g. potential implications for priority species such as wild salmon, or predefined criteria, e.g. the number of jobs gained/lost associated with an establishment (1–3 jobs gained equals a positive impact of 1, 3–7 jobs an impact of 2, and more than 7 an impact of 3, with the converse being the case for jobs lost).

In line with regulations, the SEA included a risk- and vulnerability analysis (RVA) for each aquaculture area, covering six topics: landslide/foundation, weather, icing, industry, traffic, and "other". The RVA was based on a risk matrix, assessing the risk as a function of probability and consequence on a scale of 2–9.

The SEA recommendation was to allow 89 of the proposed aquaculture areas and disallow 20. Subsequently, the politicians changed these by turning down 8 of the SEA recommendations, and on the other hand, allowed five of the areas that were not recommended in the SEA (Supplementary material, Tables 8 and 9).

3.2. Case 2: The Tromsø region

The Tromsø region coastal planning process was for five municipalities with a total population of around 88 000, of which 70 000 lived in Tromsø, the largest city in North-Norway. The other municipalities had between 2000 and 6500 inhabitants. The total size of the planned sea area was about 5100 km^2, of which almost half belonged to one of the municipalities. The municipalities had 22 approved aquaculture localities in 2015, all for salmon. The number of persons employed directly in the core aquaculture activity in 2014 was between 80 and 200, and the number of registered fishers where 642.

The background for this plan was also stated to be the increasing competition and conflict levels in the coastal zone, as well as the resulting need for good regulatory tools for the municipalities. The purpose was to accommodate industrial development, while taking the non-commercial interests into consideration (Kystplan T-REG 2015a). A total of 34 new or expanded aquaculture areas were proposed in this plan. Of these, 33 were for salmon (31 new and two expansion of existing locality) and one for cod. Two proposed aquaculture areas that were located very closely were treated as one case in the SEA, although there were individual decisions on them. The average number of

Table 1
Impact assessment themes for Mid and South Troms, and whether a clear rule was used for setting value and impact score.

	Main Theme	Code sub-theme	Sub-theme	Value	Impact	Clear scoring rule?[a]	
						Value	Impact
ND	Nature's diversity	ND1	Stocks of anadromous salmonid fishes	0–3	−3–0	Y	Y
		ND2	Spawning areas	0–3	−3–0	Y	Y
		ND3	Nature conservation areas	0–3	−3–0	Y	N
		ND4	Important nature types	0–3	−3–0	Y	N
		ND5	Prioritized species	0–3	−3–0	Y	N
		ND6	Other	N/A	N/A	N/A	N/A
EP	Environ-ment and pollution	EP1	Pollution - Aquatic environment	1–2	−3 - +3	Y	N
		EP2	Noise/light	0–3	−3–0	N	N
		EP3	Emissions of greenhouse gases	N/A	−3 - +3	N/A	N
CH	Cultural heritage	CH1	Sami natural and cultural foundation	0–3	−3 - +3	P	N
		CH2	Other cultural heritage and cultural environment	0–3	−3 - +3	P	N
		CH3	Landscape and aesthetics (incl. Geology)	1–3	−3 - +3	N	N
SOC	Society	SOC1	Outdoor areas and activities	0–3	−3 - +3	P	N
		SOC2	Fishing areas	0–3	−3–0	N	N
		SOC3	Aquaculture areas	0–2	−3–0	N	Y
		SOC4	Industry and employment	0–3	−3 - +3	N	Y
		SOC5	Impact on competitive conditions	0–3	−3 - +3	N	N
		SOC6	Ports, fairway	0–3	−3–0	N	N
		SOC7	Defense (military)	0–3	−3–0	N	N
		SOC8	Transport safety and needs	0–3	−3–0	N	N
		SOC9	Other citizen interests, children and youth	0–3	−3–0	N	N
		SOC10	Relationship to municipal plan/other development strategy	0–3	0–3	N	N

[a] From our assessment, see first part of the Results section. Y = Yes, P = Partly, N = No, N/A = Not applicable.

proposed aquaculture areas per municipality was 6.8, ranging from 22 to zero for individual municipalities (standard deviation 9.2).

The planning process was managed by a person from a consultancy firm, who carried out elements of the process such as the impact assessment. For each of the proposed aquaculture areas, the SEA covered 14 themes, as shown in Table 2. The first five themes (Cultural heritage; Nature's diversity; Outdoor recreation; Landscape; Fisheries) were assessed based on the methodology proposed in the Norwegian Public Roads Administration Guidelines V712 with value, impact and consequence described according to ordinal scales. The remaining nine themes were given a verbal description only. Some were explicitly said to not be very relevant for area-use at sea, but were included as they had been in the plan programme, including *Public health* and *Children and youth's formative conditions* (Kystplan T-REG 2015b; 6)

In the Tromsø region SEA and RVA, no numerical values were used for "value" and "impact". Instead, the SEA/RVA used the written designations ("small", "medium", and "large" for value, and "large negative" to "large positive" for impact). "Consequence" is described using both written designations ("very large negative" to "very large positive") and minus- or plus signs. In our analysis, these were coded as numerical values in same scale used in the Mid and South Troms SEA. Note that the Tromsø region impact assessment did not explicitly include any positive effects of aquaculture on employment, industry activity or regional income.

The risk and vulnerability analysis in the Tromsø region focused on three subjects: wind, high water, and landslides/avalanches. The vulnerability pertaining to each subject was assessed as either small-, medium-, very vulnerable, or not vulnerable.

The SEA recommendation was to allow 15 aquaculture areas and to disallow 19. Subsequently, the politicians turned down four of the SEA recommendations, and on the other hand allowed four of the areas that were not recommended.

4. Methods

As stated in the introduction, core aspects of throughput legitimacy include transparency and fairness (Franck 1995; Schmidt 2013; Schmidt and Wood 2019). In the context of impact assessments and for the purpose of this study, we regard transparency as pertaining to how clear and explicit the knowledge base and methods used to assign scores are presented, and also the clarity of the reasoning behind decisions (Soma et al., 2016). The concept of fairness here relates to the consistency of the SEA-process. Consistency can be understood both across geographies or planning processes and procedurally through planning/SEA processes. Across, it relates to how various proposed aquaculture areas are handled within one municipality, how they are handled across municipalities, and also across different coastal zone planning processes. Procedurally, it is that each step in the SEA process is consistent with what has been observed and concluded in the previous steps.

Table 2
Impact assessment themes and scoring range for Tromsø region.

	IA Theme	Value	Impact	Consequence
CH	Cultural heritage	0 .. 3	−3 .. 3	−4 .. 4
ND	Nature's diversity	0 .. 3	−3 .. 3	−4 .. 4
OR	Outdoor recreation	0 .. 3	−3 .. 3	−4 .. 4
LA	Landscape	0 .. 3	−3 .. 3	−4 .. 4
FI	Fisheries	0 .. 3	−3 .. 3	−4 .. 4
	Pollution and food security	Verbal only		
	Public health	Verbal only		
	Children and youth's formative conditions	Verbal only		
	Climate adaptation	Verbal only		
	Transport needs, energy use and -solutions	Verbal only		
	Sami natural and cultural foundation	Verbal only		
	Noise and light	Verbal only		
	Preparedness and accident risk	Verbal only		
	Settlement and leisure buildings	Verbal only		

For both, the consistency of the SEA process will relate to the knowledge base used, how the value, impact and consequence of a specific SEA theme is determined, how the administration comes to a trade-off recommendation, and finally how the politicians come to final decisions about the proposed aquaculture areas.

The document analyses of the data and methods used to assess consequences for the different SEA themes of allowing aquaculture were conducted based on the methodological descriptions of each coastal zone planning process. The data sources listed in each SEA were classified depending on type (national guidelines, national public databases, technical report or agency/expert input, public meeting or stakeholder input), whether or not the content and origin of the data was transparent, and whether it was produced independently of the coastal zone planning process or as part of it. The SEAs' methodology descriptions for setting value and impact scores were classified into whether the scores would be set from clear, objective rules (classified here as yes, no or partly), or conversely through discretionary judgements. The facilitation and actual participation in the SEA processes by different groups are also important for transparency (Ringholm et al., 2018) but was not included in this study.

To analyse how consistent the trade-offs were across proposed aquaculture areas in each coastal zone process, we tested the goodness of fit of several statistical models each representing possible decision rules for how the results of the impact assessment led to yes or no conclusions regarding the proposed aquaculture areas. A better statistical fit means that a larger proportion of the variation in the dependent variable is explained from the variation in the explanatory variables.

The probit statistical method was employed, using STATA 15 (StataCorp 2017). Probit is used for regression analyses when the dependent variable only has two possible outcomes, such as here (recommend/not recommend, approve/reject) (Maddala 1992; 327). Both the logit and probit methods are candidates for such analyses, but the difference between the results of them will be small, unless the samples are large with many observations at the tails (op cit.). Here the samples are small.

Goodness of fit for probit analyses is not measured the same way as for ordinary linear regression, which use R^2. Instead, a pseudo-R^2 value is used (McFadden 1974). Values of the pseudo-R^2 between 0.2 and 0.4 are considered indications of very good model fits, similar to 0.7–0.9 for the ordinary R^2 (Louviere et al., 2000; 55). If there is a high goodness of fit, it means that priorities/trade-offs are consistent across the proposed aquaculture areas.

The data from each coastal zone plan had to be analysed separately, as the themes were different. We were interested in what were seemingly differences in consistency between the two coastal zone planning processes, and between SEA recommendations and political decisions. For the MST data set, the following explanatory variables were tested from the consequences score for the SEA themes: total sum of consequence score, sum score per main theme, average score per main theme, sum of consequence score with absolute value ≥ 2 per main theme, consequence score with absolute value ≥ 2 per theme, score per individual theme. For the latter, in particular, the number of observations (proposed aquaculture areas) were low compared to the number of explanatory variables, but we ran the analyses, nevertheless. For the Tromsø Region data set, sum consequence score, consequence score per theme with absolute value ≥ 1.5, and score per individual theme were tested. We chose different thresholds (2 for MST and 1.5 for Tromsø Region) based on the differences in colouring scheme in the Ias, the resulting number of available observations, and results of probit regression analyses. Also, the risk and vulnerability analysis (RVA) was used as an explanatory variable in the regression analyses. The data for value, impact and consequence in the impact assessment are from the plan documents. They were punched into an Excel-file and then checked back from the data file against the data in the documents.

For procedural consistency we analysed the verbal summaries of the

SEA for each individual proposed aquaculture area and compared their content with the individual SEA theme consequences scores to identify any discrepancies and systematic bias. A discrepancy was noted when the verbal summary had not mentioned a SEA-theme that had a non-zero consequence score, or it was mentioned qualitatively wrong. For example, if the verbal summary stated that "there is no expected consequence on landscape", but the consequence score for "Landscape and aesthetics" is "-2", then the verbal summary has presented the consequences of allowing aquaculture in the area as less negative (effectively, more positive) than the conclusion from the process of setting the SEA theme score. We then searched for patterns in discrepancies, overall and related to the administrative recommendations. For Mid and South Troms the analysis was also done by municipality, but not for the Tromsø region. For the latter, all impact assessments were done by one person, and for three of the five municipalities there were respectively two, one and zero proposed aquaculture areas. The use of the information sources and the actual setting of value and impact scores also forms part of the procedural consistency, but this has not been evaluated here.

Interviews with several participants in the planning processes have been performed. These have not been used explicitly as data but form part of our contextual understanding for designing and interpreting the analyses done here, together with documents produced in the planning processes.

5. Results

5.1. The knowledge base and methods for setting value, impact and consequence scores

Both SEAs contain a table showing which data sources have been used for assessing the different themes. The tables, however, list only the name of the data source, and not exactly what data has been used. For example, the SEA lists the name of larger databases, but does not specify which dataset or datasets from said database have been used. Nor is there any explicit consideration regarding how the original data was gathered. For this, it is necessary to go back to each individual source. The same is true for public meetings and stakeholder information. The SEAs are not clear on exactly what kind of information public meetings resulted in nor how that knowledge has influenced the process.

The two SEAs list a similar overall number of data sources and a similar set of data sources, as Table 3 shows (see Table 10 in Supplementary material for details). National database is the type listed most often by both SEAs. Overall, data sources that are created outside the planning process, namely guidelines, national databases and technical reports, are listed more often than public meeting/stakeholder input. For the Mid and South Troms SEA, public meetings or stakeholder input are listed as data sources twice as many times as for the Tromsø region SEA. This type of data source is used for the same types of interests/ consequences of aquaculture in the two SEAs, namely fisheries, landscape and outdoor recreation. For Mid and South Troms, it is also specifically used for consequences on aquaculture, other industries and other citizen interests. The "Other" data source category includes sources that did not fit into the other categories or could not be classified based on the description of the source.[1]

Table 3
Number of times different types of data sources are listed in the SEA methodology descriptions.

Data source	Mid and South Troms	Tromsø region
Public guidelines and plans	4	5
National database	26	24
Other	0	7
Public meeting/Stakeholder input	10	5
Technical report or agency/expert input	6	10
Total	**46**	**51**

For the Mid and South Troms SEA, out of the 22 themes, only six had value-scores based on a clearly stated rule, and for three this was only partly so (Table 1, 2nd column from right). These were themes under *Nature's diversity* (ND1-5) and *Pollution and aquatic environment* (EP1). The scoring was based i.a. on the distance in kilometres from a potential aquaculture area to salmon-spawning rivers (ND1) and the importance of a salmon river or a type of area or resource based on national registers (local, regional or national importance) (ND1-5). For impact, only four themes are scored with a clearly stated rule (Table 1, outer right column): *Anadromous wild fish stocks* (ND1), *Spawning areas* (ND2), *Aquaculture* (SOC3) and *Industry and employment* (SOC4). The rules are based on i.a. the number of new jobs expected if aquaculture is allowed in an area (SOC4), and the distance to or percentage area overlap (ND2). Thus, for most themes discretionary judgement was used when scoring value and impact. Only two themes had clearly stated scoring rules for *both* value and impact, meaning that the consequences scores in turn were based only on clear rules and not on additional discretionary judgements.

For the Tromsø region SEA, the value and impact scores for the five themes assessed on an ordinal scale were based on the methodology proposed in the Norwegian Public Roads Administration V712 handbook. The handbook states that the assessment should base itself on national goals and guidelines, including the European Landscape Convention, the Planning and Building Act, and white papers on the governments' environmental politics. The handbook also provides criteria for assessing the value of a theme as low, medium or high, but while this provides some degree of guidance for scoring, it must still largely be based on the practitioner's own judgement. For impact scoring, the handbook provides some guiding principles for what should be considered when setting a score, but little on what constitutes a small, medium or large impact. Thus, much seems to have been left to the discretionary judgement of the consultant.

5.2. Trade-off decisions

The consistency of the decisions on whether to recommend or allow aquaculture is assessed as a goodness of fit for different models representing possible decision rules. These are shown in Table 4 for the SEA recommendations and Table 5 for the political decisions.

For Mid and South Troms (MST), we tested six different statistical models of how the scores on SEA themes could matter for the SEA recommendations and political decisions, as indicated in Tables 4 and 5. In model #1 the independent variables from the SEA were the sum of consequence scores for all themes. In model 2 the independent variables were the sum of consequence for each theme group (Nature's diversity (ND), Environment and pollution (EP), Cultural heritage and environment (CH), and Society (SOC)). In model 3 they were the average consequence score per theme group. In model 4 they were the sum of consequence scores equal to or larger than 2 and equal to or smaller than −2, for each theme group. In model 5 it was the consequence scores for individual themes that were either equal to or larger than 2, or equal to or smaller than −2. In model 6, the consequence scores for all IA themes were included. For the SEA recommendations, model 5 gave best fit, as indicated by the higher pseudo R^2 score (Table 4). Several variables (themes) were omitted from the analysis of this model by STATA, as they had no or few observations. For the political decisions, models 5 and 6 have a similar fit (same pseudo-R2 score), as Table 5 shows. Specific values for *Spawning areas for marine fish* (ND2) and *Outdoor recreation* (SOC1) predict success or failure perfectly for quite a few observations.

For the Tromsø region, only three models were investigated, as

[1] They included hiking maps, "tourist fishing", "physical activity", "universal design" and "noise".

Table 4
Goodness of fit for SEA recommendations.

#	Model	pR^2 MST	Notes MST	pR^2 Tromsø	Notes Tromsø
1	Sum Consequence + RVA	0.04		0.002	Sum consequence > −1.5 predicts data perfectly except for sum consequence = = 1.5. Sum consequence omitted. 16 observations used effectively.
2	Sum Consequence per theme group + RVA	0.10		n.a.	
3	Average Consequence per theme group + RVA	0.23		n.a.	
4	Sum of Consequence above a threshold per theme group (≥2 or ≤-2) + RVA	0.27	EP≠0 predicts success perfectly, so omitted. 109 observations used effectively.	n.a.	
5	Consequence above threshold, for each themes + RVA	0.42	Predicts success perfectly if ≠0, so omitted (# of obs dropped): ND2 (7), EP1 (1), SOC3 (3), SOC5 (1), SOC6 (4). Predicts data perfectly so omitted: SOC9>0 (4). Dropped due to collinearity: ND6, EP2, EP3, CH1, SOC8. 90 observations used effectively. 3 successes completely determined.		CH ≠0 predicts failure perfectly, so omitted, with 7 observations. 27 observations used effectively. Convergence not achieved. 8 failures and 13 successes completely determined.
6	Consequence for each theme + RVA		Predicts success perfectly if ≠0, so omitted (# of obs dropped): ND6 (1), CH1 (1) EP3 omitted due to collinearity. 108 observations used effectively. No solution. 17 failures and 91 successes completely determined.	0.77	

pR^2 = pseudo R^2. N.a. = not applicable.

Table 5
Goodness of fit for political decisions.

#	Model	pR^2 MST	Note MST	pR^2 Tromsø	Note Tromsø
1	Sum Consequence + RVA			0.12	
2	Sum Consequence per theme group + RVA	0.23		n.a.	
3	Average Consequence per theme group + RVA	0.23		n.a.	
4	Sum of Consequence above a threshold per theme group + RVA	0.29	EP ≠0 predicts success perfectly, so omitted, with 1 observation. 109 observations used effectively.	n.a.	
5	Consequence above threshold, for each theme + RVA	0.52	Predicts success or failure perfectly if ≠0, so omitted (# of obs dropped): ND2 (7), EP1 (1), SOC1 (8), SOC5 (1), SOC9 (1). Dropped due to collinearity: ND6, EP2, EP3, CH1, SOC8. 92 observations used effectively.	0.71	7 successes completely determined
6	Consequence for each theme + RVA	0.52	Predicts success or failure perfectly if≠0, so omitted (# of obs dropped): ND2 (7), EP1 (1), SOC1 (8), SOC5 (1), SOC9 (1). Variables omitted due to collinearity: ND6, EP2, EP3, CH1, SOC8. 92 observations used effectively.	0.30	

indicated in Tables 4 and 5. This was since the SEA for Tromsø only had 5 individual themes with quantitative/ordinal data and no theme groups. Model 1 is similar for Mid and South Troms, model 5 uses the themes with score ≤ −1.5 or ≥1.5, and model 6 included the score of each of the five themes with numerical (ordinal) scores, including Nature's Diversity (ND). For the SEA recommendations, model 6 has seemingly a better goodness of fit than model 1, as the pseudo R2 value is much higher. However, for model 1 the Total consequence variable was omitted from the analysis by STATA, as a value below minus 1.5 almost perfectly predicted the SEA recommendation. This means the correlation with the SEA recommendation was almost perfect. However, the pseudo R2 value for model 6 also signifies a very high degree of correlation. Model 5 did not converge to a solution but had many completely determined outcomes. For the political decisions, model 5 with consequence scores above the threshold for each theme best explains the data, with a very high goodness of fit.

The statistical analyses to investigate how consistently actual trade-off decisions have been based on the consequence scores of the SEAs for the proposed aquaculture areas does not give absolutely clear answers but require interpretation. For several of the probit analyses some SEA themes were omitted as explanatory variables by the software, as particular values for them perfectly predicted the administration's or politicians' yes or no to the proposed aquaculture areas. When this concerned only one, two or three decisions on proposed aquaculture areas, it could well be random, but when it holds for many areas it becomes more likely that it signifies a decision rule – but only if what it predicts is reasonable for that theme. Our most important indicator for a decision rule was, however, that the statistical analysis of it gave a high pseudo R^2 (pR^2) value. For some of the models the probit analysis did not converge/gave no solution, which could be expected as the ratios of explanatory variables to observations were low there.

The decision-making rule that best explains the conclusions on the proposed aquaculture areas differs between the two SEAs. For the SEA

recommendations for the Mid and South Troms region and the political decisions in both SEAs, it seems to have been based on consequence scores above a threshold for all themes. For the SEA recommendation concerning the Tromsø region SEA, it seems clear that the external consultant based the decisions on the sum of consequence scores.

5.3. Verbal summaries

For Mid and South Troms, 108 of the 110 verbal summaries for the proposed aquaculture areas had discrepancies with the SEA theme scores (Supplemental Material Fig. 4). The average number of discrepancies per proposed aquaculture area was 4.3, while the highest was 13. Ninety percent of the discrepancies in the verbal summaries made the consequences seem less negative/more positive than the theme scores indicated, and conversely, ten percent of the discrepancies made the consequences seem more negative/less positive. The themes for which the scores most often were misrepresented in the verbal summaries were NM1 Stocks of anadromous salmonid fishes (65% of the verbal summaries had discrepancies), NM2 Spawning areas (38%), and KM3 Landscape and aesthetics (35%). All themes except one were summarised wrongly once or more.

Looking at the pattern of discrepancies for each municipality in Mid and South Troms, all municipalities have one or several themes for which the majority of the verbal summaries have discrepancies (Supplemental Material Fig. 4). For example, municipality 1903 have discrepancies for 78% (= 18 out of 23 proposed aquaculture areas) for the first theme NM1 (Stocks of anadromous salmonid fishes), 78% for theme KM3 (Landscape and aesthetics), 100% for theme SF8 (Transport and safety), and so on (Supplemental Material Table 11). While almost all municipalities have more than 49% discrepancies for the NM1-theme, for the other themes it is only a minority or a few municipalities that have that large proportion of discrepancies. All municipalities have however at least one theme where there is discrepancy between the verbal summaries and the SEA theme scores for 50% or more of the proposed aquaculture areas.

There does not seem to be an obvious pattern across the municipalities in Mid and South Troms in how the discrepancies in verbal summaries vary with the administrative recommendations ("no", "yes" or "yes, if.."). This goes both for the count of discrepancies per aquaculture area and if the bias in the discrepancies is more positive or negative between the aquaculture areas that have different administrative recommendations (Supplementary material Tables 12 and 13).

For the **Tromsø region**, 19 of the 34 verbal summaries had discrepancies (Supplementary Material Fig. 5). The average number of discrepancies per proposed aquaculture area was 0.8, while the highest was two (Remember that while Mid and South Troms had 22 SEA themes, the Tromsø region only had five themes with scores). All the discrepancies made the consequences for the proposed aquaculture areas look less negative than the SEA theme consequence scores indicated. The themes for which the scores most often were misrepresented in the verbal summaries were Landscape (24% of the verbal summaries) had discrepancies), and Nature's diversity and Cultural heritage (both 21%). All themes were summarised wrongly two times or more. The analysis for the Tromsø region was not split up between municipalities, as explained in the Methods chapter. There is no obvious pattern in the discrepancies between the aquaculture areas that were administratively recommended and those that were not (Supplementary Material Fig. 5).

The verbal summaries did not concentrate on the SEA themes with extreme scores, not for the two SEA processes taken as a whole, and not for individual municipalities in Mid and South Troms (Supplementary material Tables 14 and 15).

6. Discussion

What do the results reveal about transparency and consistency in the coastal zone planning and SEA processes we have studied? How does choices and practices for the SEA processes seem to affect the transparency and consistency? Could transparency and consistency in the SEAs be improved, and if so, what are the trade-offs involved?

6.1. Transparency

As earlier stated, we conceptualize transparency as pertaining to how clear and explicit the knowledge base and methods used to assign value and impact scores are formulated, as well as the clarity of the reasoning behind trade-off decisions.

The two SEAs utilise similar sets of knowledge sources, based on the lists that each SEA has for this. The transparency on this is still limited, as the sources are big databases or reports, and it is not specified in detail which data from them that is used. The lists are dominated by data sources prepared by experts and sector authorities outside of the SEA processes. For this kind of data, it should normally be easy to verify their origin and the methods used to produce them. As such, extensive use of "external data" should support the transparency of the SEA processes. However, there can be transparency issues also with the use of external data. Verifying the origin of the data and the methods used to collect and synthesise them requires going back to the original source as this is not clearly stated in the SEAs. Data sources such as national databases or expert reports can also themselves become "black boxes", where the inner workings of how the data has been produced and interpreted might be hidden (Latour 1987).

As many municipalities lacks capacity for planning (NIVI Analyse 2014) and since there are limited opportunities for generating data within a planning process, readily available data in public, national databases, can be useful (Kvalvik et al., 2020). Getting more information will give decision-makers a broader knowledge base to form their decisions and can plug identified knowledge gaps. Some themes do however depend on local perceptions more than others, like the local importance of a recreational area and how an aquaculture establishment can impact local businesses and industries. The local significance of an area can of course be mapped with standardised methods and made available in national databases, like it has been done for e.g. areas used for outdoor recreation (Norwegian Environmental Agency 2014). Some national databases also contain a mix of both stakeholder input as well as technical surveys conducted by agencies or experts, such as the Directorate of Fisheries' data on the use- and importance of fishing areas.

Due to limited resources and time constraints on the planning and SEA process it might not be possible to collect new local data if the available data is insufficient. Public hearings or meetings might then be the best alternative for gathering such information. However, as with external data, the issue of black boxes pertains to data gathered locally as well. It may not be clear how information from public meetings have been used in a SEA, nor how data was produced in public meetings or stakeholder consultations despite there being minutes and reports from those meetings. This points towards a paradox, where the transparency of the process can actually be reduced by presenting more information and more knowledge sources, even if the presentation itself is clear and explicit. That is, if the extra information and knowledge sources are in effect black boxes, and also if it becomes difficult to "navigate the mountains of data available" (Héritier, 2003 in Schmidt and Wood 2019).

The choice of number of SEA themes can also affect transparency. The knowledge sources are in both our cases presented linked to individual SEA themes. With many themes, the description of related knowledge sources and data will tend to be more detailed and specific than when there are few SEA themes. This in itself increases transparency, but the increased complexity with many themes and details on knowledge sources may also here be hard to penetrate for some, thus reducing transparency. Comprehensiveness and complexity often go hand in hand, and with potentially opposite effects on transparency. The effects on *experienced* transparency will also differ between individuals

or groups. Differences in resources and ability to comprehend information affects the transparency of the process for some, and also the power dynamics between authorities, companies and civil society (Soma et al., 2016).

The transparency on how value, impact and consequence scores are set in the two SEAs differ. Both rely on discretionary judgements to a large degree, but the Mid and South Troms SEA document has more explicitly stated rules for this than the Tromsø region SEA. We learned from interviews that the group involved with the Mid and South Troms process spent much time and effort to ensure consistent score-setting across the municipalities. With 13 different planners performing the SEA this was considered necessary. Making standardised explicit scoring rules was one way to try to achieve this, and it had transparency as a biproduct. For the Tromsø region, it was only referred to a national SEA manual for the scoring. With only one person doing the SEA for all the proposed aquaculture areas there, it should not be necessary to present the scoring method in the SEA document to achieve consistency, but by not including a detailed description of the scoring method the Tromsø region SEA becomes less transparent than the other SEA process.

None of the SEA documents present any description of criteria for recommending or not recommending a proposed aquaculture area. This is seemingly totally up to the discretion of the persons doing the SEA. A lack of clearly explained methods in the SEA document for setting scores and widespread use of discretionary judgement without specification of why or how this has been done, make the decision-making little transparent. Whether more detailed and explicit descriptions of scoring and decision-making add "weight" to administrative recommendations is an interesting question.

6.2. Consistency

Consistency in this study relates to how consistent decision rules have been applied across different aquaculture localities and municipalities, and how consistently steps in the SEA process have followed from previous steps. Consistency here is connected strongly to fairness, in the sense that for processes to appear legitimate, rules and regulations should apply equally to all (Franck 1995; Schmidt and Wood 2019). In the context of SEAs, "consistency is critical to ensuring the quality of SEA decisions" (Noble 2004) and a lack of consistency can potentially "disturb the credibility of the technical exercise and hinder the overall understanding of SEA by the stakeholders" (Fidélis et al., 2016). The results indicate the difficulty associated with achieving consistency in a process sat at the nexus of science and policy (Gao et al., 2013) and where practitioners and politicians must balance both national and local concerns.

The statistical analyses of how consistently the administrative recommendations for proposed aquaculture areas were based on the consequence scores of the SEA themes, indicate that the recommendations for the Tromsø region were clearly more consistent than those for Mid and South Troms. It may not be surprising that trade-offs done by 13 different people, as for Mid and South Troms, are less consistent than the ones done by a single person. When the final coastal zone plans were decided by the municipal councils some of the administrative recommendations were however overturned. For the Tromsø region, the political decisions went against 24% of the recommendations, and for Mid and South Troms 12%. The more consistent SEA recommendations for the Tromsø region were thus changed twice as often as the less consistent SEA recommendations of Mid and South Troms.

This begs the question of whether the municipal planners of Mid and South Troms adjusted their trade-off decisions to counter shortcomings in the relatively stringent assessment system to make their recommendations better reflect local conditions? The 13 planners presumably knew their municipalities and local conditions better than the consultant knew local conditions in the Tromsø region. Their proximity to the context could have given them the knowledge and confidence to adjust trade-offs accordingly.

This points to a similar paradox as for transparency. Measures to increase one type or aspect of consistency may reduce another. While standardized rules for setting values, impacts and consequences can provide consistent results across municipalities and processes, they may fail to adequately reflect the local context. If local considerations are not valued or traded off in accordance with local perceptions due to too stringent methods, this might reduce the legitimacy of the decisions made, regardless of the degree of consistency it provides across municipalities.

That practitioners use their experience and knowledge of and proximity to the context when taking decisions regarding both methods and assessments should be expected following the idea that planning cannot be fully rational and value-free (Zhang et al., 2018). It has even been argued that undermined discretion can counteract the interests of the public (ibid). In this view, the practitioner not only has the possibility, but also the responsibility to use their judgement in the "interest of the public". This, however, raises the central question of what the norms and values the judgements are grounded in.

Clear and explicitly stated decision-rules enhance transparency and facilitates consistency across geographies and SEA processes but can hinder decisions in being consistent with local contexts. Clear decision-rules may also be difficult to design if there are many themes, as it becomes more difficult to determine how consequences for many different themes should be weighed against each other. On the other hand, with few, and then necessarily broader SEA themes, it will be more difficult to assess information, values and impacts for each theme. More must be left to the discretion of the persons doing the SEA, and this aspect will be less transparent than with many themes.

In interviews it was said that there was proximity between local politicians and municipal planners responsible for the SEAs. Can local politicians have influenced the planners' recommendations? Whether this has contributed to the lower consistency observed for Mid and South Troms compared to for the Tromsø region is not possible to conclude from our data. That different types of proximity can facilitate both benevolent discretion and potentially distort what is meant to be professional advice also makes the interaction between transparency and consistency in SEA processes evident. Our statistical analyses indicate that also the political decisions for the Tromsø region were more consistent than the political decisions for Mid and South Troms. The municipal councils have however not necessarily made all decisions on proposed aquaculture areas of their own will. Different state authorities made formal objections to the draft plans, and these must be resolved before the plan can be valid. If negotiations between the municipality and the authority behind the objection does not resolve it, the ministry in charge of planning will decide.

When we have tried to assess the consistency of the trade-offs made in the two SEAs, we have not distinguished between national and regional interests on the one hand, and "pure" local or municipal interests on the other. It could be that the administrative recommendations for Mid and South Troms appear less consistent because local interests are considered differently in the different municipalities. Local valuation of purely local interests can, and often will, differ between municipalities. National/regional interests, however, should arguably each be traded off consistently with other national/regional interests across municipalities for efficient resource use. There is, of course, also the possibility that municipal planners have emphasised national and regional interests differently in their trade-offs. To increase consistency in the trade-offs of national and regional interests, one solution might be to call for authorities other than the municipalities to oversee the trade-offs. This is to some extent what different state authorities did through their formal objections to the draft plans. However, the municipal self-rule has been strengthened in Norway recently (Hersoug et al., 2021), through changes to the Norwegian Constitution from 2016 (§49), to the Municipalities' Act from 2020, and through government instructions to state sector authorities. Hence, it is unlikely that the municipalities' power in coastal zone planning will be reduced any time soon in

Norway.

Our analyses also indicated which decision-making rules that most likely were followed when administrative recommendations were made. For the Tromsø region it seemed quite clearly based on the sum of consequences scores, and for Mid and South Troms the statistical analyses indicated that it was based on themes with high consequences scores (in absolute value). There can be challenges with both of the decision-making rules mentioned above. The most fundamental concern relates however to both decision-making rules, and is whether the scores for the different themes actually are comparable (Strand 2014). If e.g. a "+2" consequence score for one theme is something very different from a "+2" consequences score for another theme, neither aggregation or comparison of them make much sense. We have not seen this point being problematised in the two SEA processes we have studied.

If only large consequences determine trade-off decisions, there is a risk of significant aggregate consequences across many areas being ignored for themes with relatively small consequences at each aquaculture area. On the other hand, basing the decision on the sum consequence score ask the question of whether the SEA scoring methodology can sufficiently consider individual themes of very large importance, which should trump practically all other interests. When the possible range for scoring is limited, as it was here, even if such a theme receives a maximum score (positive or negative) the conclusion based on sum consequence scores could go the other way. In practice, this may not be a problem, as there are other mechanisms for assessing consequences, such as sector authorities' possibility for making formal objections related to their specific areas of concern, be it e.g. nature conservation, fisheries or cultural heritage. Still, if different coastal zone planning processes and their associated SEAs use different decision-making rules, this could in itself be a source of inconsistency for the trade-offs made between different municipalities and planning processes.

We cannot know from our analyses if the decision rule indicated from the statistical analyses were used consciously in Mid and South Troms. We have not interviewed the planners about this. On the other hand, it is not always that people are aware of what kind of rules are behind their decision-making, and unconscious biases are common (Kahnemann 2011). Statistical analyses can potentially reveal such unconscious processes. The content of the verbal summaries for the SEAs for each proposed aquaculture area for Mid and South Troms could perhaps indicate what the planners focused on when making their trade-off decisions. If so, our analysis of the summaries does not support the findings from the statistical analyses about the decision-making rule. The verbal summaries did not stick to referring the extreme consequence scores. But the planners could still have based their trade-offs on the extreme scores.

The analysis of the summaries did however show that their content was biased compared to the SEA themes' consequence scores. The biases varied a lot between municipalities. Especially striking was how some municipalities misrepresented the consequence scores for one or more SEA themes for very many of the proposed aquaculture areas. There was thus poor procedural consistency between the SEA themes' consequence scores and many of the verbal summaries. There were also some such inconsistencies in the verbal summaries from the Tromsø region SEA, but a lot less than for Mid and South Troms. One possible source for this difference may have been the difference in number of SEA themes with value, impact and consequence scoring. For the Tromsø region it was five, and for Mid and South Troms it was twenty-two. While it should be easier to consistently deal with SEA themes that are narrow and more precise, which is more likely if there are many themes, it is clearly much easier to summarise scores from five themes than for twenty-two. In parallel to what we saw above about having many information sources and data sets to relate to, having many SEA themes can also make it difficult to keep track of everything. We argued above that comprehensiveness and complexity may go hand in hand and work in opposite directions for transparency, and it seems the same may be the case for consistency.

The pattern of discrepancies across municipalities in Mid and South Troms strongly indicate that the persons behind the verbal summaries have their own specific biases or unconscious "blind spots". It was interesting to observe that the SEA theme that most often had discrepancies in the verbal summaries was about the consequences on wild salmon stocks. This has probably been the most prominent issue for the consequences of Norwegian salmon farming the latter years, both in media (Olsen and Osmundsen 2017) and for public management (NFD 2015). Maybe there can be a tendency for consequences that are very obvious and pervasive to fall out of focus. Similarly, the Tromsø region SEA did not even include jobs or income as an explicit SEA theme. It must however have been implicitly included in the trade-off decisions, or else there would be no reason to allow aquaculture as all the SEA themes only included negative consequences. While we don't know from our analyses if the shortcomings in the verbal summaries or SEA themes have affected the trade-off decisions, it seems clear that measures should be taken to quality-assure against such blind spots in the presentation. Even if the shortcomings have not affected the administrative recommendations, they may have affected the political decisions based on the SEA presentations, and also the public's impression of the SEAs and thus the legitimacy of the recommendations and final decisions.

This paper has considered the impact assessment and trade-off of various impacts of aquaculture in Norwegian coastal zone planning. While the actual impacts and details of the impact assessment process are specific to aquaculture and governance in this Norwegian context, the points made in the paper are applicable to a broader set of contexts where impact assessments and trade-offs are to be performed. Some of the points are relevant for practically any process where decisions are to be facilitated and made on an assessment of a complex set of impacts.

7. Conclusion

The study has shown and discussed how different choices regarding the elements that make up a SEA can affect transparency and consistency. Transparency and consistency are important for the SEAs *throughput legitimacy*. Transparency is key as it involves making the "processes and procedures occurring within the 'black box' of multi-level governance" (Schmidt and Wood 2019) more visible. Consistency is important as it is key for *fairness* - that rules apply equally and appropriately to all (Franck 1995; Schmidt and Wood 2019). This is relevant *across* geographies and administrative processes and also *through* the SEA processes, where steps in the processes should follow logically and clearly from previous steps.

More comprehensive set-ups and descriptions will generally improve transparency as it makes it easier to have precise descriptions, but the added complexity that this brings also increases the risk for information overload for some groups. This may impact groups' power and influence in the processes, and thus justice and legitimacy. Future research should investigate how different groups experience and perceive this to help balance between these two effects. It should also be analysed how it vary with different SEA themes. We expect that there will be a lot of variation between different cultural and socio-political settings.

More comprehensive SEA set-ups, that are presented clearly and detailed, also facilitates consistency across geographies and SEA processes, as does the use of data from national databases, expert reports and similar that are collected independently of the planning process, as well as standardized methods for assigning value and impact scores. However, if the SEA documents simply refer to much information and methods described elsewhere, and especially if these are grounded in a certain degree of "scientific rigor", this can reduce transparency as they may in effect appear as black boxes for most stakeholders.

None of the SEA processes studied here had general descriptions of how trade-off decisions were made, except to state that it was based on the assessed consequences and the risk and vulnerability analyses. Thus, it seemed to be totally up to the discretion of the planners, and the trade-off decisions were little transparent, although some individual decisions were explained by referring to consequence scores for individual

themes. The analyses of the administrative recommendations in the two SEAs indicate that they generally were based on different logics: One based on the sum of consequence scores for all themes for each proposed aquaculture area, and the other on the themes with extreme consequence scores. Both have their limitations, as discussed above.

Being more explicit in the SEA process on how trade-off decisions should be made would improve transparency and could improve consistency both across individual cases within the SEA and wider across geography and different SEA processes. But there are limitations to how rigid this should be. Much room for practitioner discretion can be a barrier to the transparency of the process, but also an avenue for innovative solutions to problems (Zhang et al., 2018). Not all themes can be easily valued through standardised rules, local conditions may vary too much for standardized methods to capture that variation in a good way, and relevant data may be limited (Mikkelsen et al., 2020).

Recognizing that SEAs are not just a rational and technical tool but also a value-based and social process (Gao et al., 2013), discretion and local adaptations should not be curtailed through exaggerated stringent standardised methods. Such discretion can make the planning process and trade-off decisions more in consistence with local conditions. Where discretion and local adaptation is used, transparency should be improved by clearly explaining why special kinds of assessments are needed, as possible describing the assessments as explicitly as possible. This comes in addition to having public hearings for SEAs and planning.

Verbal summaries of the SEAs for each proposed aquaculture area may be especially important for the politicians' decisions and for the public's understanding of the cases, since they generally will know the individual SEAs less well than the bureaucrats that have made them. The patterns of bias found in the cases here underscore that measures should be taken to quality-assure verbal summaries and avoid that individuals' blind spots lead to such biases in SEA processes.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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