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Summary

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The growth of seal and cormorant populations has challenged the viability of coastal fisheries in the Baltic Sea. In 2017 widely spread frustration among local and regional fishery stakeholders generated a transnational cooperation project operated by the Fisheries Local Action Groups. The Baltic Sea Seal and Cormorant project aimed at producing new knowledge of the seal and cormorant induced problems, and at raising public awareness about the troubled situation in the Baltic Sea area. In co-operation with the Natural Resources Institute Finland the project launched a survey in 2018 to investigate the impacts of seal and cormorant populations on small-scale fishing livelihoods along the Baltic Sea coast. This report presents the main results based on 219 interviews conducted in 6 countries.

The general picture of the Baltic Sea coastal fishers – the informants - shows a rather aging population of professionals with a long experience within their occupation. A common tendency is also the exercise of pluriactivity amongst the fishers, as fishing is usually not the only income source. The effects of seals and cormorants would often necessitate changes in fishing strategies and making investments, but the possibility for fishers to find new paths has become narrowed. In this situation engaging and attracting younger persons to become commercial fishers is challenging.

The findings confirm that the impacts of seals and cormorants are often serious obstacles for continuation of the fishing livelihood. According to the fishers the seals hamper coastal fishing livelihood more often than the cormorant, but regional differences exist. Moreover, the results show the multiplicity of impacts, and the related complexities and uncertainties. According to fishers, seals typically cause direct effects such as reduction of catch, and damages in gear and on the fish. On the other hand, the cormorant was considered to cause more often indirect impact, such as changes in fish stocks and fish behavior. It is important to consider this multiplicity of impacts in discussions about the national and international seal and cormorant policies, as well as in research, planning and decision making. Steps forward necessitate wide collaboration across sectors both regionally and internationally. Mitigation of the seal and cormorant induced problems should be designed together with fishers and other stakeholder groups.

Keywords: Small-scale fisheries, seal, cormorant, Baltic Sea, human-animal conflict, local development, Fisheries Local Action Group

Yhteenveto

Hylje- ja merimetsopopulaatioiden kasvu on muodostanut haasteen Itämeren rannikkokalastuksen elinvoimaisuudelle. Kalatalouden paikallisten ja alueellisten toimijoiden jaettu kokemus ja turhautuminen kehitykseen johti vuonna 2017 kalatalouden toimintaryhmien toteuttaman monikansallisen yhteistyöhankkeen käynnistämiseen. Itämeren hylje- ja merimetsohankkeen tavoitteiksi asetettiin uuden tiedon tuottaminen hylkeiden ja merimetsojen aiheuttamista ongelmista sekä aiheesta tiedottaminen Itämeren alueella. Vuonna 2018 hanke käynnisti yhteistyössä Luonnonvarakeskuksen kanssa haastattelututkimuksen, jonka tavoitteena oli tarkastella hylkeiden ja merimetsojen vaikutuksia Itämeren rannikon pienimuotoiselle kalastuselinkeinolle. Tässä raportissa esitellään keskeisiä tuloksia, jotka perustuvat kuudessa Itämeren maassa kerättyyn 219 kalastajahaastattelun aineistoon.

Itämeren rannikon kalastajien – informanttien – yleiskuva kertoo ikääntyvästä ryhmästä ammattilaisia, joilla on pitkä kokemus alalta. Kalastajat ovat pääosin monitoimisia: kalastus ei yleensä ole ainoa tulonlähde. Hylkeiden ja merimetsojen vaikutukset aiheuttaisivat usein tarvetta muuttaa kalastusstrategioita ja tehdä investointeja, mutta tällaisia mahdollisuuksia ei monellakaan ole. Tässä tilanteessa nuorten kalastajien houkutteleminen elinkeinon pariin on haasteellista.

Tuloksista käy ilmi, että hylkeet ja merimetsot aiheuttavat usein vakavia ongelmia kalastuselinkeinon jatkuvuudelle Kalastajien mukaan hylkeet haittaavat rannikkokalastusta yleensä enemmän kuin merimetsot, joskin tilanne vaihtelee alueellisesti. Tulokset kertovat myös vaikutusten monimuotoisuudesta sekä niiden monimutkaisuuksista ja epävarmuuksista. Hylkeet aiheuttavat kalastajien mukaan useammin suoria vaikutuksia kuten kalansaaliiden vähentämistä sekä pyydysten ja kalojen vaurioittamista. Sen sijaan merimetso aiheuttaa useammin epäsuoria vaikutuksia, kuten kalakantojen ja kalojen käyttäytymisen muutoksia. Vaikutusten moninaisuus on tärkeää ottaa huomioon kansallisessa ja kansainvälisestä hylje- ja merimetsopolitiikasta, tutkimuksessa, suunnittelussa ja päätöksenteossa. Tarvitaan laaja-alaista sektorirajat ylittävää alueellista ja kansainvälistä yhteistyötä kestävien ratkaisujen toteuttamiseksi. Hylkeiden ja merimetsojen aiheuttamien ongelmien lieventämiskeinoja tulee suunnitella yhdessä kalastajien ja muiden sidosryhmien kanssa.

Asiasanat: Pienimuotoinen rannikkokalastus, hylje, merimetso, Itämeri, eläinkonflikti, paikallinen kehittäminen, kalatalousryhmä

Contents

1. Background

During the last 20-30 years, the effects of the rapidly growing seal and cormorant populations have become major problems for the viability of small-scale fishing livelihood in many coastal regions of the Baltic Sea. Similar trends of animal-related conflicts have been noted also in other parts of Europe and beyond. According to Rauschmayer et al. (2008), the intensity of wildlife-related conflicts in the European fisheries is linked to the extent of wildlife damage and to the emphasis nature conservationists put on the protection of these species. The seal and cormorant induced losses are claimed to endanger the existence of small-scale fishing livelihood. Resting on a wide interview survey, this report compares the effects of the seals and cormorants on fishing livelihood experienced by 219 coastal fishers in six countries around the Baltic Sea.

Concrete consequences of the seals and cormorants on the coastal fishing livelihood have been rarely studied in the Baltic Sea countries – especially estimating the economic impacts is considered difficult (Sjögren 2018). In Finland, for example, coastal fishers valued their cormorant induced losses in 2009, on average, as €3,800, which was clearly less than those of the seal, €11,500 (Salmi et al. 2010). Reported in the interviews, only part of the fishers could make an estimation of the losses. Presently the seal and cormorant induced damages are claimed to cause the greatest threat for the sustainable future of the livelihood in Finland (Setälä et al. 2018) and along many other parts of the Baltic Sea coast (Baltic Sea Seal and Cormorant TNC Project 2019). However, the opinion is still divided both over the seriousness of the effects on fisheries and about how best to resolve the situation. The same international agreements and governance structures are often applied in the Baltic Sea countries, but the severity of seal and cormorant induced losses, general circumstances and conflict mitigation policies vary both nationwide and regionally. This increases complexities and uncertainties. Governance tools applied for conflict mitigation include technologies for harassment and fishing gear development, hunting and culling, economic compensations and institutional arrangements (Salmi 2009).

As a consequence of growing animal populations, consequent damages and wide frustration among local and regional fishery stakeholders along the Baltic Sea coast, a transnational cooperation (TNC) project for addressing the conflict was initiated in 2017. For this purpose the initiators used a community-led local development tool (CLLD) under the European Maritime and Fisheries Fund (EMFF), operated by the Fisheries Local Action Groups (FLAGs). The project aimed at producing new knowledge about the extent of the seal and cormorant induced problems, and at raising public awareness about the troubled situation in the Baltic Sea area. The TNC project has also summarized research reports and communicated a common view of the Baltic Sea FLAGs to decision makers at the local, regional, national and European level. This way the project has struggled to find ways to achieve balanced management of the seal and cormorant populations in order to minimize the negative effects for coastal fishery. The TNC project has established a platform for Baltic Sea FLAGs to meet and exchange experiences, knowledge and good practice.

When evaluating the needs to establish the TNC project, it was noticed that the earlier research on the impact of seals and cormorants to fishery has often focused on singular impacts such as predation and damages in caught fish. There was shortage of broader systematic evaluation of how the seal and cormorant affected workload, operational costs and livelihood as a whole. It was noticed that some of the impact types were not properly reflected. The essential aim was to conduct an extensive evaluation of impacts on fisheries livelihood using a uniform research method in the Region of Baltic Sea. It was considered essential to conduct a survey of this scale directly to the Baltic small-scale fishers and study their experiences and estimates on the scale of the damages but also to ask their views on possible measures to mitigate the seal and cormorant induced damages.

This report is a result of collaboration between the TNC project and Natural Resources Institute Finland (Luke). Luke has provided the project with expertise in social scientific fisheries research when planning the questionnaire and, after collecting the material, in analysis and reporting of the results. Luke's contribution is part of the program 'Partnership between research and fishers', funded by the European Maritime and Fisheries Fund. This 'basic report' collects the survey's primary observations that indicate the impacts of the seals and cormorants, the state of the Baltic Sea small-scale fisheries and fishers' views about the best ways to manage the conflicts. The collected wide material opens opportunities also for future case-specific analyses, follow-ups and scientific articles about consequences of the human-animal conflict mitigation policies. This is the case especially regarding the qualitative material written in response to open ended questions.

2. Material and methods

In March 2018 the Baltic Sea Seal and Cormorant TNC project, in cooperation with the Natural Resources Institute Finland (Luke), launched a survey to investigate the impacts of seal and cormorant populations on livelihoods of coastal small-scale fisheries in the Baltic Sea. This report presents the main results of the material that was collected in 6 countries, through structured interviews. The questionnaire that contained 19 questions was translated into English (Appendix 1), Finnish, Swedish and German. The first part of the 15 page long questionnaire included personal and professional information. The second part focused on estimations of seal or cormorant induced effects on the livelihood and fishing practices, and changes in catches. The third part of the questionnaire focused on estimations on economic losses, factors affecting the amount of fishers and fish landings, the impact of seal and cormorant populations on commercially important fish species and measures to mitigate the seal and cormorant induced problems. In addition to the structured questions, the questionnaire form included 16 open comment fields. Thus quantitative and qualitative material was collected with the interviews side by side.

There were originally 14 local groups participating in the project: seven groups from Sweden, five from Finland, one from Estonia and one group from Germany. The aim was to interview 280 professional coastal small-scale fishers, 20 from each local group, amounting to 140 Swedish fishers, 100 from Finland, 20 from Estonia and 20 fishers from Germany. Each group formed an individual study area. In addition, other countries in the Baltic Sea Region were given the option to participate. A group from Eastern Denmark and a group from Poland, the Utska region, joined the study, forming a total of 16 regional study areas in six countries (Appendix 2).

The collection of research material in the study areas was coordinated by the project group of the Baltic Sea Seal and Cormorant TNC project, its project leader and research coordinator. All groups nominated an impartial person to conduct the interviews in their area. Seventeen interviewers, nine female and eight male, conducted the data collection between April and December 2018. Before the data collection process was launched all groups were informed about the purpose of the research, the methodology, research questions, ethical basis of the interviewer's task, the consent form (Appendix 3) and the schedule. In this international multi-interviewer and multi-language survey, where the interviewers were typically not professionals in conducting research, training and coordination was particularly important for securing the reliability of the results.

To guarantee comparability between the study areas the interviewers were invited to join one of three Skype briefings organized by the TNC project group between April and June 2018. In order to secure the informants' confidence and reliability of the collected material, interviews were to be conducted face-to-face. In Sweden three interviews were conducted by phone for practical reasons. In six cases in Germany and Poland the informants delivered some of the answers or supplement information to the interviewer afterwards to complete their answers. In two of these cases the fishers asked their company`s representative to deliver the missing information to the interviewer, as the fishers did not hold the information at the interview situation.

The informants were selected from the group of professional small-scale coastal fishers. The definitions of entrepreneurs belonging to this group, however, varies between countries, e.g. according to national standards based on legislation, working time, fishing boat sizes and fishing methods. Each local FLAG or Leader group provided their interviewer with a list of professional fishers (here after called the informants) of the study area. From the list, the interviewer randomly selected 20 informants from their study area and contacted them directly by phone or via e-mail to arrange appointments. If the selected informant refused to participate or did not answer, the interviewer randomly selected another. In one study area the list was divided to smaller subsets to ensure the geographical

representativeness of the selection. In another area the interviewer used the snowball sampling method because of the difficulty to reach qualified informants.

The location for the interview was decided by the informant. All informants were provided with the consent form to be signed before the interview. They were given relevant information about the research, such as handling of information and dissemination of results. The interviewers logged the interview by filling the informant's answers in a Microsoft Word questionnaire form or by using a pen and a printed questionnaire form. The different recording methods were needed because of varying interview locations and circumstances. After the meetings the interviewers transferred the data into a Microsoft Excel online form or into a separate Excel file. These were, together with the consent forms and filled-in paper forms, emailed to the research coordinator. The Polish group delivered interviews as separated forms to the research coordinator who then filled the data into the Excel file. The filled-in papers and consent forms are stored by the ESKO Flag in Hamina, Finland, for two years after the time of the interviews. The coordinator proofread, translated and coded the answers in Excel. The information in the comment fields was used to detail the answers, when applicable. In case the informants had given a range instead of a single number, an average was calculated and filled in the question field. Different currencies were transformed to euros based on the average rate of the year in question.

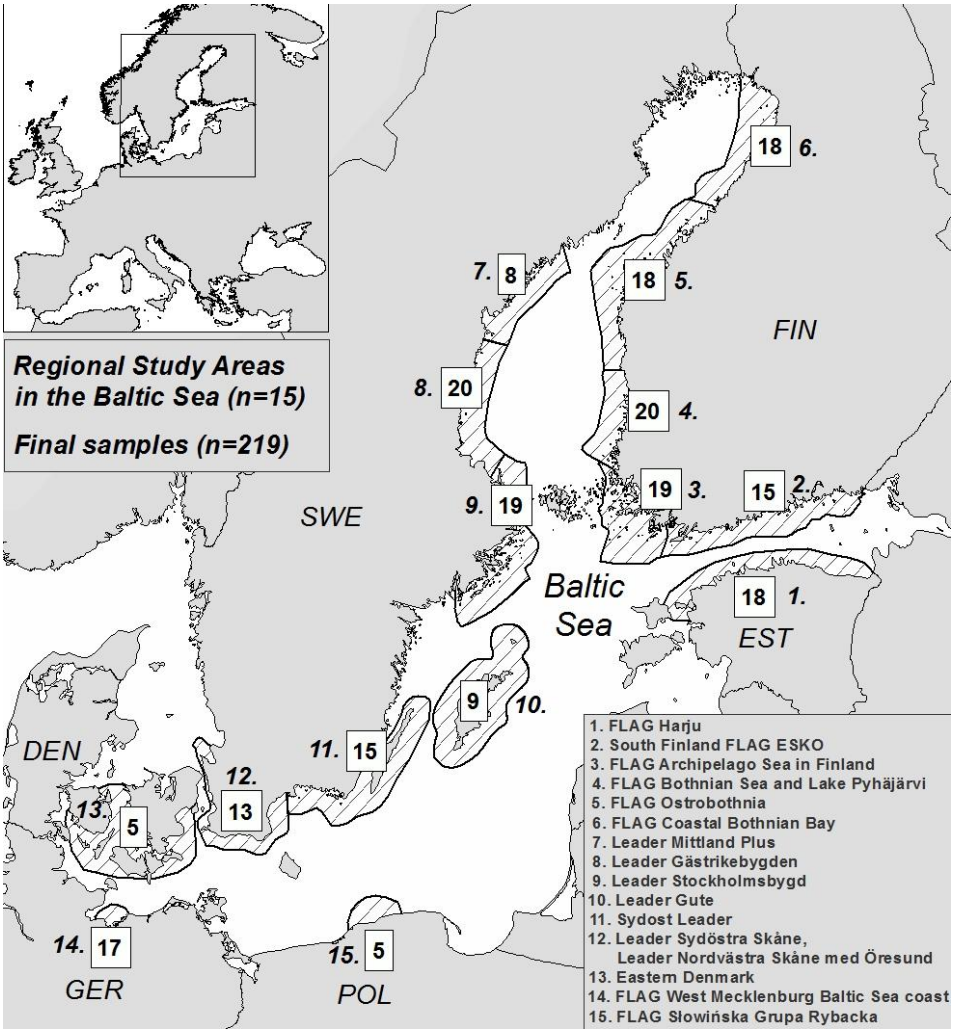

Figure 1. The marked areas show the 15 Regional Study Areas that are used for classification of the material resulting from the face-to-face interviews with commercial fishers. The final samples in each study area are marked inside white boxes.

The amount of conducted interviews in Finland was 93, in Sweden 98, in Germany 17, in Estonia 20, in Poland 5 and in Denmark 7, adding to a total of 240 interviews. Twenty-one interviews were removed and discarded from the research material due to representation reasons. Among the discarded interviews were interviews of fishers outside the sample regions or retired professional fishers who did not have income from fishing. Other reason for discarding was open sea trawling without using any coastal fishing methods. One interview paper was completely empty.

The final sample consists of 219 interviews in 15 study areas; 90 interviews from Finland, 84 from Sweden, 18 from Estonia, 17 from Germany, 5 from Poland and 5 interviews from Denmark (Figure 1). Of the informants 98% were male. The amount of study areas that is used in this report when presenting the results is 15 as two neighboring regional study areas in Sweden were merged due to a low number of informants. However, in the analysis samples from Poland and Denmark were considered too small to be a valid base for analysis (n=5 in each country). Therefore the final results are mostly presented divided in 13 study areas and four countries: Estonia, Finland, Sweden and Germany. Many of the 219 informants left some questions unanswered. Thus when presenting the results, the varying numbers of respondents are indicated.

The results presented in the report reflect the fishers' views and experiences in relation to the consequences of the existence and growth of the seal and cormorant populations, but also their view on how to manage future problems. The results largely represent the situation of the most professional coastal commercial small-scale fishers in the studied Baltic Sea regions and thus are not generalizable to the whole coastal small-scale fisher population. However, the overall emphases detected in the studied regions, and particular in comparisons between regions and countries, provide essential empirical findings, and are the core results of this report.

3. Coastal fishery in the study areas

3.1. Small-scale fishing strategies and methods

Commercial fisheries along the Baltic Sea coasts are typically small-scale operations. In contrast to large-scale fisheries, small scale fisheries are most often owner-operated and characterized by shorter fishing trips with smaller boats (Hultman et al. 2018). Small-scale fisheries in the Baltic Sea are also characterized by fishing strategies that target several fish species and use multiple gear types. This provides higher flexibility in shifting between target species and gear types according to seasons and fluctuations of fish availability through years. The size of the small-scale fishing fleet in the Baltic Sea was estimated as 5626 vessels in 2015, which is equivalent to 91% of the total (Arias-Schreiber et al. 2018).

A majority of the coastal fishers interviewed in this survey used gill nets or combined gill nets and trap nets (Figure 2). Although there was smaller variation in fishing methods, the targeted fish species vary substantially across regions and seasons. Multi-species fishing is a common strategy. In the northern parts of the Baltic Sea the fishers targeted, for instance, Baltic herring, pike-perch, perch, European whitefish and Baltic salmon. In the southern parts, the landings consisted also of cod, eel and other species like flounder, trout, turbot and mackerel. Some fishers used both trawls and coastal fishing methods. The fishing strategy 'other' refers most often to using long lines. Three fishers used both long lines and gill nets.

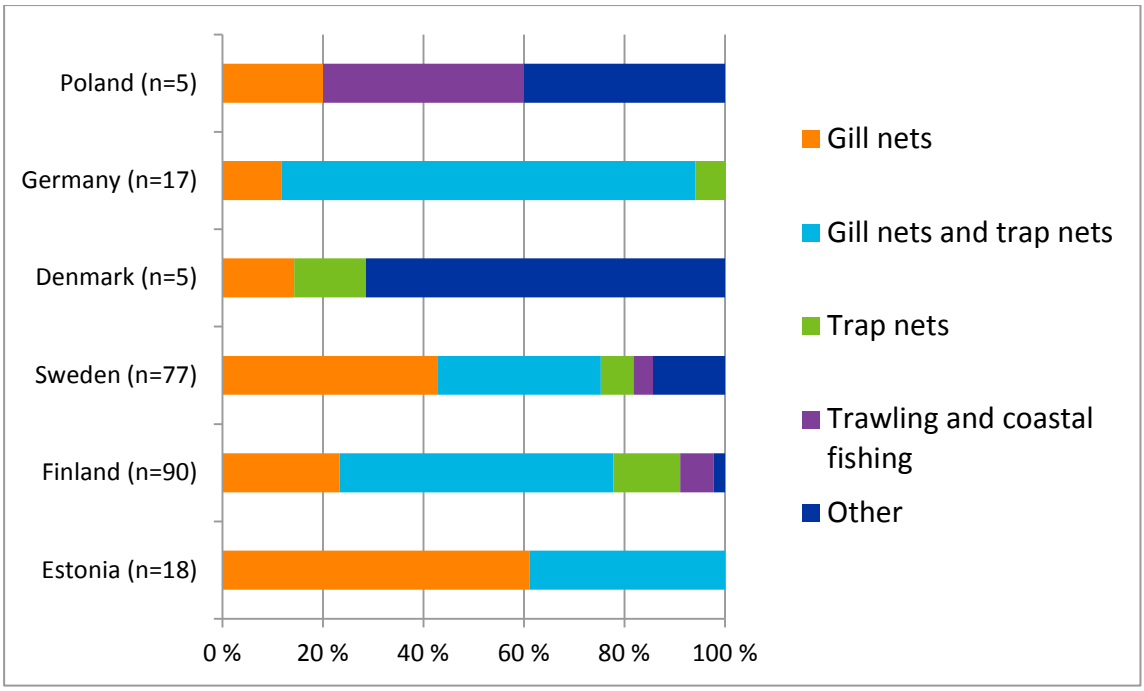

Figure 2. Distribution of fishing strategies according to countries. The categorization to fishing strategies is mostly based on answers regarding gear-specific catches on 2017.

Historically the Baltic Sea small-scale fisheries have adapted to numerous changes in their societal and environmental circumstances, with regard to e.g. marketing, profitability, fish stock fluctuations, fishing regulations and quota systems. The effects of the seals and cormorants are additions to the multiple challenges that the Baltic Sea small-scale fishers are facing and a test to their ability to reinvent the flexible strategies. Those who have continued their occupation have searched for new strategies in fishing and with regard to securing the income of the household (Salmi 2005). Although

many fishers have discontinued their livelihood, the remaining ones have reacted to the presence of the seals and cormorants with the aim of keeping the livelihood on a profitable level. Fishers have applied several adaptation strategies. They have attempted to harass the animals or prevent their effect by technological changes. They have also changed fishing strategies, fishing areas and the target species. In the open ended questions some fishers commented that due to seals they have had to change both their fishing methods and fishing grounds. It is obvious that fishers have also modified their marketing strategies. Many have survived by processing the smaller catches and selling it directly to the consumers or by leaning on other income sources in addition to seasonal fisheries.

Flexible strategies and innovative reactions can be considered as the strength of small-scale fisheries, although, naturally there are limits to adaptation. In view of this survey, fishers' adaptive strategies complicate the interpretation of the collected material and the results. Most often the seals and cormorants have not precluded the fishers from fishing totally, but the fishers may have been forced to use their time for a secondary fishing strategy that brings either less income or more costs. Moreover, some fishers have, for instance, increased their fishing effort due to the effects of the seals and cormorants. This means that the catches may have not dropped dramatically, but then again the costs and work load have increased. In the open ended questions some informants commented that their fishing operations have changed completely due to seals: they must, for instance, stay continuously in the vicinity of their gill nets and change the nets more often in order to secure some fish catches. This report aims at providing a holistic view to the perceived effects of the seals and cormorants by taking the above-described complexities and uncertainties, related to fishers' adaptation strategies, into account.

3.2. Age structure and experience in commercial fishing

Estonian fishers were the most aging group while the Finnish fishers were the youngest (Figure 3).

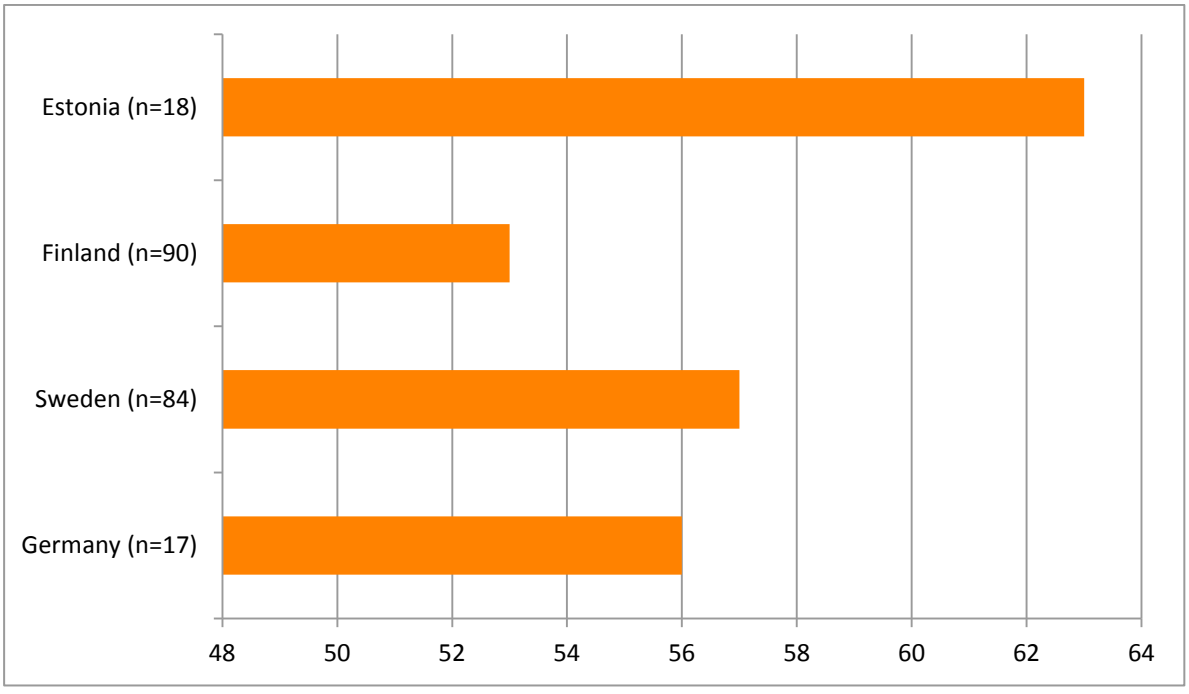

Figure 3. Average age of the informants according to country.

The informants' average age varied in the four countries by 10 years. In Estonia the average age was 63 years and in Finland 53 years. The highest average age among the Finnish FLAGs was in the Archipelago Sea (56 yrs.) and the lowest in Ostrobothnia (49 yrs.). In Sweden, the average age was 57 years, being highest in LAG Leader Stockholmsbygd (61 yrs.) and lowest in the area covered by Lead-

er Sydöstra Skåne and Leader Nordvästra Skåne med Öresund (47 yrs.). In Germany the average age of the informants was 56 years. In Appendix 4, table A, the samples are distributed in four age groups according to country, showing that the majority of fishers are over 50 years old in all countries.

When asking the fishers 'How many years have you fished commercially' the result (Figure 4) shows that the Estonian (35 yrs.) and German fishers (34 yrs.) had been executing their profession, on average, the longest.

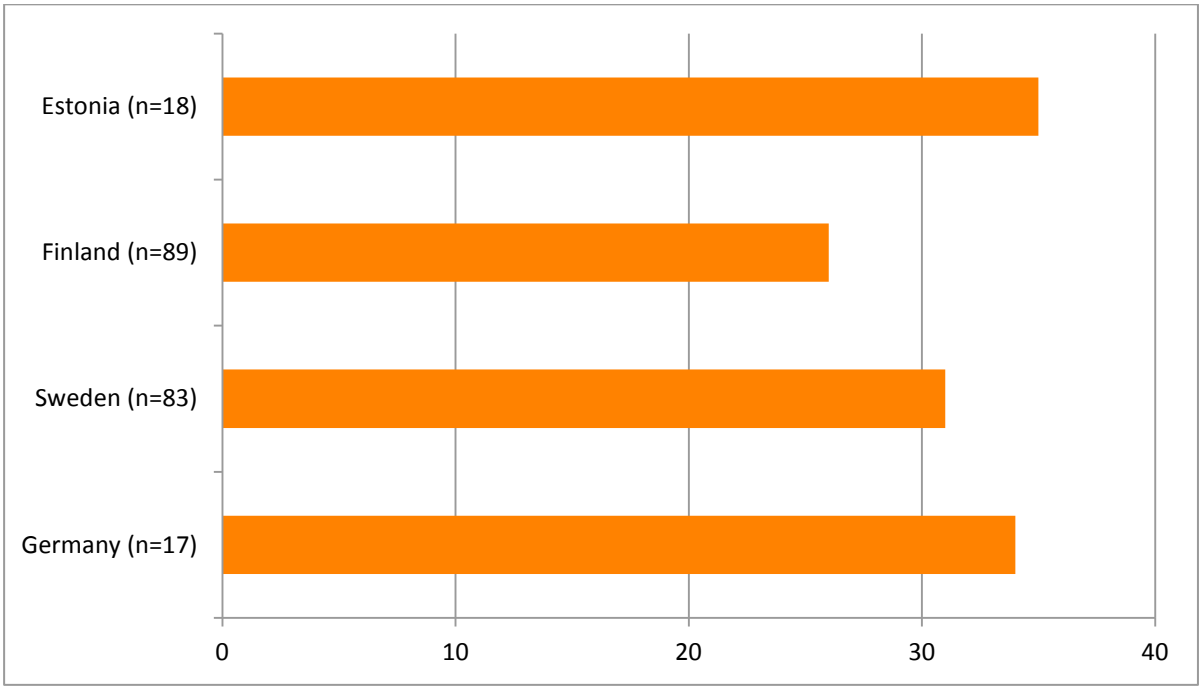

Figure 4. Average numbers of years of active commercial fishery according to country.

Shortest time period of commercial fishing was noticed in the FLAG Ostrobothnia in Finland (22 yrs.) and the Leader Gute in Sweden (24 yrs.). Appendix 4, table B, displays regional averages in years informants had fished actively.

3.3. Fishing income

The income from fishing was compared with the total *household* income. In Estonia more than one half of the fishers answered that the share of fishing income is smaller than 30% (Appendix 4, table C). Meanwhile, the most typical category in other countries was 30–79%, the averages being 49% in Finland, 32% in Sweden and 71% in Germany.

The average share of the informant's fishing income compared to the total *personal* income was relatively similar in three countries; Finland (66%), Sweden (63%) and Germany (61%), while the share in Estonia was generally lower, only 34%. In Finland 47% of the interviewed fishers earned at least 80% of their personal income from fishing (Appendix 4, table D). In Sweden and Germany, fishers earned most typically from 30% to 79% of their total income from fishing, while the Estonian fishers' share was most often below 30%.

In Estonia and Germany the informants' gross earnings in fishing were in general less than €10,000 (Appendix 4, table E), while one third of the Finnish fishers earned between €10,000–19,999. In Sweden one fourth of the fishers earned €20,000–39,999. Average gross earnings among the Finnish informants was €36,747 and in Sweden €36,544. In Germany the average was €21,529 and in Estonia €4,877 (Appendix 4, table F).

4. Impacts of seals and cormorants on fishing livelihood

4.1. Occurrence of of the impacts

The informants were asked whether their 'fishing livelihood is hampered by seals only, cormorants only, both or neither'. They were also given a fifth alternative 'I don't know'. In most regions both seals and cormorants were considered to hamper the fishing livelihood (Figure 5).

In Finland the most northern study groups identified 'seals only' as hampering the fishers' livelihood; in the FLAG Ostrobothnia by 20% and in the Coastal Bothnian Bay by 18%. In FLAG Bothnian Sea and Lake Pyhäjärvi region 5% of the informants identified 'cormorants only' as the source of hindrance to their livelihood. The area most hampered by 'seals only' in Sweden was Leader Gästrikebygden (n=4) whereas no area was only hampered by cormorants in Sweden. Similar answers were given in Estonia where 10% of the impacts where caused by 'seals only' and none by cormorants. In Germany only a mixture by seals and cormorants were detected and one fisher answered that neither seals nor cormorants caused damage. It is remarkable that only 1% of all informants indicated that neither of the species hampers their livelihood and none answered the fifth alternative 'I don't know'.

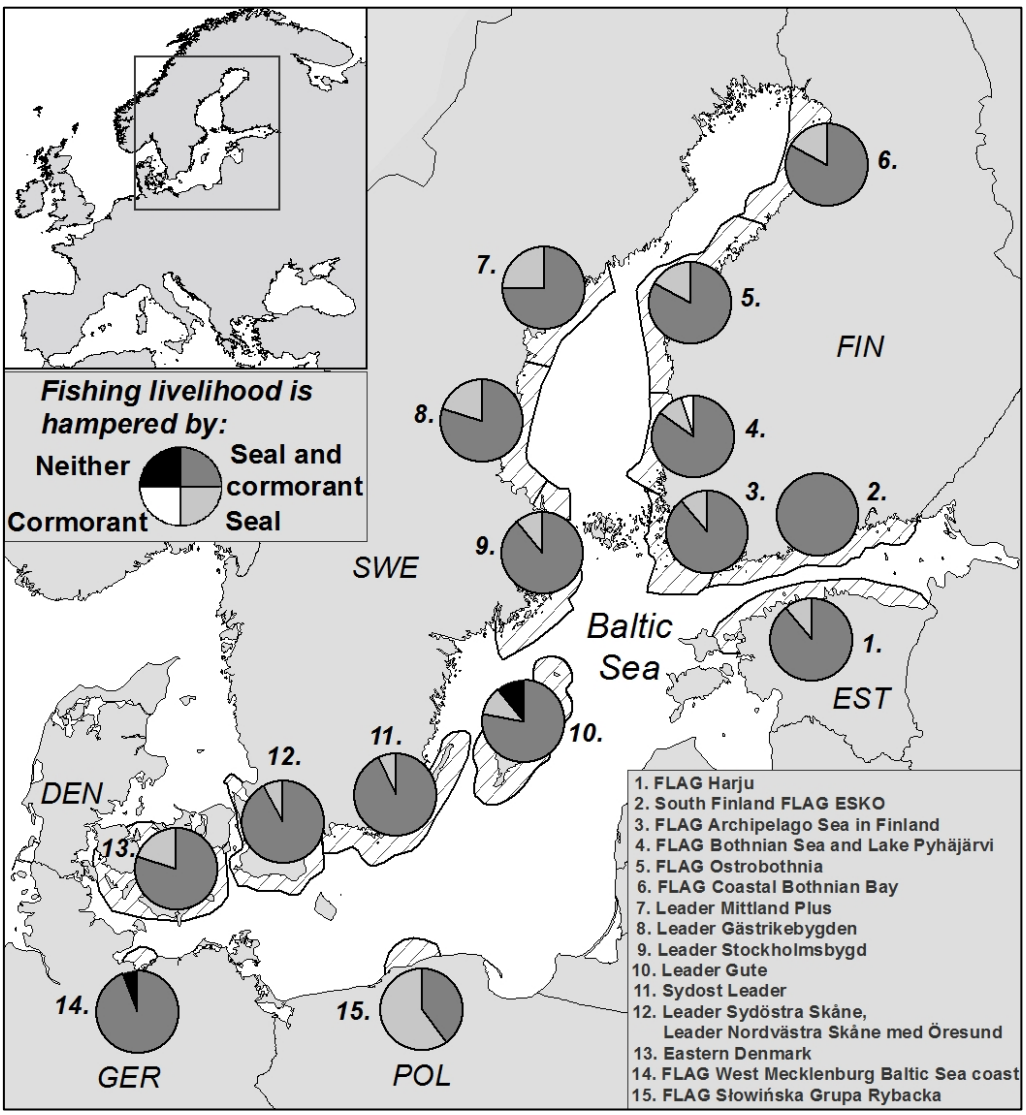

Figure 5. Breakdown of seal and cormorant induced impact that hampers fishers' livelihood in the study areas.

4.2. Gravity and types of the impacts

The informants were asked about the gravity of seal and cormorant induced impacts in relation to six impact types: 1) damage to fishing gear, 2) damages in caught fish, 3) reduction of catches by taking fish from the gear and fishing grounds, 4) reduction of catches due to changes in fish stocks and behavior, 5) an increase of the work load and, 6) an increase of the operation costs of fishing. The extent of the impact (no, minor, considerable, serious) was asked separately regarding the seal and the cormorant. In Figure 6 all six indicators have been aggregated as one average regarding the seals and one regarding the cormorants in each study area. The seal induced impacts are considered as considerable or serious in nearly all areas, while the cormorant induced impacts are usually considered as less serious than those of the seal. In Germany however, the fishers indicated that, on average, the cormorants affect the fishing livelihood more than the seals.

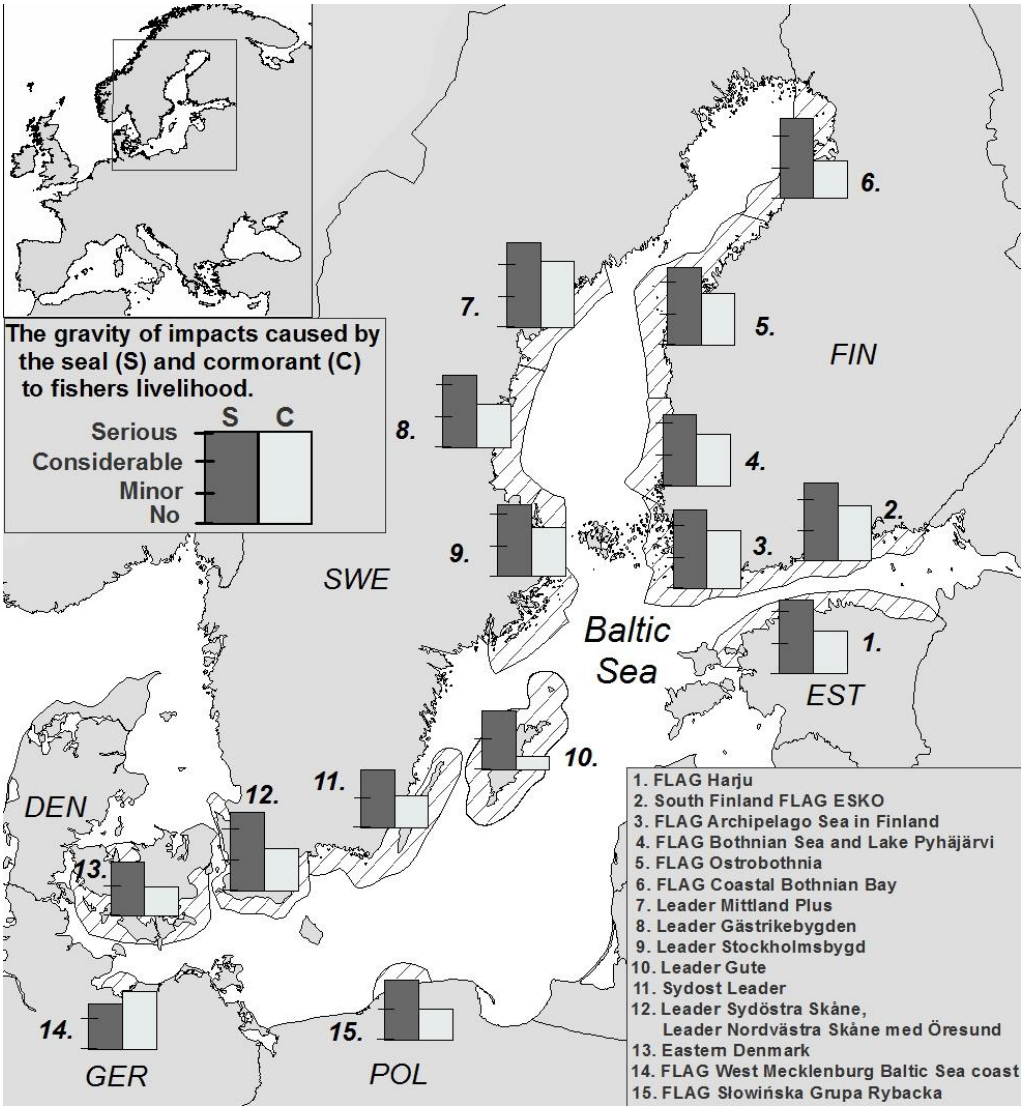

Figure 6. The average gravity of the seal and cormorant induced impacts on six indicators estimated by the fishers. The averages are calculated by including only those fishers who gave estimations.

Appendix 5 shows the experienced differences in impact types (seal figures A–D and cormorant figures E–H) distributed by countries. In Finland the most serious impacts by the seals included reduction of catches, fishing gear damages and damages in caught fish. Most serious impacts by the cormorants were changes in fish stocks and fish behavior and reduction of catches. Damages in caught fish and reduction of catches were most often regarded as considerable. In Sweden the most serious

experienced damages caused by the seal were reduction of catches, changes in fish stocks and fish behavior as well as damages in caught fish and on fishing gear. Changes in fish stocks and fish behavior was most often named as the impact type that has caused serious damages by the cormorants. Considerable damages were often perceived also as a consequence of reduction of catches.

In Estonia the most serious impact by the seals were damages on fishing gear, reduction of catches, increase in operation costs and damage in caught fish. The most serious impact by the cormorants was changes in fish stocks and fish behavior. A considerable impact is damages in caught fish and minor impact caused is the increase in workload the cormorants cause. In Germany seals caused considerable damages by reducing catches and causing changes in fish stocks and fish behavior. Cormorants were considered to cause considerable damages by changing the fish stocks and fish behavior as well as reducing catches.

The gravity of the seal and cormorant impacts was often higher in those fishing strategies that combine trap net and gill net fishing or those who use gill nets only (Appendix 5, figures I–L). In Germany, however, those who used trap nets only experienced highest seal impacts. It is remarkable also that those respondents that combined trawling with coastal fishing methods in Finland and Sweden experienced relatively high impacts from both seals and cormorants.

The informants were asked about the reduction in catches (kg) caused by the seals and the cormorant between a 'normal' year and 2017. Many respondents did not answer this question, since they had changed their fishing methods and practices, or for instance, due to increased fishing efforts. In Estonia and Germany gill net, trap net and fyke net catches were perceived to be the most impacted modes of fishing. The perceived reduction in catches caused by the seals and cormorants in Finland was most often seen on trap and fyke net fishing as well as on trawling, while in Sweden the most noticeable impact was perceived on gill net fishing. Catch-wise the Estonian fishers who answered this question had faced a loss of an average 2,628 kg of fish due to seals and cormorants induced causes. In Finland the amount was 14,173 kg, in Sweden 9,206 kg and in Germany 1,538 kg. Trawl fishing catch was left out of the calculations.

When asking 'How many days seal and cormorant induced problems precluded you from fishing with the indicated gears in 2017' the most prominent impact was experienced by Estonian trap and fyke net fishers. In all other countries gill net fishing was the most impacted method. Seal and cormorant induced problems precluded most often Estonian fishers from fishing. Many fishers found this question impossible to answer, e.g. because instead of staying on land they have changed their fishing effort, methods and locations.

5. Economic consequences to the livelihood

The economic consequences were approached by asking the informants: 'What is your estimate of the losses (EUR) that seals and cormorants caused to your fishing livelihood in 2017?'. Informants were instructed to include costs due to damages in gear and caught fish, increases in work load, loss of fishing income due to reduced catches and other possible causes. A total of 175 informants (84%) gave their estimations regarding the seal induced losses and 112 informants (54%) estimated the cormorant induced losses. The proportion of those who did not provide the euro sum was higher in relation to the cormorant in all study areas except Germany (Figure 7). The respond rate was more than 50% in all study areas when estimating the seal induced losses, while the cormorant related question was answered by less than 50% of the respondents in two out of five study areas in Finland In Sweden the respond rate was less htan 50% in four out of six study areas and this was the case also in Poland. In Germany over 94% of the informants answered the questions about induced losses caused by cormorants and 88% about seals.

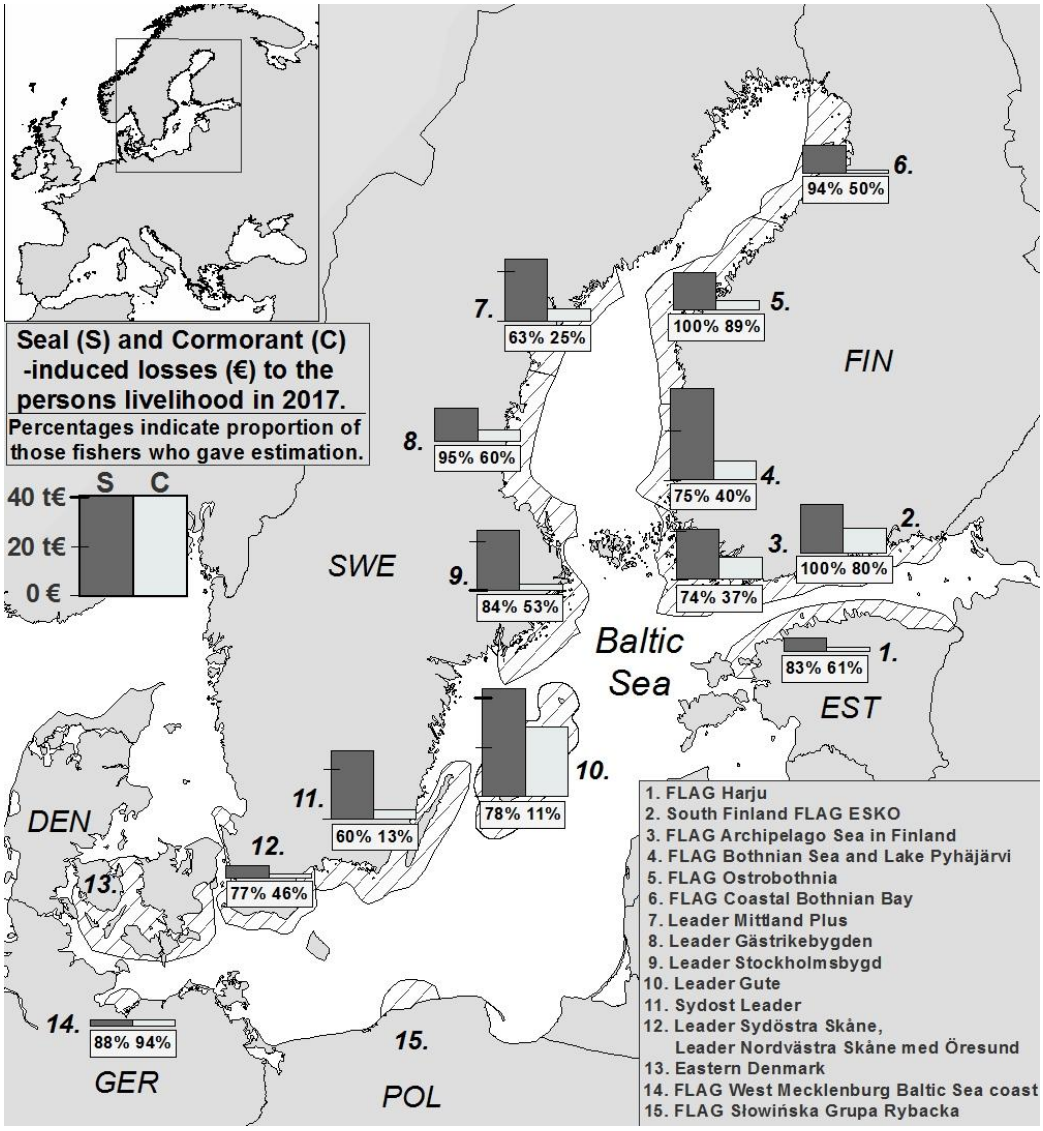

Figure 7. The average seal and cormorant induced losses (EUR) estimated by the interviewed fishers. The averages are calculated by including only those fishers who gave estimations. The proportions of fishers (%) who gave estimations are indicated in white boxes.

In Finland the average estimation of the seal induced losses was €20,465 (n= 79) and cormorant induced losses €6,188 (n=52). Regarding the seal losses Bothnian Sea and Lake Pyhäjärvi FLAG informants registered the highest average level of €36,433 and the lowest by the Coastal Bothnia Bay FLAG of €11,547. For the cormorant losses South Finland ESKO FLAG informants perceived the highest lost by €9,875 and the lowest by the Coastal Bothnia Bay FLAG €1,444.

In Sweden the seals were considered to cause losses, on average, for €19,834 (n=66) and the cormorant respectively €6,534 (n=33). In Sweden both the highest and lowest average losses were registered by informants in two study areas. Within the Leader Gute froup highest scores both in seal and cormorant loss were perceived; €43,609 respectively €28,106, while Leader Sydöstra Skåne and Leader Nordvästra Skåne med Öresund perceived the losses to be €5,000 respectively €1,667.

In Estonia and Germany fishers estimations were considerably lower than the average in Finland and Sweden: here the average estimation of the seal induced losses was €5,451 (n=15) and cormorant induced losses €1,698 (n=11). In Germany the average estimation of the seal induced losses was €2,562 (n=15) and cormorant induced losses €2,507 (n=16).

Appendix 6, figures A–D, present an overview of averages of the estimated seal and cormorant losses in three classes based on the share of personal fishing income by country. In Estonia those who earned less than 30% of their income from fishing experienced higher cormorant induced losses than other Estonian groups. In other countries the most professional fishers typically estimated the losses as higher than those who operated in part time basis.

6. Changes in the coastal communities

The informants were asked about changes in the numbers of commercial fishers in his/her municipality or community. In general changes varied between 32% and 81% of negative change, meaning a decreased amount of commercial small-scale coastal fishers between year 2000 and 2017 (Figure 8). The only increases of fishers where found in a few study areas in Estonia and in Sweden (Appendix 7).

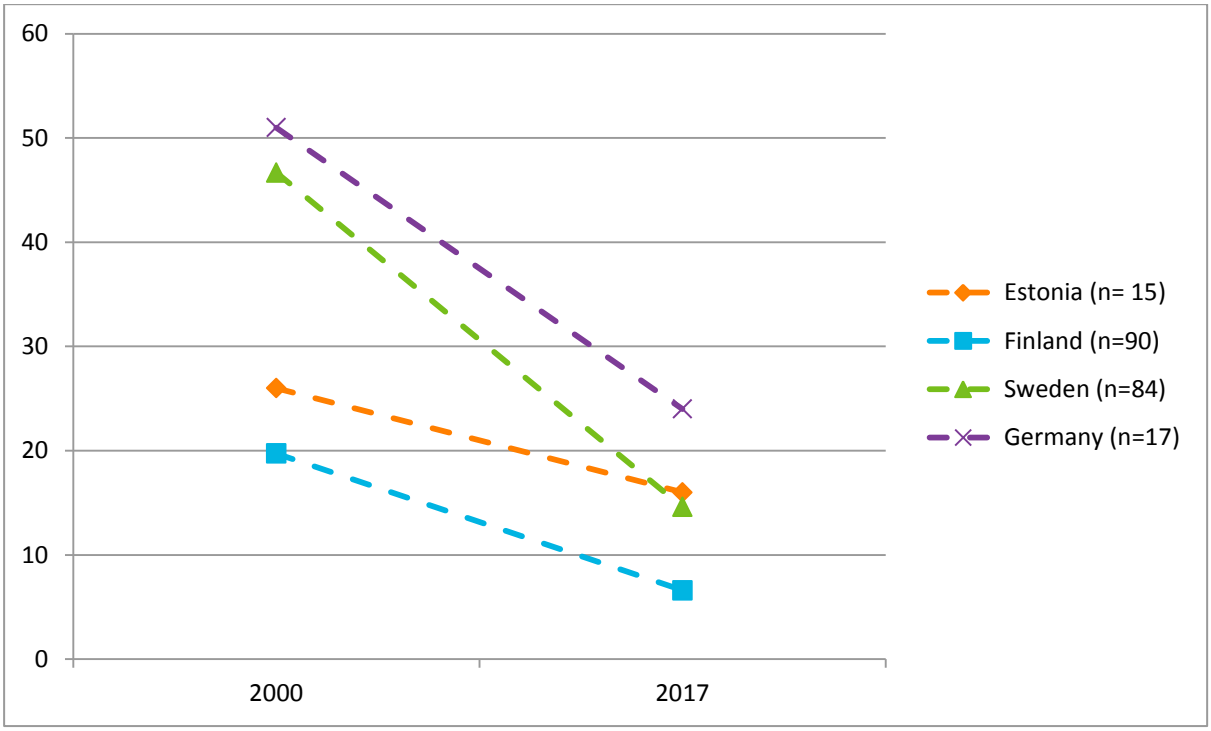

Figure 8. Changes in the average estimations of the amount of coastal fishers in the municipality or coastal area between the years 2000 and 2017 by country.

In order to establish the reasons for the changes in the amount of commercial fishers and fish landings due to impacts by seal and cormorants several options were given (see Appendix 1, question 15). The interviewed fishers were also asked to name 'other causes', in addition to the given alternatives. Overregulation of fishery and the perceived negative attitude by the state towards the fishers and invasive species caused challenges for the fishers in Estonia. In Finland and Sweden imposed bureaucracy and EU regulations, low viability within the trade and the fact that the fishers are aging and recruitment is difficult among younger generations. The Finnish fishers also perceived their profession to be physically hard, long working days and not much spare-time. Regulatory fishing quotas, high investment costs and increase in fuel and material prices were considered hindrance, especially at the beginning when starting a new business. Iceless winters and more windy conditions were categorized as climate change factors.

In Sweden trawling (especially industrial fishing and bottom trawling), the low fish price, recreational and sport fishing as well as environmental challenges and eutrophication were, according to the fishers, reasons for reduction of both fisher numbers and fish landings. The German fishers recognized regulatory quotas, bureaucracy, decreased viability to cause challenges. Also the aging group of fishers, higher costs and a permanent change of technical measures were proposed to be the cause to decreased amount of fishers and fish landings in Germany. Reasons for the possible reduction in the amount of fishers and fish landings are displayed by country in Appendix 8.

In Estonia, Finland and Sweden the seals' and cormorants' effects on the amount of commercial fishers and fish landings were perceived as serious. In Estonia 'the effects of increase in seal population on fish landings' and 'the effects of a reduction in the abundance of fish on fish landings' had serious impact (Appendix 8, figure A). The Finnish and Swedish informants indicated similar reasons for the possible reduction of fishers and fish landings in their municipalities and coastal communities (Appendix 8, figures B and C). The most serious reason in both countries were 'the effects of increase in seal population on the number of commercial fishers' and 'the effects of increase in seal population on fish landings'. Similarly with Estonia 'the effects of increasing utilization of the water areas for other purposes on the number of commercial fishers' were often regarded of having no or minor impact. The Finnish fishers also regarded 'the problems in fish marketing on the number of commercial fishers' as having no or minor impact. Moreover, in Sweden 'the deterioration of the coastal waters on the number of commercial fishers' was most often seen as having no or minor impact.

German informants (Appendix 8, figure D) rarely saw considerable or serious reasons for the reduced numbers of fishers or fish landings. Nevertheless, considerable reasons were attached to 'the effects of fishing regulation on the number of commercial fishers' and 'the effects of fishing regulations on fish landings. In Germany 'the deterioration of the coastal waters on the number of commercial fishers' and 'the deterioration of the coastal waters on fish landings' were most often considered to have no or minor impact.

Due to the 8 000 km long coastal stretch of the Baltic Sea, species vary within the geographical space. Fishers were asked about seal's and cormorant's impacts on the most important fish species in their municipality or coastal area. In the open ended question many fishers were convinced about the effects of the pivotal animals in this report and their abundance of certain fish species. Some fishers commented that there are also other reasons for the variations of fish stocks – the reasons for reduction are not always straightforward and certain. Appendix 9 shows which species were perceived by the fishers as decreased in their local context caused by the seals and cormorants. In Estonia fishers (n=15) named perch and eel as most affected by seals and cormorants. In Finland (n=70) trout, pike, pike-perch and European whitefish were most effected, while the Swedish informants (n=69) perceived flounder, burbot and pike as the most exposed species. Fishers in Germany (n=14) indicated that perch and the Baltic salmon were mostly impacted in their areas.

7. Best measures to mitigate the seal and cormorant induced problems

The informants were asked about the best measures to mitigate the seal and cormorant induced problems. They were asked to assess the importance of four given measure types and also to add their own suggestions. In all four countries the most popular alternative was using methods affecting the overall numbers of seals and cormorants by using suggested techniques, such as hunting, capturing or egg oiling (Figure 9). In Finland one half of the informants choose this alternative as the foremost way of mitigating the problems, where as in Sweden it was not as prominent (35%). In Germany 45% and in Estonia 43% of the respondents choose this alternative as most important. 'Protective methods driving away or reducing the numbers of those seal individuals and cormorants that cause damage to local fishing' were also found important by many. The least popular method, except for 'other measures', was most often the 'Methods reducing the damages to the fishing gear or to the fish in the gear'. Estonian fishers considered 'Compensations in money' the least effective way of mitigating seal and cormorant induced problems.

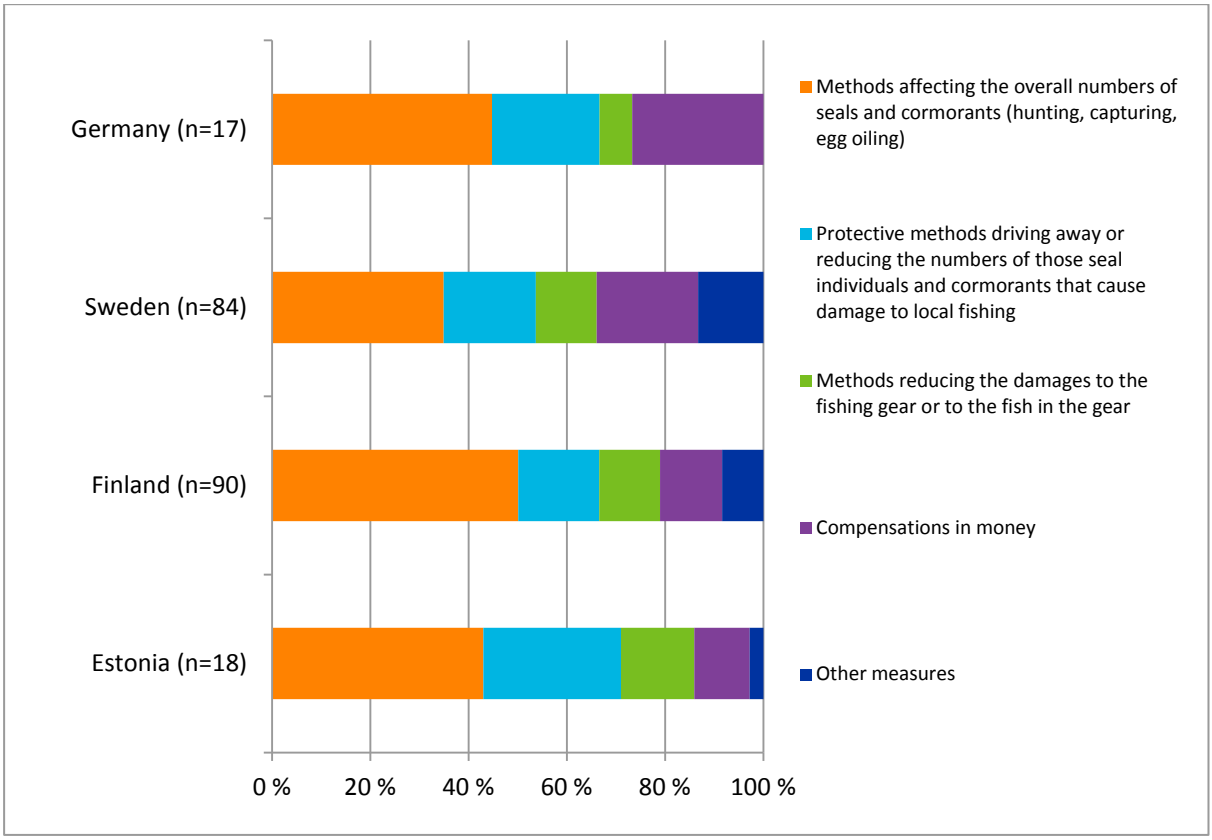

Figure 9. Distribution of the most popular measures for mitigating seal and cormorant induced problems according to country.

In their answers to open questions many fishers called for wider opportunities for hunting seals and cormorants. Active hunting near the fishing gear may improve catches for a couple of days, however fishers stressed that in time it would also affect the behavior of the animals, as they would become more timid again. Some stated that hunting is not sufficient, but a more systematic decimation of the populations is needed. In the cormorant case, oiling or piercing the eggs was considered relevant. Also a bounty for catching a seal was recommended as a tool for decreasing the seal induced problems. The killed animals should be used as a resource. Thus the ban for trading seal products should be cancelled.

The opinion was divided regarding the role of monetary compensations. Some stated that compensations could help in the short run. Fishers also wanted rising of the level of the compensations. On the other hand, a common view was that compensations are not a solution to the problem – fishers rather capture fish to consumers. The informants also commented that harassment of the animals only transfers the problems to other areas. The opinion was divided between the roles of seal-proof fishing technologies. Many commented that investments for this type of fishing gear are too high for small-scale fishers.

8. Discussion

This report is based on a study depicting commercial fishers' experiences and perceptions of an ongoing human-animal conflict in the Baltic Sea. The main contenders are the fishers, the seals and the cormorants. In the analysis of the collected interview data the effects of seals and cormorants have partly been separated, but in many cases the fishers perceive these effects as a whole, the 'animal side' of the livelihood. The coordinated efforts in the collection of the material for this report are results of wide transnational collaboration, where the report presents the main findings of a cross-sectional study. The material allowes also for scientific analyses, and in future it may be repeated in order to study the changes of the experienced impacts of seals and cormorants.

The results show the extent and significance of animal-related constraints that the small-scale fishers face in the Baltic Sea coastal regions. The impacts of seals and cormorants are often seen as serious obstacles for continuation of the fishing livelihood. The seal is considered to hamper coastal fishing usually more compared to the cormorant – particularly in Sweden and Finland. However, the cormorant induced problems were experienced as more severe in Germany. The survey confirms a multiplicity of impacts, and the related complexities and uncertainties. In the fishers' estimations uncertainties vary between the direct and indirect effects to their livelihood. According to fishers, seals typically cause direct effects such as reduction of catch, and damages in gear and on the fish. On the other hand, the cormorant was considered to cause more often indirect impact, such as changes in fish stocks and fish behaviour. It is important to consider this multiplicity of impacts in discussions about the national and international seal and cormorant policies, as well as in research, planning and decision making.

The estimations of seal and cormorant induced losses were partricularly high in Finnish and Swedish coastal areas. Although many fishers refused to give any estimation due to the uncertainties related to the indirect effects, comparisons with a previous survey in Finland (Salmi et al. 2010) enable assessing the change that has occurred in nine years (2009-2018): the average estimations of seal induced losses had increased from €11,500 to €20,465 and those of the cormorant increased from €3,800 to €6,188. This is in line with the perception of an increase of the animal-related problems in Finnish coastal fisheries. In all studied areas the fishers stated that the number of fishers in their communities had decreased heavily during the last 17 years. This is naturally a result of several reasons. In the northern coasts of the Baltic Sea fishers highlight the role of the seals and cormorants in the decreasing trend, while in other parts they also stress the effects of a reduction in the abundance of fish and the effects of fishing regulations. When interpreting these differences one should, among other issues, consider also differences in the animal populations across the Baltic Sea regions.

The general picture of the participating informants, the small-scale costal fishers of the Baltic Sea, shows a rather aging population of professionals with a long experience within their occupation. A common tendency is the exercise of pluriactivity, while fishing is not the only income source amongst the fishers. Typical to small-scale fisheries in general, the Baltic Sea coastal fishers' income level is generally low in comparison to an average income in the studied countries, and their capacity to invest in new technologies and flexible strategies is often modest. The effects of seals and cormorants would often necessitate changes in fishing strategies, but the possibility for fishers to find new paths has become narrowed – partly as a consequence of fishing regulations. In this situation engaging and attracting younger persons to become commercial fishers is challenging.

When considering the results of this report, i.e. the complexity of seal and cormorant induced impacts experienced by the Baltic Sea coastal fisheries and the socially and economically difficult position of the small-scale fishing livelihood, it is clear that steps forward necessitate wide collaboration across sectors both regionally and internationally. To guarantee their functionality and acceptability,

governance tools for mitigation of the seal and cormorant induced problems should be designed together with fishers and other stakeholder groups in order to incorporate local knowledge, values and the diversity of fishing cultures.

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Appendices

Appendix 1. Questionnaire.

Baltic
fisheries
S&C

BALTIC SEA SEAL AND CORMORANT TNC-PROJECT

Saving the Endangered Baltic Sea Coastal Fishers

– finding sustainable solutions to deal with growing seal and cormorant populations

The aim is that 20 fishers will be interviewed in each FLAG. 5 FLAGs in Finland, 7 FLAGs in Sweden, 1 FLAG in Estonia and 1 FLAG in Germany. The total number of interviews will be 280. It is, however, possible that several FLAGs e.g. from Denmark, Poland and Latvia will form another project using similar methods in a later phase.

1. Background information

a) Country_____
b) FLAG code_____
c) Name of the interviewer_____
d) Date of the interview _____
e) The interviewee is
   a) Full time fisher
   b) Part- time fisher
f) Name of the interviewee, fisher _____
g) Address of the interviewee_____
h) Fisher code, as in the register_____
i) Age _____
j) How many years have you fished commercially? Only active years_____
k) What is the share of fishing income compared to the total household income? All fishing income, the work of other household members included. Please, use the % sign in your answer_____
l) What is the share of fishing income compared to the total personal income? Only personal fishing income. Please use the % sign in your answer_____
m) What were your gross earnings in fishing in 2017? Answer in € _____
n) What were your net earnings in fishing in 2017? Answer in € _____
o) Location of fishing activities. Write the codes of ICES statistical rectangles _____

1.1. Other comments _____

2. Impacts of the seals and the cormorants:

My fishing livelihood is hampered by:

a) Seals only
b) Cormorants only
c) Both
d) Neither
e) I don`t know

3. What was the last year of a "normal" situation, meaning that the seals and the cormorant had not begun to affect your fishing livelihood? Please, name the year._____

3.1 Other comments_____

4. How did your fish catches change between the "normal" year and 2017? What was your catch in the "normal" year?

a) Gill net catch (kg) in the normal situation _____
b) Trap net & fyke net catch (kg) in the normal situation _____
c) Long line & hooks catch (kg) in the normal situation _____
d) Trawl catch (kg) in the normal situation _____
e) Other gear, which gear and catch (kg) in the normal situation _____

4.1 Other comments: _____

5. How did your fish catches change between the "normal" year and 2017? What was your catch in 2017?

a. Gillnet catch (kg) in 2017 _____
b. Trap net & fyke net catch (kg) in 2017 _____
c. Long line & hooks catch (kg) in 2017 _____
d. Trawl catch (kg) in 2017 _____
e. The other gear and catch (kg) in 2017 _____

5.1 Other comments: _____

6. Reduction in catches caused by the seals and the cormorant (kg)

a. Gillnet _____
b. Trap net & fyke net _____
c. Long line & hooks _____
d. Trawl _____
e. The other gear and catch in (kg) _____

6.1 Other comments: _____

7. The types and gravity of impacts to my fishing livelihood:

1. Damage to fishing gear caused by seals

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

2. Damages in caught fish caused by seals

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

3. Reduction of catches by taking fish from the gear or harassing fish from the gear and fishing grounds caused by seals

a) No
b) Minor
c) Considerable
d) Serious
e) I don´t know

4. Reduction of catches due to changes in fish stocks and fish behaviour caused by seals

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

5. An increase of the workload connected to seals

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

6. An increase of the operation costs of the fishing affected by seals

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

7.1 Other comments: _____

8. The types and gravity of impacts to my fishing livelihood:

A. Damage to fishing gear caused by cormorants

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

B. Damages in caught fish caused by cormorants

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

C. Reduction of catches by taking fish from the gear or harassing fish from the gear and fishing grounds caused by cormorant

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

D. Reduction of catches due to changes in fish stocks and fish behaviour caused by cormorants

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

E. An increase of the workload connected to cormorants

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

F. An increase of the operation costs of the fishing caused by cormorants

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

8.1 Other comments: _____

9. Did the seal and cormorant induced problems hamper your fishing in 2017?

1. No
2. Yes

9 A. If you answered 1. *No* to the question 9, please go to question 10.
If you answered 2. *Yes* to the question 9, please answer the following questions 9 A), B), C), D) and E)

A. How many days seal and cormorant induced problems precluded you from gillnet fishing in 2017?_____

B. How many days seal and cormorant induce problems precluded you from trap and fyke net fishing in 2017? _____

C. How many days seal and cormorant induced problems precluded you from long line & hook fishing in 2017? _____

D. How many days seal and cormorant induced problems precluded you from trawl fishing in 2017? _____

E. How many days seal and cormorant induced problems precluded you from fishing with some other gear? Please answer, which gear and how many days. _____

9.1 Other comments:_____

10. What is your estimate of the losses (in euros) that seals caused to your fishing livelihood in 2017? Include costs due to damages in gear and caught fish, increases in workload, loss of fishing income due to reduced catches and other possible issues. _____

10.1 Other comments: _____

11. What is your estimate of the losses (in euros) that the cormorant caused to your fishing livelihood in 2017? Include costs due to damages in gear and caught fish, increases in workload, loss of fishing income due to reduced catches and other possible issues. _____

11.1 Other comments: _____

12. What is your estimate of the total losses (in euros) that seals and the cormorant caused to your fishing livelihood in 2017?

Include costs due to damages in gear and caught fish, increases in workload, loss of fishing income due to reduced catches and other possible issues. _____

12.1. Other comments: _____

13. What was the number of commercial fishers in your municipality / coastal community around the year 2000? _____

14. What is the number of commercial fishers in your municipality / coastal community now?_____

15. Which are the reasons for the possible lowering of the fisher numbers and fish landings in your area:

A. The deterioration of the coastal waters on the number of commercial fishers

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

B. The deterioration of the coastal waters on fish landings

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

C. The effects of a reduction in the abundance of fish on the number of commercial fishers

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

D. The effects of a reduction in the abundance of fish on fish landings

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

E. The problems in fish marketing on the number of commercial fishers

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

F. The problems in fish marketing on fish landings

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

E- F.1 Other comments: please name any other problem in fish marketing_____

G. The effects of increasing utilization of the water areas for other purposes on the number of commercial fishers.

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

H. The effects of increasing utilization of the water areas for other purposes on fish landings.

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

I. The effects of fishing regulations on the number of commercial fishers

a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

J. The effects of fishing regulations on fish landings.
a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

K. The effects of increase in seal population on the number of commercial fishers
a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

L. The effects of increase in seal population on fish landings.
a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

M. The effects of an increase in cormorant population on the number of commercial fishers.
a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

N. The effects of increase in cormorant population on fish landings.
a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

O. What other causes for lowering the number of fisher and fish landings? Please, name the reason: _____

O.1 The effects of above-mentioned cause for lowering a number of the commercial fishers.
a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

O.2 The effects of above-mentioned cause for lowering a number of fish landings.
a) No
b) Minor
c) Considerable
d) Serious
e) I don`t know

15.1 Other coments:_____

16. Have seal or/and cormorant caused reduction on most important fish species for commercial fishing in your municipality/ coastal area?
1. No
2. Yes

16. A If you answered 1. No to the question 16, please go to the question. If you answered 2. Yes to the question 16. please name the most important fish species and the reduction of landings in your municipality / coastal area in % caused by seals or and cormorants. You may name three fish species and the reduction.

A) What is the impact on most important fish species for commercial fishing?
1. species _____, reduction of landings in your municipality/ coastal area _____%
2. species _____, reduction of landings in your municipality/ coastal area _____%
3. species _____, reduction of landings in your municipality/ coastal area _____%

16.B Other comments: _____

17. Do you know coastal water areas in your municipality / coastal area that have been emptied by seal or cormorant?
1. No
2. Yes. A proportion of the total fishing area? _____% (ices)

17.1 Other comments:_____

18. Which are the best measures to mitigate the seal and cormorant induced problems? Read through all the following arguments from A to F and choose three (3) most important measures and asses your choices in the following order: Most important, second most important, third most important by using the drop box.

A. Methods affecting the overall numbers of seals and cormorants (hunting, capturing, egg oiling)
1) the most important
2) 2nd most important
3) 3rd most important

B. Protective methods driving away or reducing the numbers of those seal individuals and cormorants that cause damage to local fishing (protective hunting, shooting, scaring, harassment).
1) the most important
2) 2nd most important
3) 3rd most important

C. Methods reducing the damages to the fishing gear or to the fish in the gear (gear technology etc.)
1) the most important
2) 2nd most important
3) 3rd most important

D. Compensations in money
1) the most important
2) 2nd most important
3) 3rd most important

E. Other measures, which? _____

E1. How would you rank the importance of the above-mentioned measure?
a) the most important
b) 2nd most important
c) 3rd most important

F. Other measures, which? _____

F. 1 How would you rank the importance of the above-mentioned measure?
a) the most important
b) 2nd most important
c) 3rd most important

18.1 Other comments:_____

19. I have answered all the question and checked my answers before sending

Please read through carefully all your answers and press send.
1. Yes
2. No

Appendix 2. Study areas.

Country	Original names (source for empirical data collection)	Regional study areas (base for analysis)
Estonia	1. MTÜ Harju Kalandusühing	1. FLAG Harju
Finland	2. Etelä-Suomen kalatalousryhmä ESKO, *Södra Finlands Fiskerigrupp*	2. South Finland FLAG ESKO
	3. Saaristomeren kalatalouden toimintaryhmä, Skärgårdshavets fiskeaktionsgrupp	3. FLAG Archipelago Sea in Finland
	4. Selkämeren ja Pyhäjärven kalatalouden toimintaryhmä	4. FLAG Bothnian Sea and Lake Pyhäjärvi
	5. Kustaktionsgruppen i Österbotten	5. FLAG Ostrobothnia
	6. Perämeren rannikon kalatalousryhmä	6. FLAG Coastal Bothnian Bay
Sweden	7. Leader Mittland Plus	7. Leader Mittland Plus
	8. Leader Gästrikebygden	8. Leader Gästrikebygden
	9. Leader Stockholmsbygd	9. Leader Stockholmsbygd
	10. Leader Gute	10. Leader Gute
	11. Sydost Leader	11. Sydost Leader
	12. Leader Sydöstra Skåne	12. Leader Sydöstra Skåne, Leader Nordsvästra Skåne med Öresund
	13. Leader Nordsvästra Skåne med Öresund	
Denmark	14. FSK, Foreningen for Skånsomt Kystfiskeri	13. Eastern Denmark
Germany	15. LAG Westmecklenburgische Ostseeküste	14. FLAG West Mecklenburg Baltic Sea coast
Poland	16. FLAG Słowińska Grupa Rybacka	15. FLAG Słowińska Grupa Rybacka

Appendix 3. Interview consent form.

Baltic Sea Seal and Cormorant TNC Project:
Assessing losses induced by seals and cormorants to Baltic coastal fisheries livelihoods

Research investigator: *Baltic Sea Seal and Cormorant TNC Project and academic colleague*
Research Participant's name: _____

This interview will take approx. 1,5 hours.
Thank you for agreeing to be interviewed as part of the above research project. The consent form is necessary to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Please read this information carefully and then sign this form to certify that you approve the following:
Your answers will be recorded to an e-form or/ and paper form by the interviewer_____

After you have answered all the questions of the questionnaire, please read carefully all your answers and correct any factual errors before sending the questionnaire form. Your answers will be sent to an electronic database for this research use only. Your answers will be analyzed by professional researchers the Baltic Sea Seal and Cormorant project`s responsible research investigator. The access to the answering form will be limited to the research group, responsible project coordinator *Anna-Kristiina Kääriäinen*, responsible project manager *Esko Taanila*, Academic colleagues and researchers with whom might collaborate as part of the research process.

Any summary of questionnaire content, your answers, publication or other outlets your answers will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could enables to identify you is not revealed. Your answers, recorded data will be kept for **2 years** by the responsible research group and then destroyed. All or part of the content of your answers of the questionnaire will be used: in academic papers, in media, policy papers or news articles and / or presentations.

By signing this form, I agree that I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview at any time. My answers will be used as described above. I have read the information form. I don't receive any benefit or payment for my participation. I can receive a copy of my questionnaire answering paper on request. I have been able to ask any questions relating to the research project and this questionnaire and I understand that I am free to contact the researcher or the research coordinator with any questions I may have in the future.

_____ _____
Participants Signature Date

_____ _____
Research coordinator`s / interviewers signature Date

If you have further questions or concerns about this study, please contact:
Anna-Kristiina Kääriäinen
Baltic Sea Seal and Cormorant TNC project
Research coordinator
Tel: +358440125157
E-mail: anna.k.kaariainen@gmail.com

Appendix 4. Informant descriptions: age, years in commercial fishery, the share of fishing income compared to household and personal income and average gross earnings from fishing.

A. Distribution of interviewed fishers in four age groups according to country.

Age, years (%)	Estonia	Finland	Sweden	Germany
Less than 40	11	14	8	0
40 – 49	11	19	14	24
50 – 59	22	36	33	47
At least 60	56	31	44	29
Total	100	100	100	100

B. Averages of the informants' active years of commercial fishery distributed per study region.

Study area	Years in commercial fishery	n=
FLAG Harju (Estonia)	35	18
South Finland FLAG ESKO (Finland)	29	15
FLAG Archipelago Sea in Finland (Finland)	26	19
FLAG Bothnian Sea and Lake Pyhäjärvi (Finland)	28	20
FLAG Ostrobothnia (Finland)	22	18
FLAG Coastal Bothnian Bay (Finland)	25	18
Leader Mittland Plus (Sweden)	25	8
Leader Gästrikebygden (Sweden)	35	20
Leader Stockholmsbygd (Sweden)	34	19
Leader Gute (Sweden)	24	9
Sydost Leader (Sweden)	33	15
Leader Sydöstra Skåne, Leader Nordsvästra Skåne med Öresund (Sweden)	27	13
Eastern Denmark (Denmark)	37	5
FLAG West Mecklenburg Baltic Sea coast (Germany)	34	17
FLAG Słowińska Grupa Rybacka (Poland)	23	5

C. Distribution of interviewed fishers (%) in four groups, showing the share of fishing income compared to the total *household* income according to country.

Share of fishing income (%)	Estonia	Finland	Sweden	Germany
0 – 29	56	22	27	0
30 – 79	33	49	32	71
80 – 100	6	24	27	29
Not known	6	4	13	0
Total	100	100	100	100

D. Distribution of interviewed fishers (%) in four groups, showing the share of fishing income compared to the total *personal* income according to country.

Share of fishing income (%)	Estonia	Finland	Sweden	Germany
0 – 29	44	16	27	37
30 – 79	33	37	32	44
80 – 100	17	47	27	19
Not known	6	1	13	0
Total	100	100	100	100

E. Distribution of interviewed fishers (%) in four groups of gross earnings in fishing in 2017 according to country.

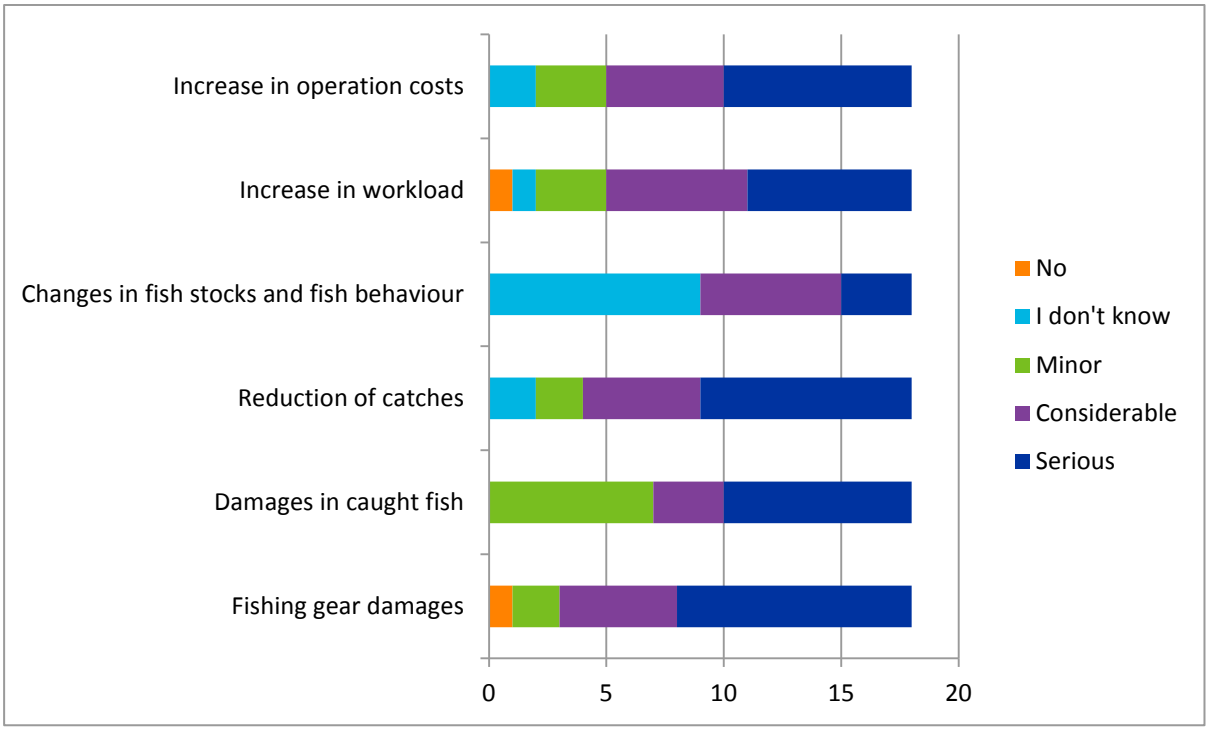
Gross earnings (€)	Estonia	Finland	Sweden	Germany
Less than 10,000	87	16	22	42
10,000 – 19,999	7	32	13	17
20,000 – 39,999	7	24	25	24
At least 40,000	0	25	16	17
No answer	0	3	24	0
Total	100	100	100	100

F. Average gross earnings in fishing in 2017.

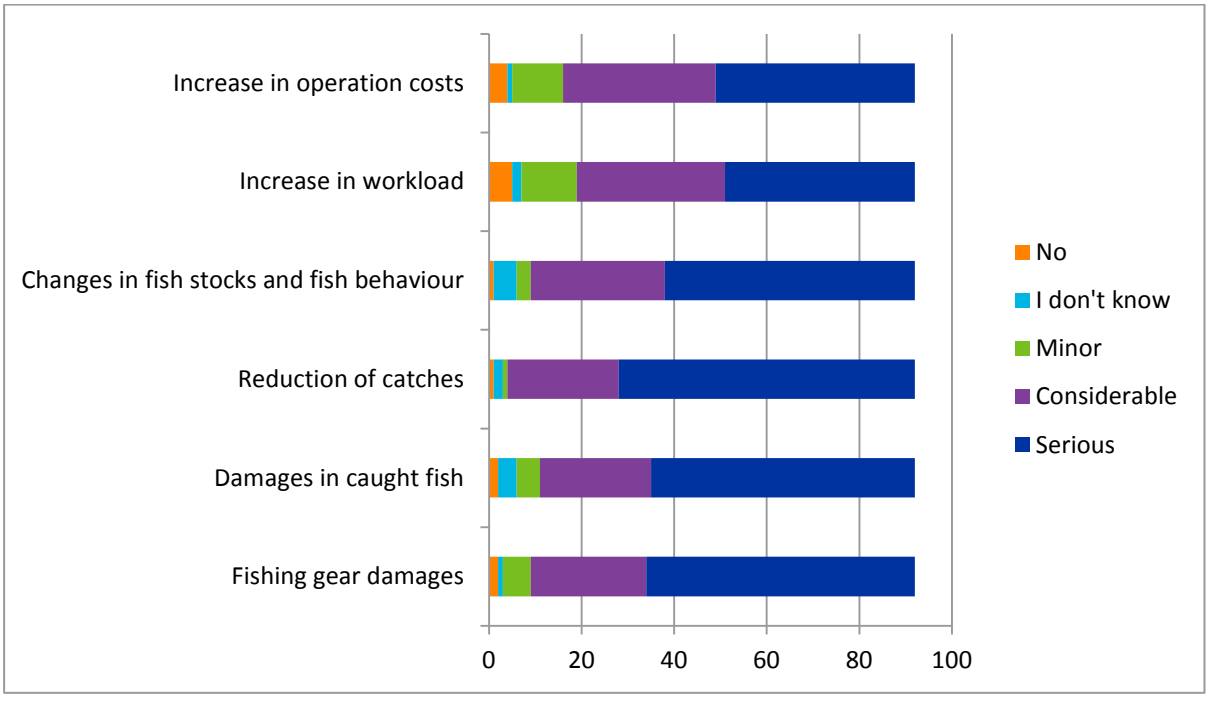
Average gross earnings (€)	Estonia (n=18)	Finland (n=90)	Sweden (n=84)	Germany (n=17)
	4,877	36,747	36,544	21,529

Appendix 5. The experienced gravities of different types of seal (A-D) and cormorant (E-H) induced impacts on fishing livelihood and average gravity levels of seal and cormorant induced impacts according to fishing strategies (I-L).

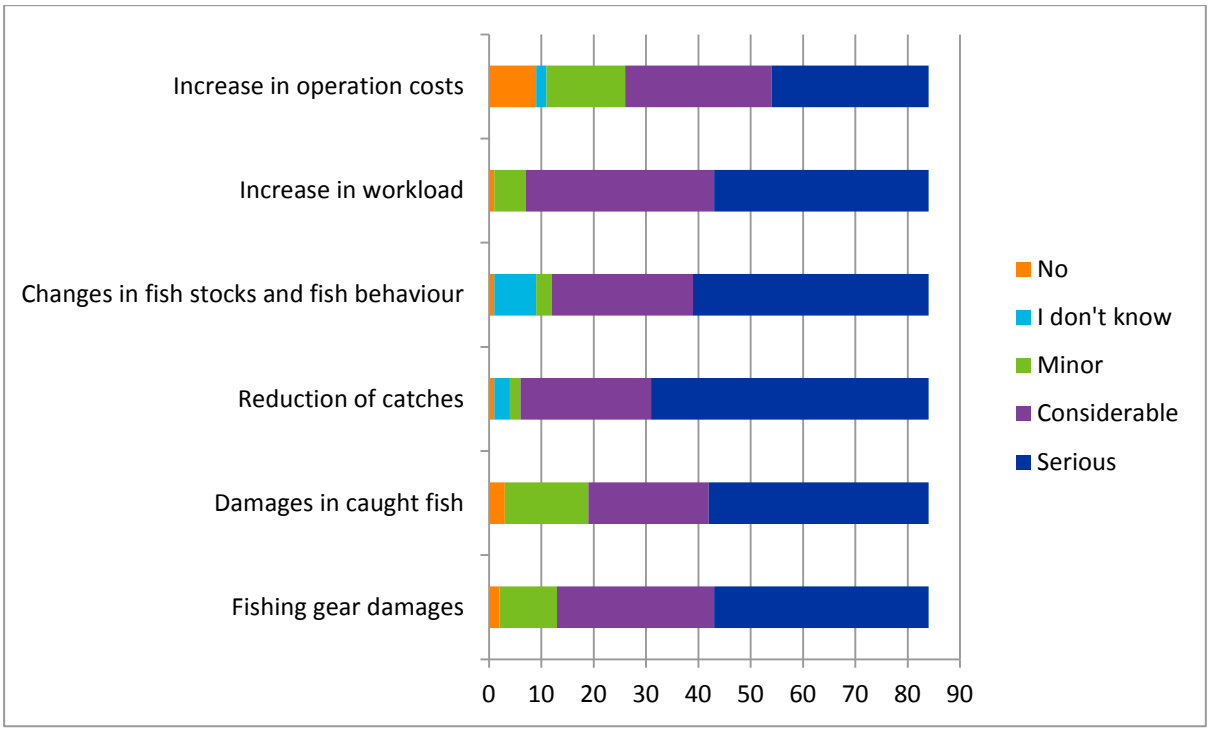
A. The gravity of seal induced impacts to the informant's fishing livelihood in Estonia (n=18).



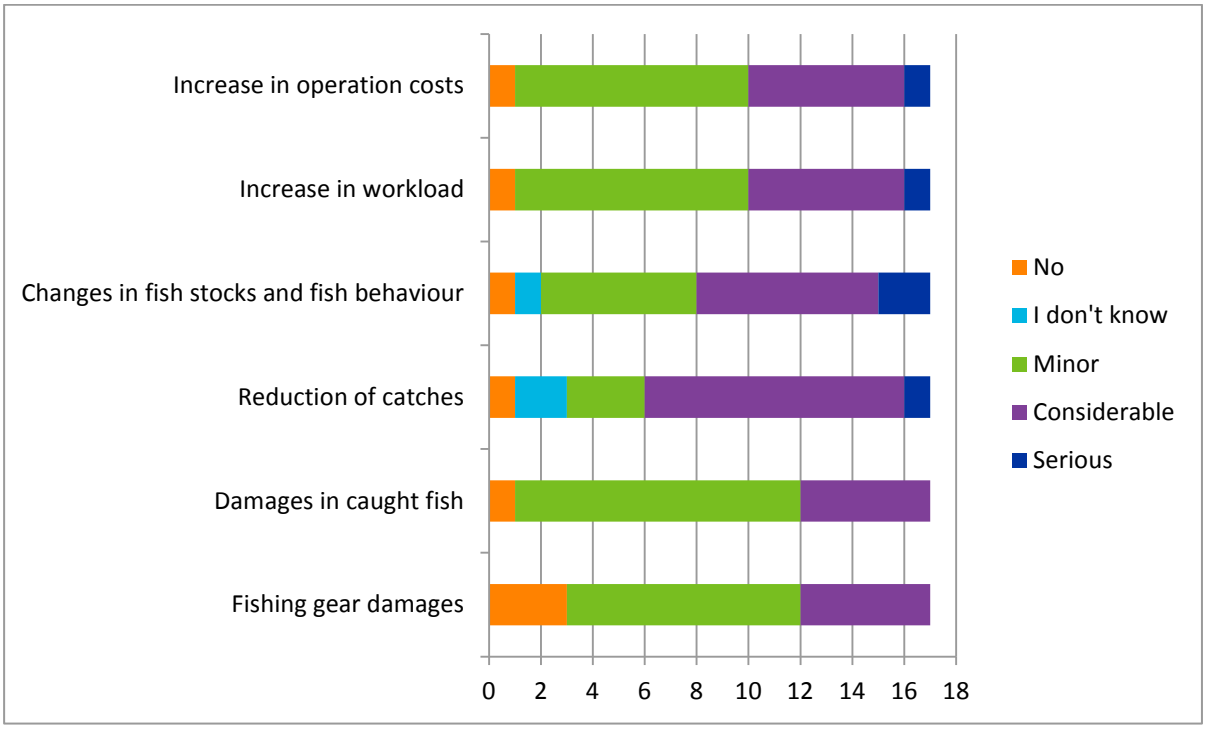
B. The gravity of seal induced impacts to the informant's fishing livelihood in Finland (n=90).



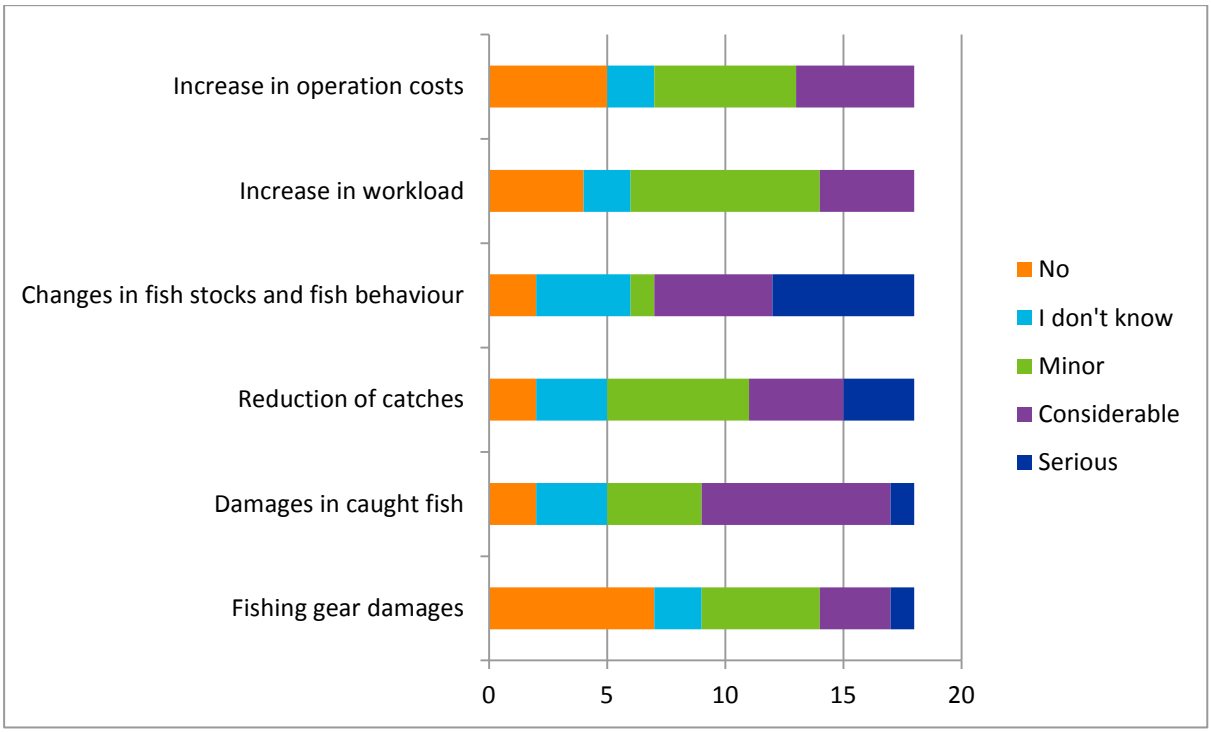
C. The gravity of seal induced impacts to the informant's fishing livelihood in Sweden (n=84).



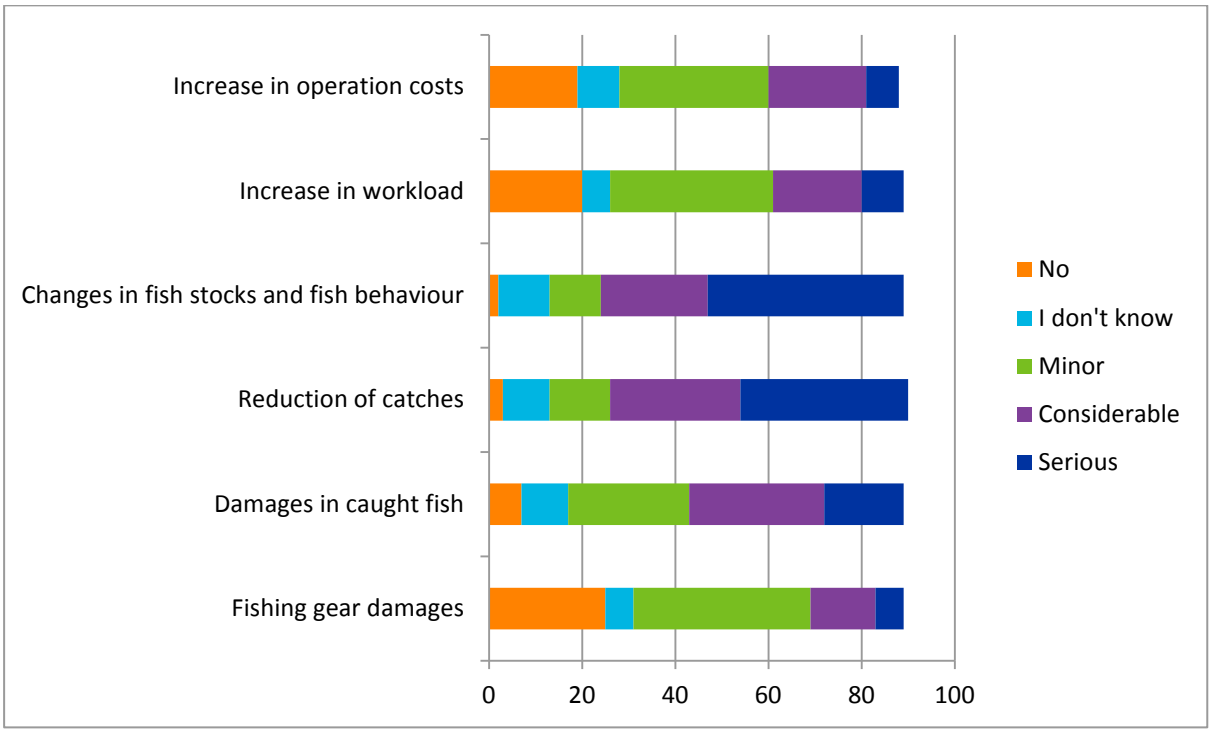
D. The gravity of seal induced impacts to the informant's fishing livelihood in Germany (n=17).



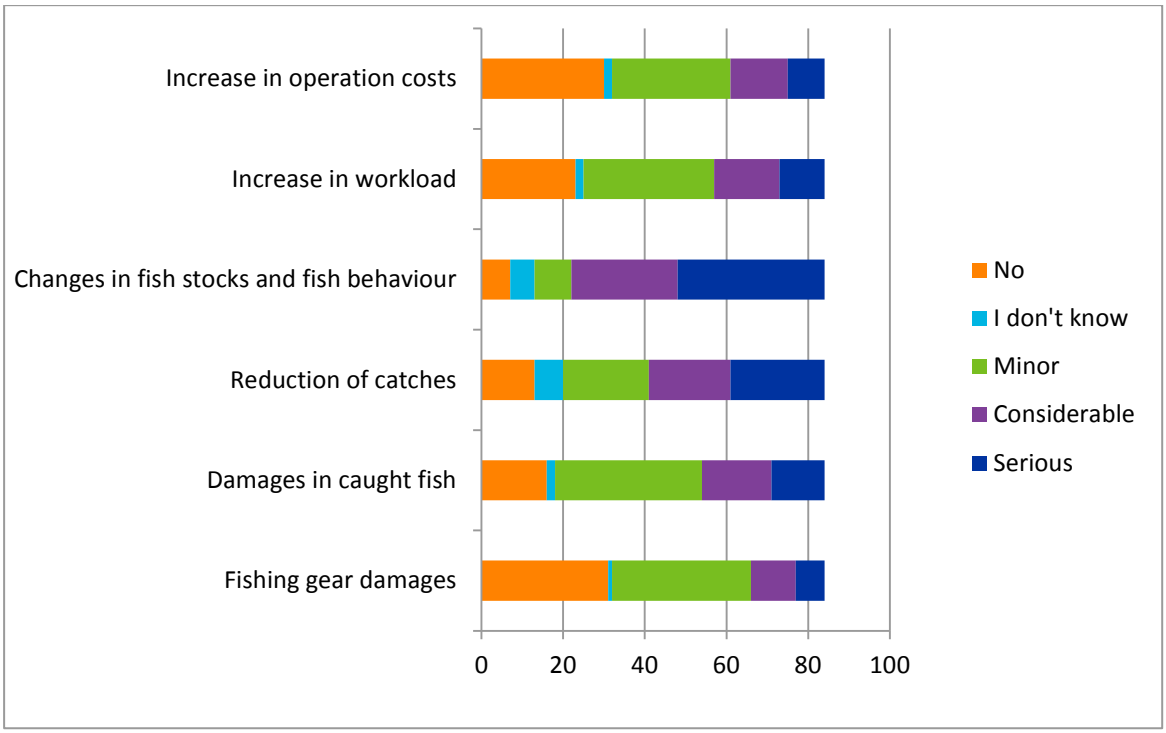
E. The gravity of cormorant induced impacts to the informant's fishing livelihood in Estonia (n=18).



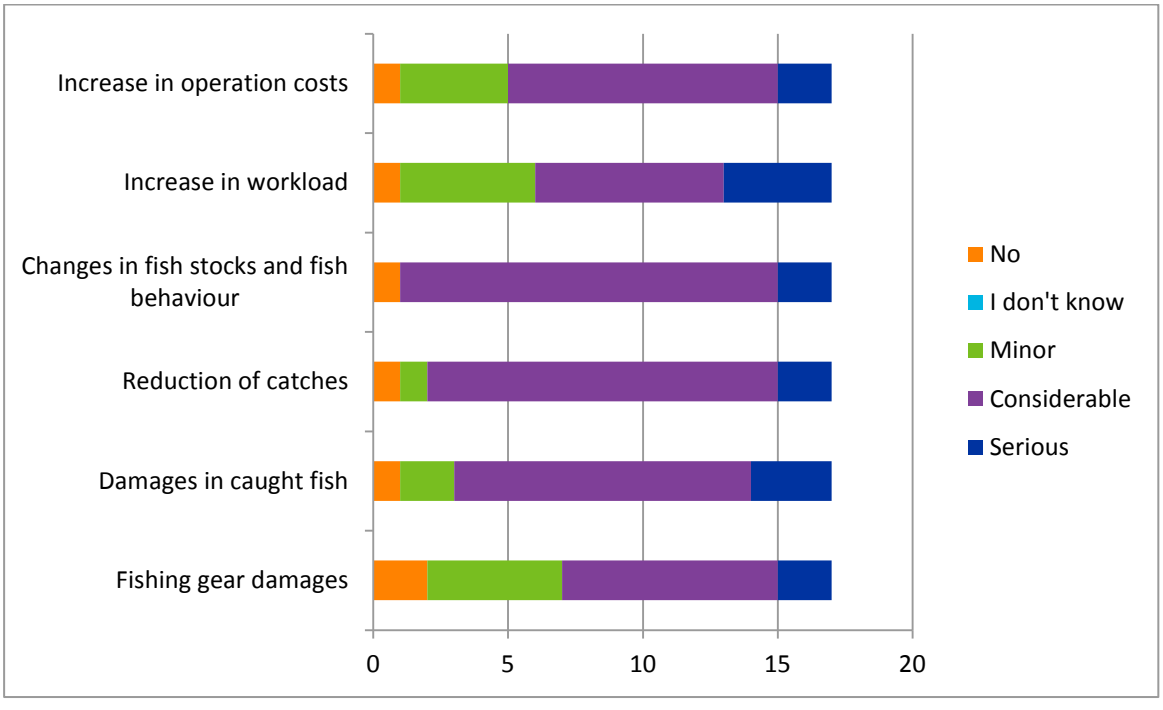
F. The gravity of cormorant induced impacts to the informant's fishing livelihood in Finland (n=89).



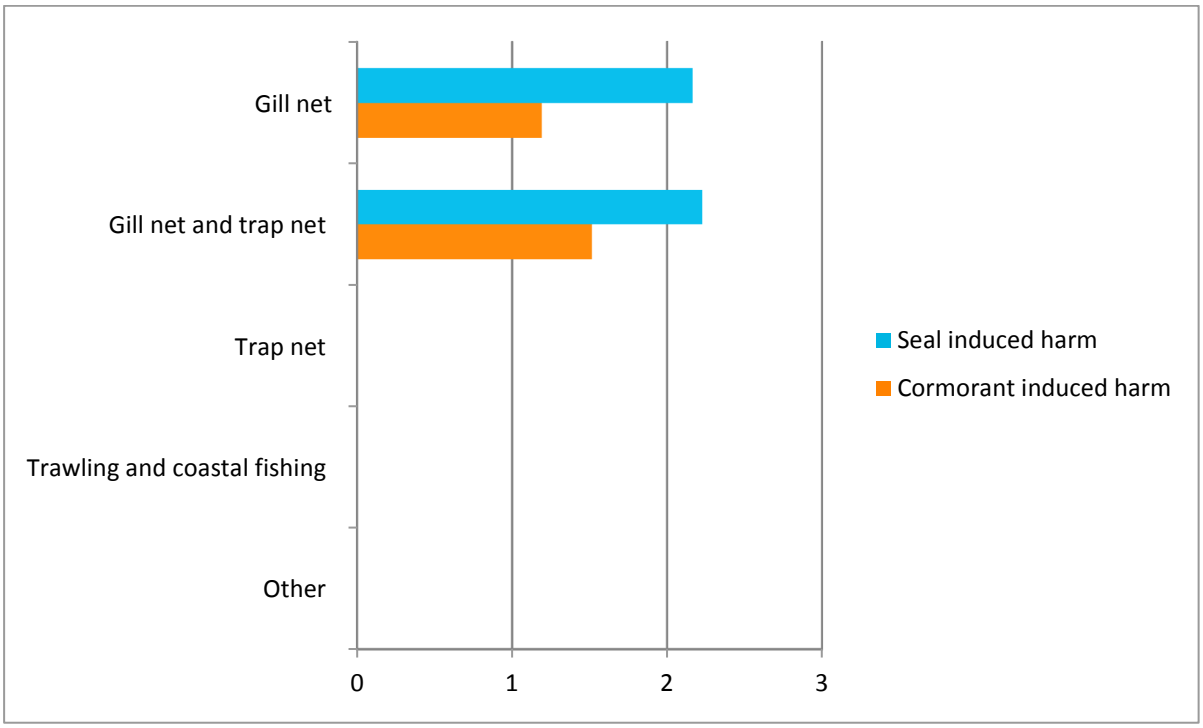
G. The gravity of cormorant induced impacts to the informant's fishing livelihood Sweden (n=84).



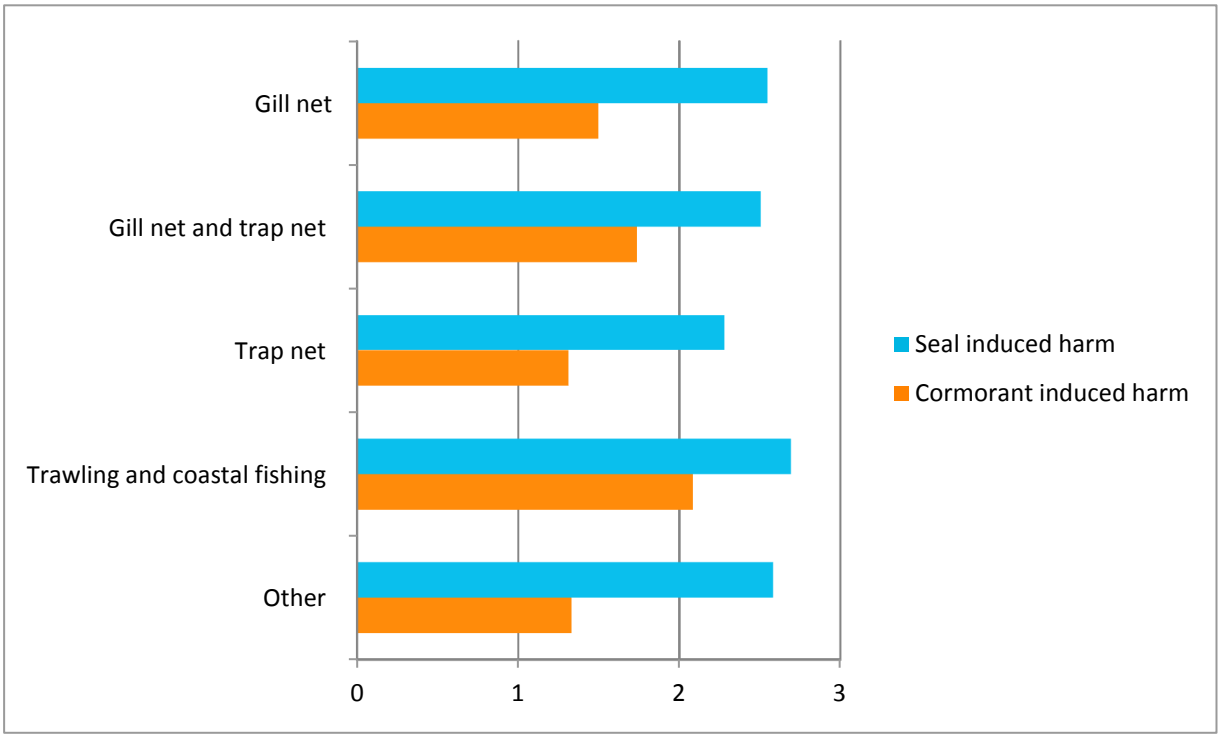
H. The gravity of cormorant induced impacts to the informant's fishing livelihood in Germany (n=17).



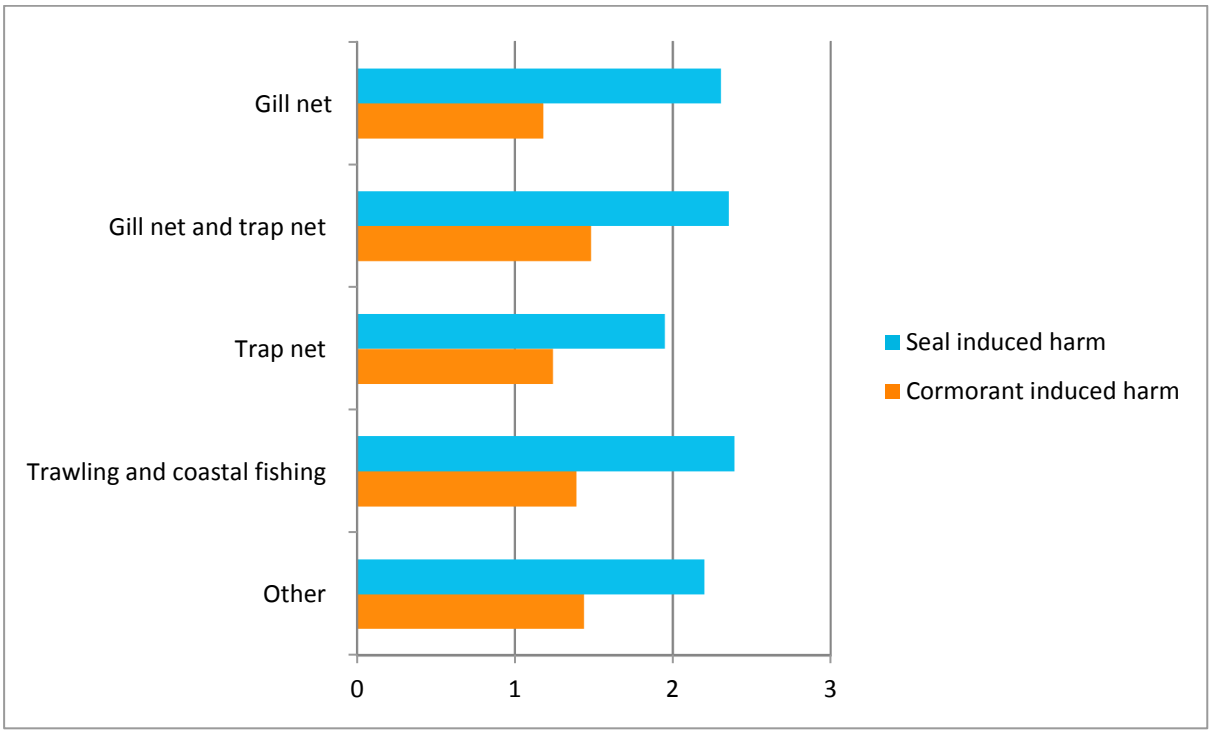
I. The average gravity levels of seal and cormorant induced impacts according to fishing strategies in Estonia. The indicator shows the average of six impact types (0=no, 1=minor, 2=considerable, 3=serious).



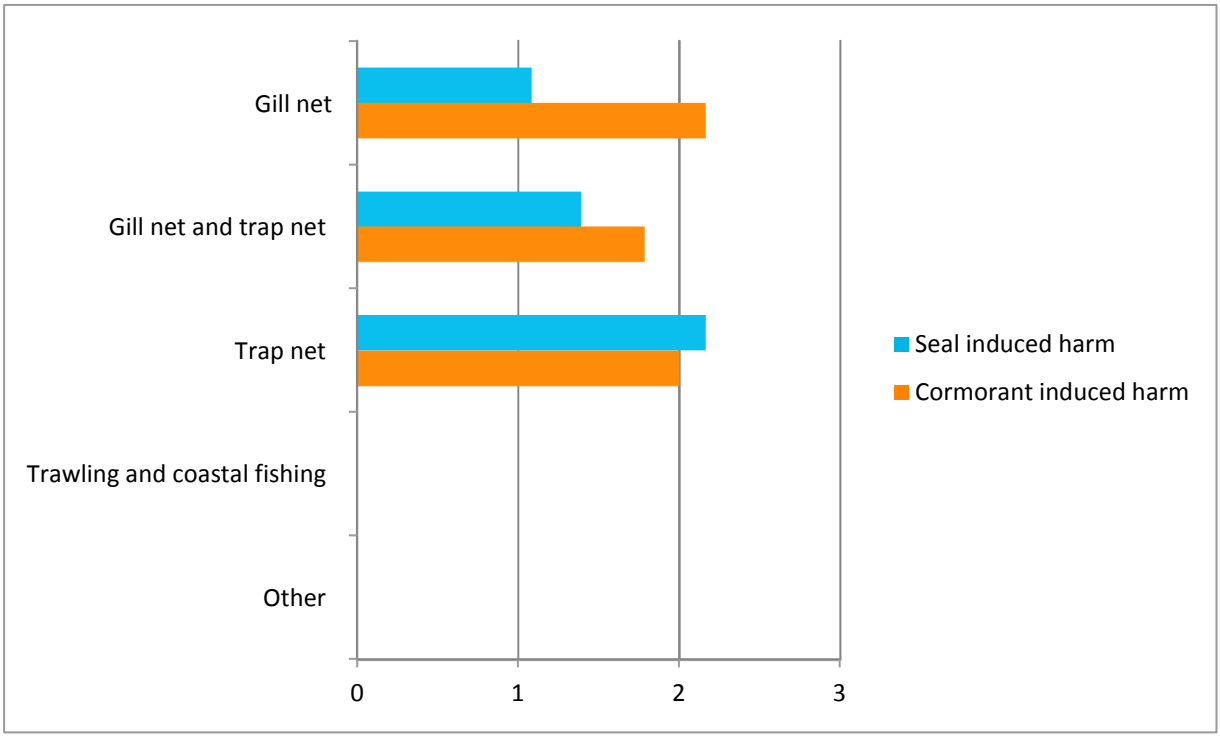
J. The average gravity levels of seal and cormorant induced impacts according to fishing strategies in Finland. The indicator shows the average of six impact types (0=no, 1=minor, 2=considerable, 3=serious).



K. The average gravity levels of seal and cormorant induced impacts according to fishing strategies in Sweden. The indicator shows the average of six impact types (0=no, 1=minor, 2=considerable, 3=serious).

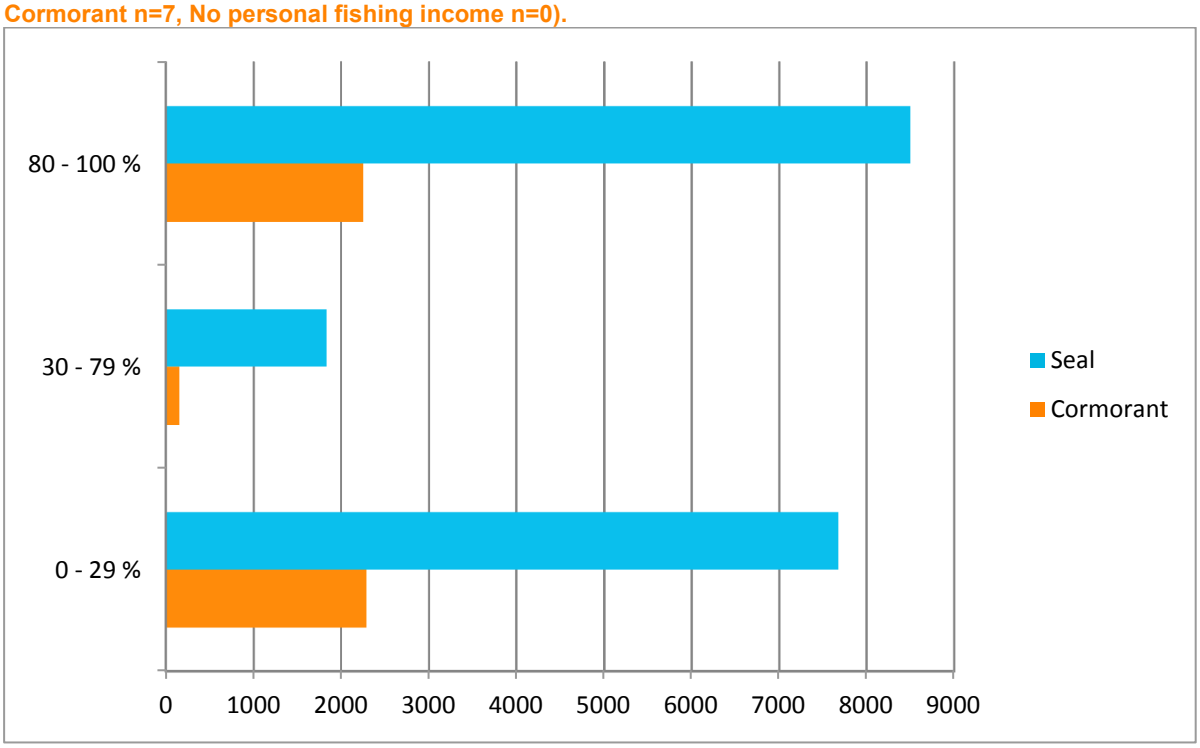


L. The average gravity levels of seal and cormorant induced impacts according to fishing strategies in Germany. The indicator shows the average of six impact types (0=no, 1=minor, 2=considerable, 3=serious).

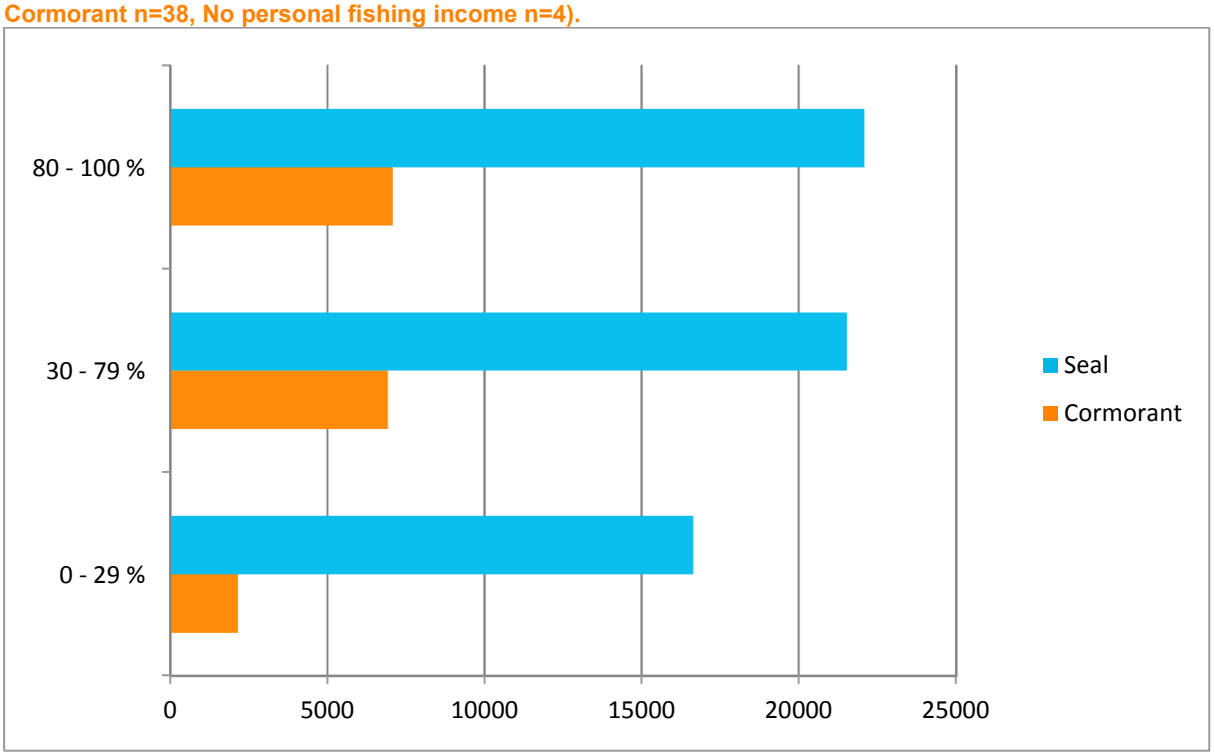


Appendix 6. Averages of the estimated seal and cormorant caused losses (EUR) on fishing livelihood in three classes according to the importance of fishing income.

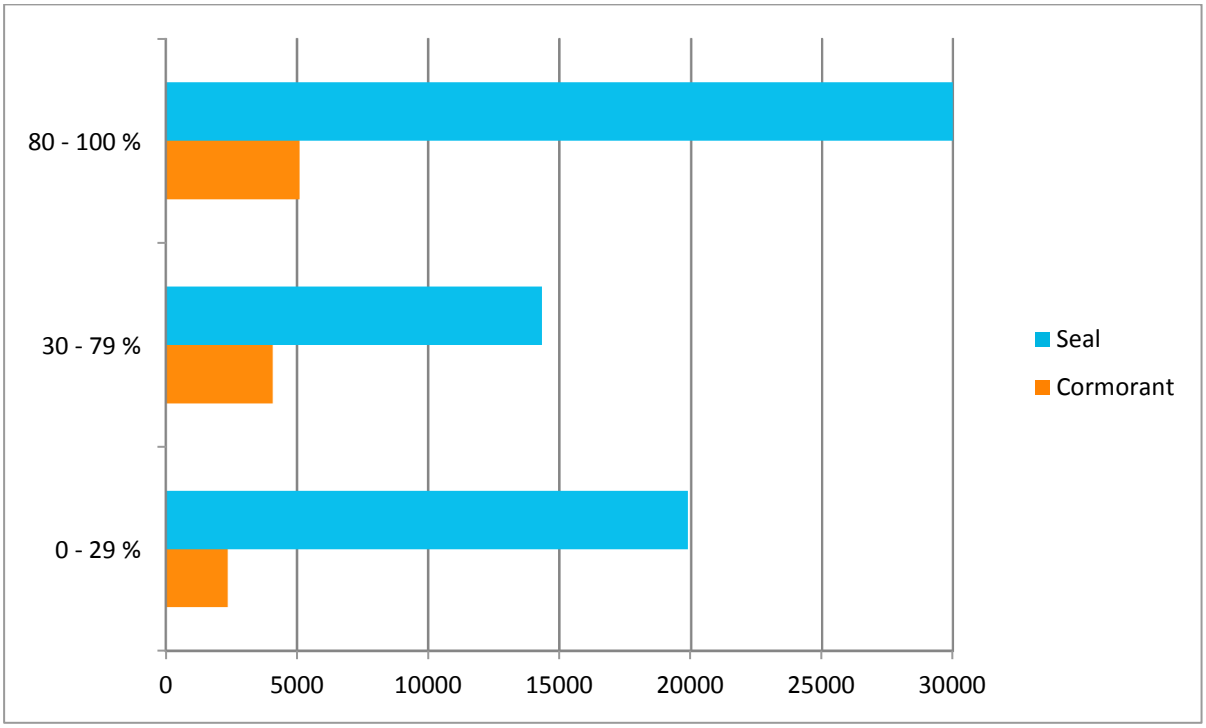
A. Estimate losses (EUR) caused on fishing livelihood in 2017 by seals and cormorants, based on the share of personal fishing income in Estonia (Seal n=15 and Cormorant n=11, No answer Seal n=3 and Cormorant n=7, No personal fishing income n=0).



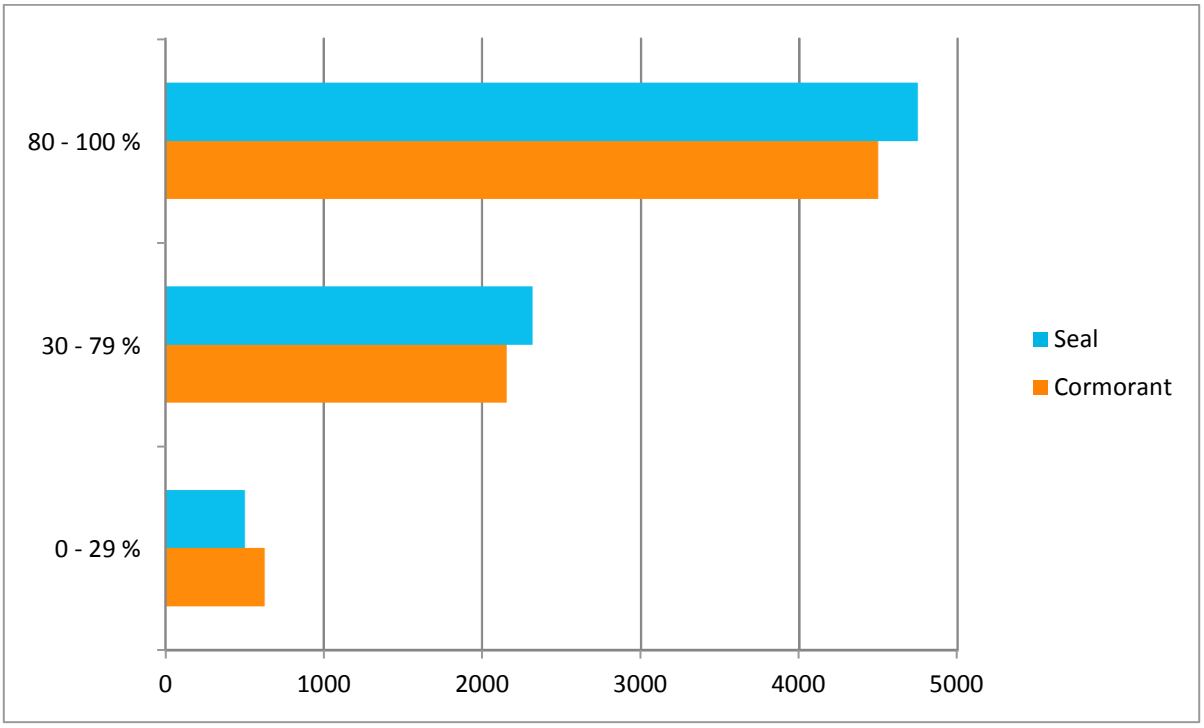
B. Estimate losses (EUR) caused on fishing livelihood in 2017 by seals and cormorants, based on the share of personal fishing income in Finland (Seal n=75 and Cormorant n=52, No answer Seal n=15 and Cormorant n=38, No personal fishing income n=4).



C. Estimate losses (EUR) caused on fishing livelihood in 2017 by seals and cormorants, based on the share of personal fishing income in Sweden (Seal n=66 and Cormorant n=33, No answer Seal n=14 and Cormorant n=42, No personal fishing income n=7).



D. Estimate losses (EUR) caused on fishing livelihood in 2017 by seals and cormorants, based on the share of personal fishing income in Germany (Seal n=15 and Cormorant n=16, No answer Seal n=2 and Cormorant n=1, No personal fishing income n=0).

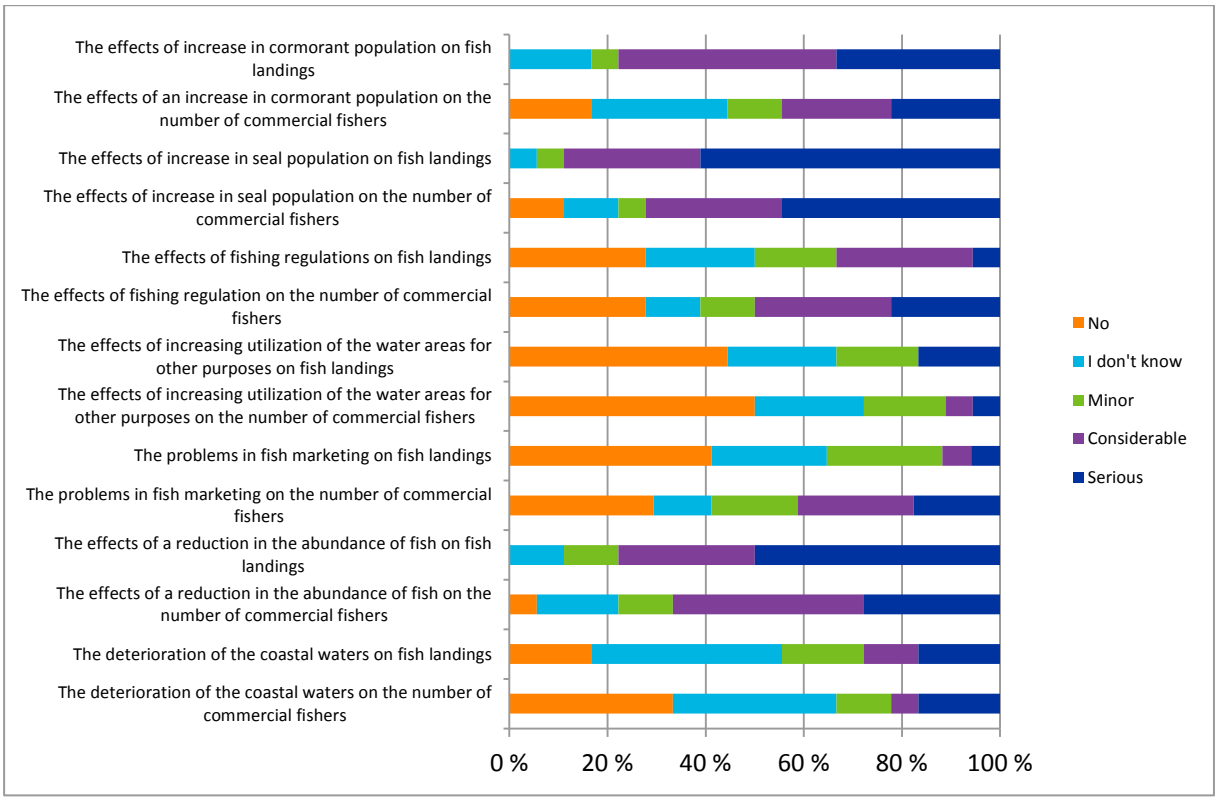


Appendix 7. Fishers' estimations of changes between 2000 and 2017 in the number of commercial fishers in their municipality or coastal community.

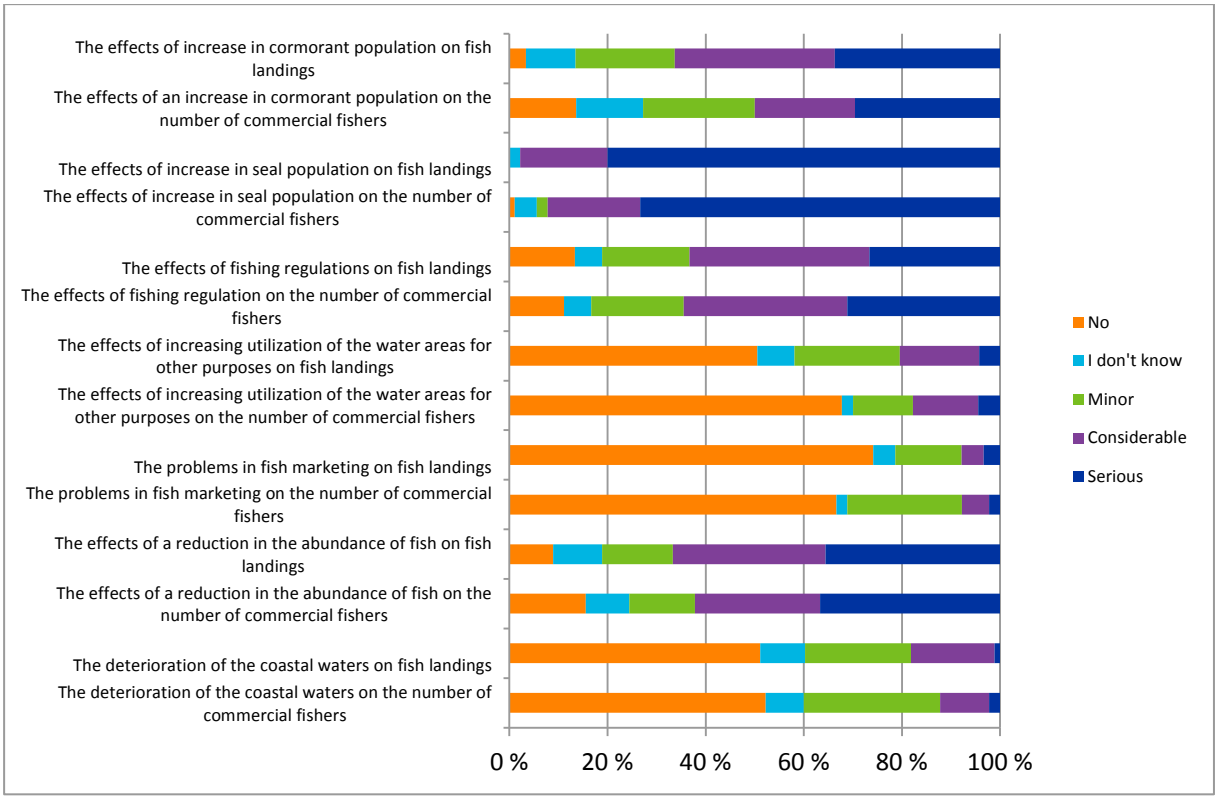
Study area	Estimated average amount of fishers 2000	Estimated average amount of fishers 2017	Changes in the regional averages of fishers between 2000 and 2017 (+ or -)	NA
FLAG Harju (Estonia)	26	17	-9 or 35%	3
South Finland FLAG ESKO (Finland)	15	4	-10 or 67%	2
FLAG Archipelago Sea in Finland (Finland)	15	6	-9 or 60%	7
FLAG Bothnian Sea and Lake Pyhäjärvi (Finland)	32	8	-24 or 75%	6
FLAG Ostrobothnia (Finland)	24	8	-13 or 54%	8
FLAG Coastal Bothnian Bay (Finland)	16	6	-10 or 63%	3
Leader Mittland Plus (Sweden)	108	73	-35 or 32%	4
Leader Gästrikebygden (Sweden)	10	6	-4 or 40%	1
Leader Stockholmsbygd (Sweden)	22	9	-14 or 64%	6
Leader Gute (Sweden)	35	10	-24 or 69%	4
Sydost Leader (Sweden)	94	18	-76 or 81%	1
Leader Sydöstra Skåne, Leader Nordsvästra Skåne med Öresund (Sweden)	17	5	-12 or 71%	3
FLAG West Mecklenburg Baltic Sea coast (Germany)	51	24	-24 or 53%	0

Appendix 8. Experienced changes in fishers' numbers and fish landings in fishers' municipalities or coastal areas.

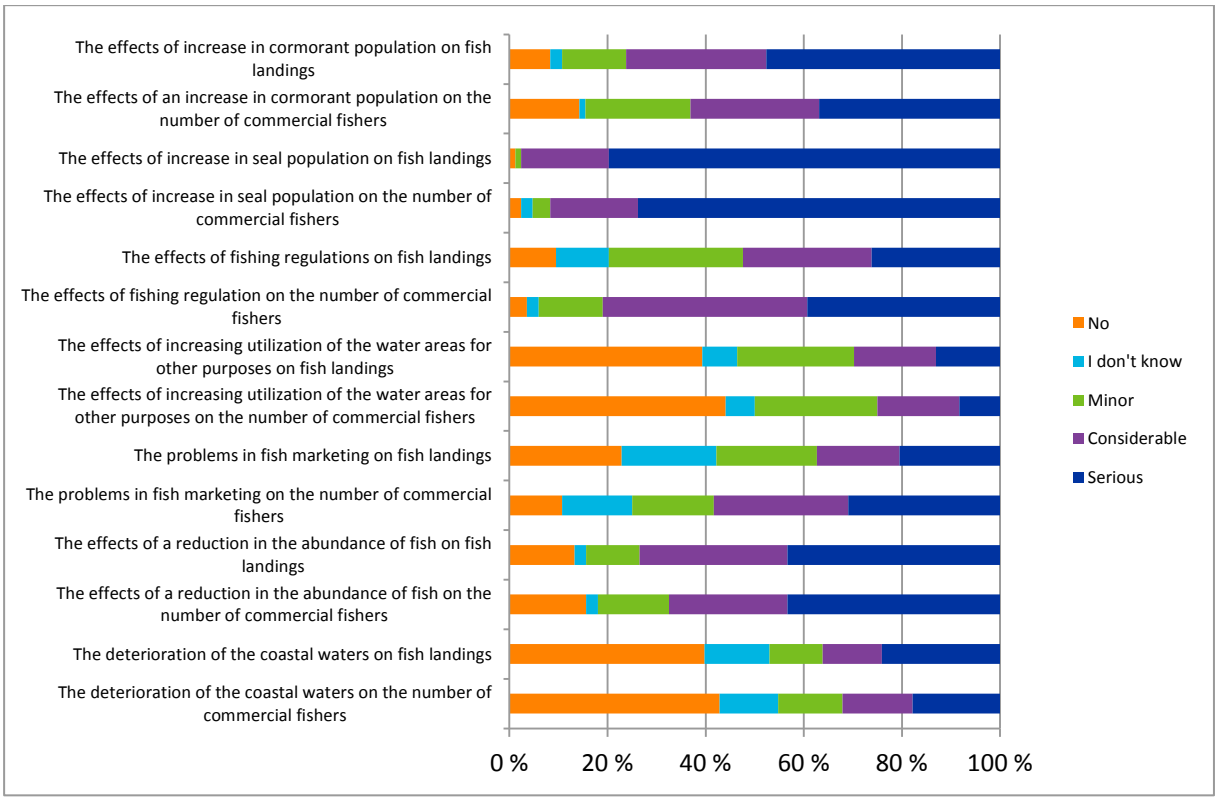
A. Reasons for the possible lowering of the fisher numbers and fish landings in Estonia.



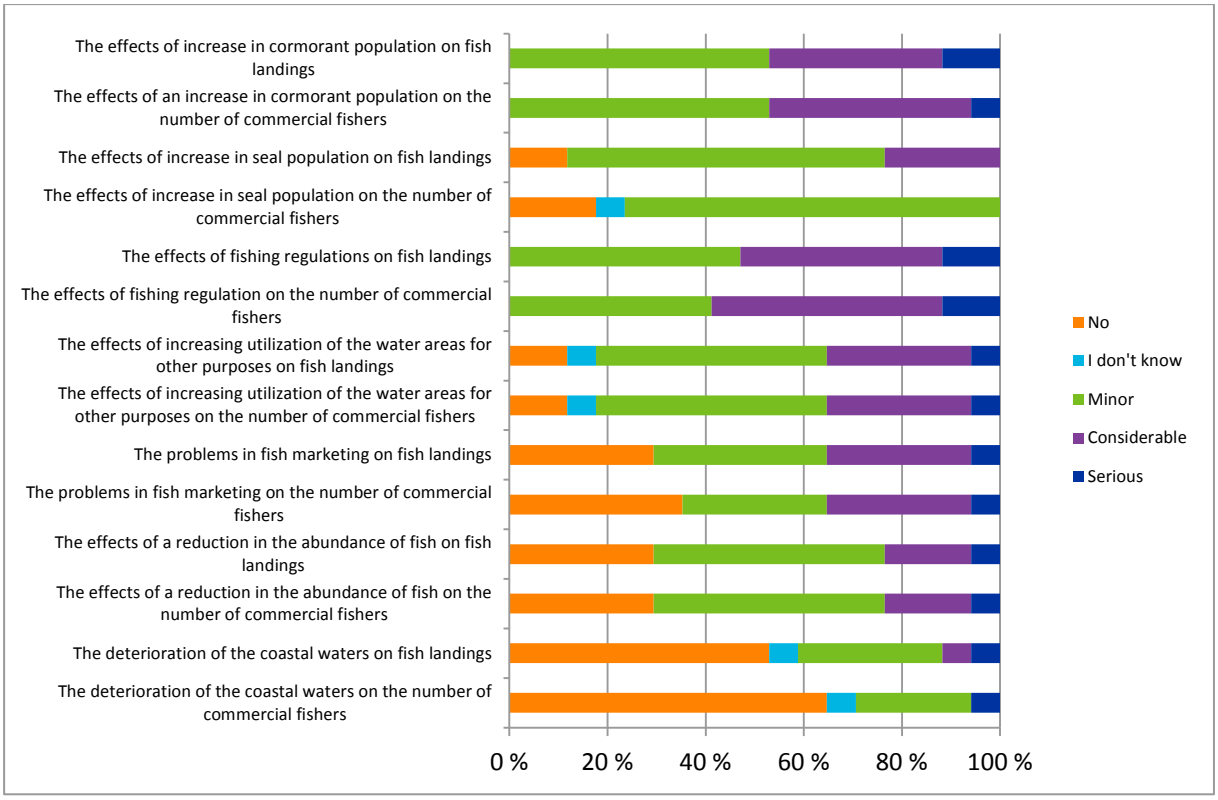
B. Reasons for the possible lowering of the fisher numbers and fish landings in Finland.



C. Reasons for the possible lowering of the fisher numbers and fish landings in Sweden.



D. Reasons for the possible lowering of the fisher numbers and fish landings in Germany.



Appendix 9. Most impacted fish species by seals and cormorants by study area.

A. Most important fish species and the reduction of landings in the fishers' municipality or coastal area caused by seals and cormorants in Estonia.

Estonia (n=15)	I	%	II and III
	whitefish Batlic salmon perch eel flounder sprat	23% 59% 95% 90% 70% 50%	whitefish Balticsalmon perch trout eel flounder sprat eelpout

B. Most important fish species and the reduction of landings in the fishers' municipality or coastal area caused by seals and cormorants in Finland.

	I	%	II and III
South Finland FLAG ESKO (n=12)	pike-perch Baltic salmon pike perch trout	84% 90% 90% 45% 75%	perch pike-perch Baltic salmon trout European whitefish pike flounder
FLAG Coastal Bothnian Bay (n=16)	European whitefish Baltic salmon vendace	67% 43% 50%	Baltic salmon trout vendace European whitefish vendace perch
FLAG Archipelago Sea in Finland (n=10)	pike-perch European whitefish Baltic herring	72% 90% 10%	perch burbot European whitefish pike-perch pike bream Baltic herring flounder
FLAG Bothnian Sea and Lake Pyhäjärvi (n=14)	pike-perch European whitefish Baltic salmon perch	63% 79% 70% 75%	perch European whitefish pike-perch Baltic herring Baltic salmon burbot trout
FLAG Ostrobothnia (n=18)	European whitefish Baltic salmon pike perch trout	52% 50% 60% 65% 50%	perch European whitefish Baltic salmon burbot pike-perch Baltic herring

C. Most important fish species and the reduction of landings in the fishers' municipality or coastal area caused by seals and cormorants in Sweden.

	I	%	II and III
LAG Leader Stock-holmsbygd (n=19)	European whitefish perch Baltic herring eel cod	71% 75% 70% 80% 78%	pike-perch European whitefish Baltic salmon pike perch Baltic herring eel cod flounder turbot
Sydost Leader (n=15)	European whitefish pike cod flounder	50% 90% 82% 90%	European whitefish perch eel cod flounder turbot
Leader Mittland Plus (n=1)	Baltic salmon	50%	
Leader Gästrike-bygden (n=17)	European whitefish Baltic salmon perch Baltic herring burbot	62% 35% 50% 53% 90%	European whitefish Baltic salmon pike perch Baltic herring
Leader Sydöstra Skåne OCH Leader Nord-västra Skåne med Öresund (n=11)	cod	58%	trout eel flounder turbot plaice herring
Leader Gute (n=6)	perch cod turbot	81% 69% 65%	pike cod flounder turbot

D. Most important fish species and the reduction of landings in the fishers' municipality or coastal area caused by seals and cormorants in Germany.

Germany (n=14)	I	%	II and III
	Baltic salmon perch Baltic herring eel cod flounder eelpout mackerel	65% 100% 50% 33% 20% 80% 50% 20%	Baltic herring eel cod plaice mackerel

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