Ecosystem Services Offered by Flads

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Abstract

Flads are coastal lagoons unique for the Baltic Sea. They are desired environments for leisure in Kvarken, which can be identified from the small amount of pristine areas that are left. Landowners play a key role in managing these environments. In this study I investigate how landowners recognize and assess ecosystem services provided by flads. Due to the high utilization rate of these areas the question emerges, are landowners familiar of the elementary and specific ecosystem services that flads produce.

Landowners knowledge base and assessment of ecosystem services was surveyed with a questionnaire based on the Common International Classification of Ecosystem Services (CICES).The survey questions were divided in two parts relating to a specific ecosystem service, first question examined whether the landowners were familiar of a certain ecosystem service offered by flads, in the second part they were asked to assess the importance of the service.

The results show that most landowners are familiar with ecosystem services offered by flads and half of them appreciate them highly, but the results are in a clear controversy with actual data considering land-use in these fragile environments. Only 21 % of the flads in Kvarken are in pristine condition and without any human pressures. Although landowners clearly recognize most of the services offered by flads, and value them quite highly land use rates indicate the opposite. It seems clear, that personal interests overrule ecological ones in every perspective.

Language: English Key words: Kvarken, ecosystem services, flad, Common International Classification of Ecosystem Services (CICES), stakeholder, landowner

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EXAMENSARBETE

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Abstrakt

Flador, eller grunda havsvikar, är unika för Östersjön. I Kvarken uppskattas de som rekreationsområden, vilket kan identifieras genom det lilla antalet naturenliga flador som finns kvar. Markägare spelar en stor roll i förvaltning om dessa områden. I denna avhandling undersöker jag markägarnas kännedom och värdesättning av ekosystemtjänster som produceras av flador. På grund av den höga användningen av dessa områden uppstår frågan, känner markägare de essentiella och specifika ekosystemtjänster som flador producerar?

Markägarnas kännedom och värdering av ekosystemtjänster undersöktes med hjälp av en enkät som baserade sig på CICES (Common International Classification of Ecosystem Services. Enkäten bestod av två frågor angående varje ekosystemtjänst som identifierats I flador, första frågan utredde om tjänsten var bekant och I den andra frågan skulle denna tjänst värdesättas.

Resultaten visar att största delen av markägarna känner de ekosystemtjänster som produceras av flador och hälften av dem uppskattar dem även högt, men resultaten är i direkt motsats med data angående markanvändning i dessa sköra områden. Endast 21% av Kvarkens flador är opåverkade av människor. Fastän markägare känner de ekosystemtjänster som produceras och även uppskattar dem indikerar markanvändningen något annat. Det är tydligt, att personliga intressen har större vikt än ekologiska.

Språk: Engelska Nyckelord: Kvarken, ekosystemtjänster, flador, Common International Classification of Ecosystem Services (CICES), markägare

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Language: English Key words: Kvarken, ecosystem services, flad, Common International Classification of Ecosystem Services (CICES), stakeholder, landowner

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1 Introduction

1.1 Degradation of ecosystems

Loss of species and habitats has increased during the Anthropocene (Steffen et al. 2011, Dirzo et al. 2014, Johnson et al. 2017). The largest threats causing extinction in marine environments are habitat loss and exploitation (Dulvy et al. 2003). Both can be hard to perceive locally and might appear as a decreased abundance of species. These, sometimes seemingly small, changes can have large impacts on our daily life, since their value and direct contribution might be unfamiliar. Natural products are easy to value if they have an established market. Resources such as fish, food or water have a market value and follow the laws of supply and demand. The value of nature and its contribution for humans can be hard to recognize, especially, if these values have no market. Human wellbeing is dependent of less visible resources that impact our daily life. Some of these resources are often taken for granted and are not recognized as such.

The most adapted way of bringing these values to life are ecosystem services, defined as "*the functions and products of ecosystems that benefit humans, or yield welfare to society*" (Board M.A .2005). According to The Economics of Ecosystems and Biodiversity (TEEB), ecosystem services are the direct and indirect contributions of ecosystems to human well-being. They can be categorized in four main types: provisioning, regulating, habitat and cultural services. Most ecosystem services depend on complex ecological linkages (Palumbi et al. 2009, 206). Ecosystem services are the activities or functions that provide humans values, such as production of fish. Ecosystem goods are the products that these functions provide, in the previous case fish, often these two get mixed and are both called ecosystem services (Bryhn et al. 2015, 13). They can also be called ecosystem-bundles meaning that one service often occurs meanwhile it is connected to another service. This also means that if the use of a service increases, it leads to the decrease of another service, a so-called trade-off.

The European Union's Biodiversity Strategy has stated the mapping and assessment of ecosystem services as one of its main action (Action 5). The aim of this action is "*halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss*" (the European Union). Mapping and Assessment of Ecosystems and their Services (MAES) was created to help with the execution of Action 5.

Globally, 60% of ecosystem services are degraded (Board M.A. 2005). The need for nature conservation has emerged as the use of natural resources has increased and the destruction of important habitats has proceeded. Conserving nature is often associated with conflicts. Areas with high nature values can be privately owned and landowners fear that they will not be able to use their land if it is protected. Nieminen (1999) studied the Finnish shoreline protection and several of the interviewees had a traditional and emotional bondage to their land and thought that the Government was insulting their basic values in their aim to protect these areas.

People do not usually object conserving biodiversity, providing it does not crash with personal or institutional goals (Young et al. 2005,1652). People's attitude towards conservation also depends on their identity (Nieminen 1999, 185).

Global targets, such as the Aichi biodiversity targets aim to stop the degradation of biodiversity. The European Union uses the Birds and Habitats Directive as the solid ground for the Natura 2000 network, and EU wide network of protected areas covering 18% of the EU land area and protecting sea (EU homepage, The EU's protected areas – Natura 2000). The acceptance of new environmental protection programs has been considerably low in EU countries, especially new member states (Grodzinska-Jurczak & Cent 2010, 11). In Finland, the national environment agencies received almost 15 000 complaints of the Natura 2000 program (Hiedanpää 2002, 113) and the establishment of nature conservation areas on private lands met strong opposition (Paloniemi & Vilja 2009, 88).

Young et al. (2005,1653) state that Natura 2000 is often a mixed blessing, with the potential to both resolve nature conservation conflicts and to cause social conflicts. The well-intentioned actions from the environmental administration disturb locals and the changes can be understood as harmful or immoral (Hiedanpää 2002, 122).

The implementation of the Natura 2000 areas in Finland has left plenty of scars, which does not facilitate the co-operation between nature conservation and private persons. "*During the first years of the implementation of Natura 2000, conflicts occurred between environmental authorities and local landowners, because decisions about which areas to include in the Natura 2000 network were quickly made and did not always convince the local actors*" (Björkell 2008, 110). In some cases, also the right of private ownership of land and water has been claimed to be endangered because of the Natura 2000 program (Li et al. 2004, 3).

1.2 Flads and their ecological significance

Kvarken, the narrow and shallow sea area between Ostrobothnia in Finland and Västerbotten in Sweden, is defined by its land uplift process, 8 mm $year^{-1}$, resulting in constantly changing landscapes. The land uplift process gives Kvarken its unique features but also creates unique habitats, i.e., flads that cannot be found as such elsewhere in the Baltic Sea. Because of these features caused by the ice age and others that can be seen in the landscape, such as de Geer moreens etc., Kvarken has been given the status of UNESCO World Heritage Natural World Heritage Site. Flads are shallow coastal inlets separated by a threshold from the surrounding sea. Flads are prioritized Natura 2000 habitats (nature type 1150, lagoons) and in Finland they are also protected by the Water Act when in natural state and <10 ha. There are approximately 2500 flads in Kvarken (Mikkola et al. 2020, in press). Flads are divided into different stages depending on how much they have been separated from the sea (Munsterhjelm 1997). Flads however have already been described in the beginning of the 20th century by Häyren (1900).

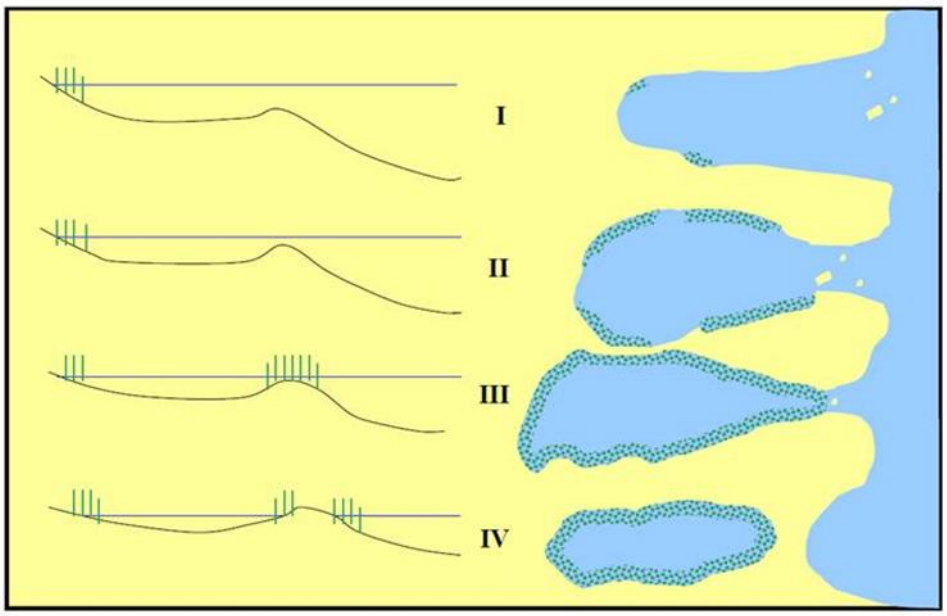

Figure 1. Division of flads into different types (Munsterhjelm 1997)

A juvenile flad is the first stage of a flad (figure 1, I) where a small threshold has emerged at the inlet of the lagoon, but it does not affect the water exchange with the surrounding sea. The second stage (figure 1, II) of the succession is called flad. Due to the land uplift process the threshold has emerged relatively close to the surface and has started to limit the water exchange with the surrounding sea, often the inlet itself has also become narrower, the water temperature in the spring is usually warmer than in the surrounding sea areas. Gloeflad (figure 1, III) is a stage where the threshold often is above sea surface level and is very often occupied by vegetation. The water exchange is very limited at this stage and the water temperature is remarkably higher in spring than in surrounding sea areas. At the last stage (figure 1, IV), the gloe stage, water can only enter the flad at hard storms and époques of very high sea surface. The last stage, which is not mentioned in figure 1 is the gloelake stage where the flad has totally been cut off from the sea and has no saltwater input anymore, usually when it reaches >1,3meters over sea surface. These sheltered and warm areas provide unique habitats for different kind of animals, such as fish, birds, insects and bats and form very biodiverse, but also necessary areas for the local species for their reproduction.

The different flad stages result in different bottom substrate types, differences in dominant vegetation types (Mikkola et al. 2020, in press) but some of them are also preferred as spawning areas for fish. In the outer archipelago especially the latest stages, gloes, are preferable spawning areas, according to unpublished information retrieved from the Kvarken Flada project, since they are significantly warmer in the spring than other areas Fish are also dependent from the amount of vegetation and a study made by Hansen et al. (2019) demonstrated that a high amount of vegetation results in a high amount of fish. The vegetation in flads offer protection against predation (Saarinen 2019, 8) but vegetation also plays a part in reducing the effects of the global climate change when the plants take up carbon dioxide during photosynthesis (McLeod et al., 2011)

Coastal waters provide a wide range of services but are under intensive human use (Schernewski et al 2018). Special features of flads, such as their tranquillity and accessibility, make them desired environments for free time activities such as boating, hunting, fishing and leisure, 79% of them are affected by humans (Mikkola et al. 2020, in press).

1.3 Aim of the study

Flads are desired areas for leisure and provide sheltered areas for boats and summer cottages. Land use in flads is very high (Saarinen, 2019) and destructive activities common. Because of this the question arose, if local landowners don't recognize ecosystem services that flads provide and what their significance is for several local species.

The purpose of this study is to find out if landowners are familiar with the ecosystem services that flads provide and how they assess them. Ecosystem services offered by flads were investigated within the Kvarken Flada project. With time and substantial information gathering about land use in flads and different ecosystem services provided in them the need for a local perspective increased. As there was no time within the project to study the perception of landowners and ecosystem services, was this done thru this master's thesis.

2 Material and methods

2.1 Interreg Botnia-Atlantica Project Kvarken Flada

Kvarken Flada is an Interreg Botnia-Atlantica project conducted between 2016 and 2020 in Ostrobothnia in Finland and Västerbotten in Sweden. Lead partner is Parks & Wildlife Finland and main partners Natural Resources Institute Finland, Centre for Economic Development, Transport and the Environment South Ostrobothnia and the County Administrative Board Västerbotten. The aim of the project was to preserve the biodiversity of flads and the ecosystem services provided by them with special focus on fish. Especially the archipelago of Kvarken and its flads are under human pressure, which leads to a knowledge demand of these valuable habitats. The project also aims to produce knowledge and material for decision makers and planners to facilitate their work.

2.2 Definition

As I refer in this thesis to the word flad it encases all four development stages as described in Munsterhjelm 1997. These are juvenile flad, flad, gloe-flads and gloe.

2.3 Respondents and study area

The questionnaire targeted landowners and residents in proximity to flads surveyed within the Kvarken Flada project in Ostrobothnia, Finland and in Västerbotten, Sweden during 2017-2019.

In Ostrobothnia 12 village common chairs were contacted between February and April 2019 and the webropol link distributed via them to members of the association. The survey was also distributed personally at three commons meetings by the author.

The survey targeted 200 cottage owners in Västerbotten. The properties are located next to flads that were surveyed during the Kvarken Flada project. The questionnaire was also distributed at a nature guiding event 11 May 2019 at a flad in Västerbotten.

The areas in which respondents own land are partially within the Natura 2000 network.

2.4 Survey

The questionnaire was based on the ecosystem services identified for flads in the Kvarken region by the Kvarken Flada project. It based on a preliminary identification of ecosystem services provided by flads, which was conducted in the beginning of 2019 with the help of local experts from the Kvarken region (Finland and Sweden) in the field of marine biology. The survey is based on CICES (Common International Qualification of Ecosystem Services); see further details in chapter 2.5. The respondents were able to answer the questions anonymously as no information of their names were gathered. The survey was divided in two parts. In the first part, background information of respondents such as age, gender and background

knowledge of flads was collected. The second part consisted of two types of questions: the first type of question was related to a precise ecosystem service and the respondent was asked if he/she is familiar with the service (Yes/No). If the respondent was familiar with the service, he or she was asked to value the service on a Likert scale from 1-5.

Likert scale

1 - Very important

2 - Important

3 - Moderately important

4 - Of little importance

5 - Unimportant

The questionnaire was designed according to the specific understanding that the concept of ecosystem services was not needed. The questionnaire was made as a Webropol survey (www.webropol.fi) (see appendix 1), no reminder of the webropol survey was sent to the recipients. The survey was anonymous.

The survey consisted of the questions in table 1.

Table 1. Survey questions

Gender
Age
Municipality
Did you know the meaning of the concept of flads?
Did you know how flads emerge?
Did you know that they are important spawning areas for fish?
Do you visit flads?
How often do you visit them?
What is the purpose of your visit?
Do you think they are good areas for sea buckthorn?
Do you think flads influence commercial fisheries?
Do you think that vegetation and animals can function as natural water treatment plants?
Do you think that the restricted water exchange makes the water heat up sooner in the spring and therefore offer better chances of survival for fish larvae?
Do you think that the vegetation contributes to clearer waters?
Do you think flads diminish eutrophication outside of flads?

Do you think that he lower salinity probably favour appearance and recruitment of fish?
Do you think flads are important carbon sinks?
Do you think flads affect positively human wellbeing due to active visits on site?
What kind of activities do you undertake?
Do you think flads affect positively human wellbeing due to passive visits on site?
What kind of passive activities do you do?
Do you think scientific studies increase the knowledge of flads?
Do you think flads can be used within environmental education?
Do you think flads have a significance as cultural heritage?
Do you think flads offer positive aesthetic experiences?
Do you think flads are important landscape elements?
Do you think flads make an important part of the local landscape?
Do you think flads are something that should be preserved for future generations?

2.5 CICES, Common International Qualification System of Ecosystem Services

CICES has been created to support evidence-based policy making to review and transfer knowledge to different situations in ways that are clear and unambiguous (Haines-Young & Potschin-Young 2018, 2). It was created by work lead from the European Environment Agency from the work on ecosystem accounting. After its first release in 2013, it has broadly been used in research concerning ecosystem services, their identification and communication (Czúcz et al. 2018, 147).

Table 2. Structure of Common International Qualification System of Ecosystem Services (CICES), including section, division, group, class and code.

Section	Division	Group	Class	Code
Provisioning (Biotic)	Biomass	Wild plants (terrestrial and aquatic) for nutrition, materials or energy	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	1.1.5.1
Provisioning (Biotic)	Biomass	Wild animals (terrestrial and aquatic) for nutrition, materials or energy	Wild animals (terrestrial and aquatic) used for nutritional purposes	1.1.6.1
Regulation & Maintenance (Biotic)	Transformation of biochemical or physical inputs to ecosystems	Mediation of wastes or toxic substances of anthropogenic origin by living processes	Bio-remediation by micro-organisms, algae, plants, and animals	2.1.1.1
Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Regulation of baseline flows and extreme events	Buffering and attenuation of mass movement	2.2.1.2
Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Regulation of baseline flows and extreme events	Hydrological cycle and water flow regulation (Including flood control, and coastal protection)	2.2.1.3
Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Maintaining nursery populations and habitats (Including gene pool protection)	2.2.2.3
Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Water conditions	Regulation of the chemical condition of freshwaters by living processes	2.2.5.1
Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Water conditions	Regulation of the chemical condition of salt waters by living processes	2.2.5.2

Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Atmospheric composition and conditions	Regulation of chemical composition of atmosphere and oceans	2.2.6.1
Section	**Division**	**Group**	**Class**	**Code**
Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Physical and experiential interactions with natural environment	Characteristics of living systems that that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	3.1.1.1
Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Physical and experiential interactions with natural environment	Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions	3.1.1.2
Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Intellectual and representative interactions with natural environment	Characteristics of living systems that enable scientific investigation or the creation of traditional ecological knowledge	3.1.2.1
Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Intellectual and representative interactions with natural environment	Characteristics of living systems that enable education and training	3.1.2.2
Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Intellectual and representative interactions with natural environment	Characteristics of living systems that are resonant in terms of culture or heritage	3.1.2.3

Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Intellectual and representative interactions with natural environment	Characteristics of living systems that enable aesthetic experiences	3.1.2.4
Section	**Division**	**Group**	**Class**	**Code**
Cultural (Biotic)	Indirect, remote, often indoor interactions with living systems that do not require presence in the environmental setting	Other biotic characteristics that have a non-use value	Characteristics or features of living systems that have an existence value	3.2.2.1
Cultural (Biotic)	Indirect, remote, often indoor interactions with living systems that do not require presence in the environmental setting	Other biotic characteristics that have a non-use value	Characteristics or features of living systems that have an option or bequest value	3.2.2.2

CICES is divided in three main sections: provisioning, regulation, maintenance and cultural services. It combines regulation and maintenance in one service instead of considering them separately. It is a hierarchical structure stating from large sections entering to smaller scales such as divisions, groups and classes. This structure enables the users to define the level of necessary detail (Czúcz et al. 2018, 147). The base for this thesis lies on the current CICES version, 5.1, which was published in January 2018. The spreadsheet and guidelines can be downloaded at https://cices.eu/resources/.

2.6 Statistical analyses

Statistical significance was determined with a binomial proportion test conducted using free software R version 3.4.3 (R Core Team, 2013). The method was applied for the questions allowing a Yes/No answer. $P < 0.05$ was considered significant.

3 Results

In total 35 answers were received. Five replies were received from Sweden, two from cottage owners and three from participants at the nature guiding event. In Finland two replies were received via the webropol online survey and 28 from participants at three different common meetings. One questionnaire response was deleted from the material since the respondent had clearly misunderstood the questions.

The average age of the respondents was 56 years and 94% of the respondents were male. The word flad was unfamiliar for 16 % of the respondents. Approximately the same proportion (15%) did not know the geological background of their origin. The major part of the respondents (94%) knew that the flads are important spawning areas for fish. One fifth of the respondents said they regularly visit flads.

3.1 Provisioning services

Stakeholder's knowledge of provisioning services in flads are shown in table 3. No significant difference was found in the answers considering whether flads as suitable areas for plants used for nutrition, whereas a significant amount of the respondents thought that flads produce fish for nutritional purposes.

Table 3. Statistical analyses of the results of answers to questions regarding provisioning services offered by flads. Displayed are the related CICES codes, the Yes/No questions in the survey, the sample size (n), χ^2 value and the p-value ($p < 0.05$ significant)

Related CICES code	Question	n	χ^2	p-value	Results
1.1.5.1	Do you know that flads are good growth areas for sea buckthorn?	29	0.27	0.6	Fig. 2
1.1.6.1	Do you think flads have an effect on commercial fisheries?	33	47.51	5.46×10^{-12}	Fig. 4

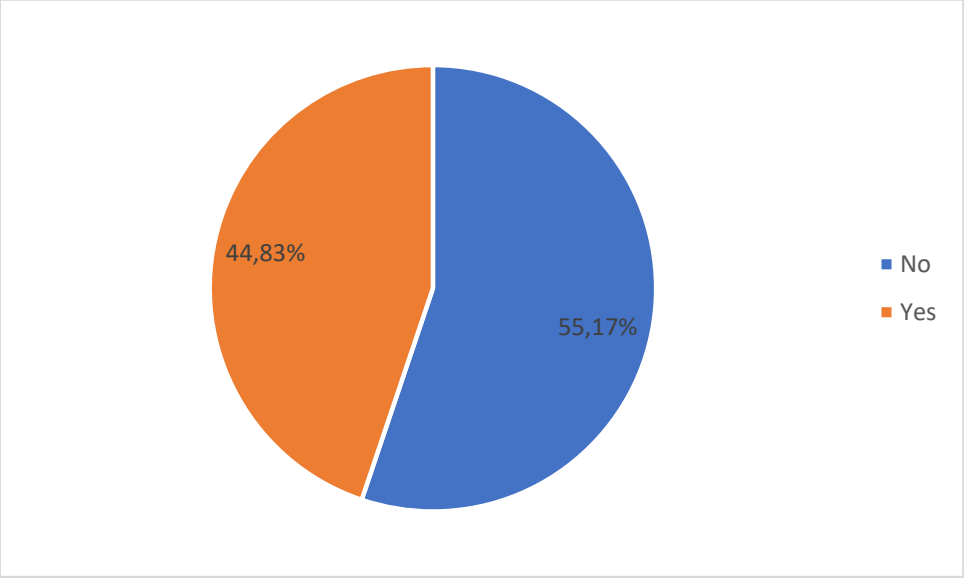

Figure 2. Proportion of Yes and No answers for Question "Do you know that flads are good growth areas for sea buckthorn?" (CICES code 1.1.5.1, table 2)

Respondents were asked if they consider flads as good growth areas for sea buckthorn. Slightly above half of the respondents, 55%, did not consider flads as good growth areas for sea buckthorn, whereas 45% considered they were (Fig. 2). There was no statistical significance between the answers.

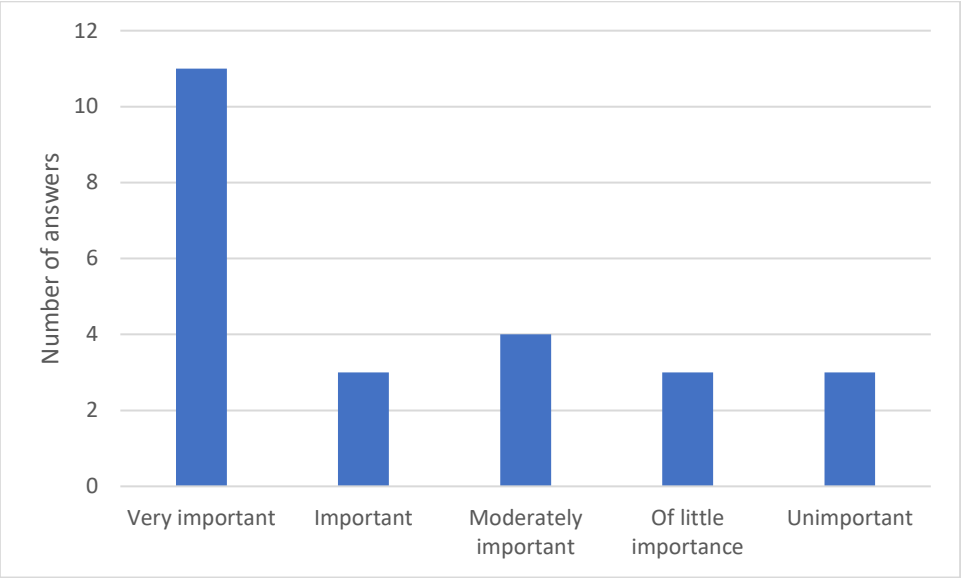

Figure 3. Assessment of flads as growth areas for sea buckthorn for respondents that answered Yes concerning whether they think flads are important growth areas for sea buckthorn.

Eleven persons considered the service of providing suitable areas for wild plants used for nutrition (sea buckthorn) very important, and 3 persons as important, if results were pooled, 6 persons rated the service as unimportant or of little importance (Fig. 3).

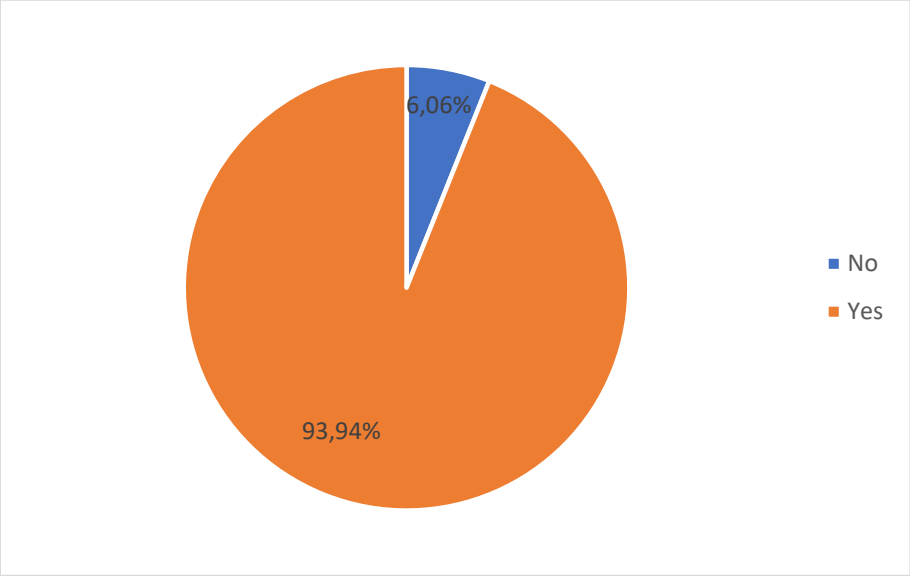

Figure 4. Proportion of Yes and No answers for Question "Do you think fish production has an effect on commercial fisheries?" (CICES code 1.1.6.1, table 2)

A significant amount of the respondents, ~94%, recognised that flads produce fish that commercial fisheries benefit from and only ~6% were of the opinion they do not (Fig. 4).

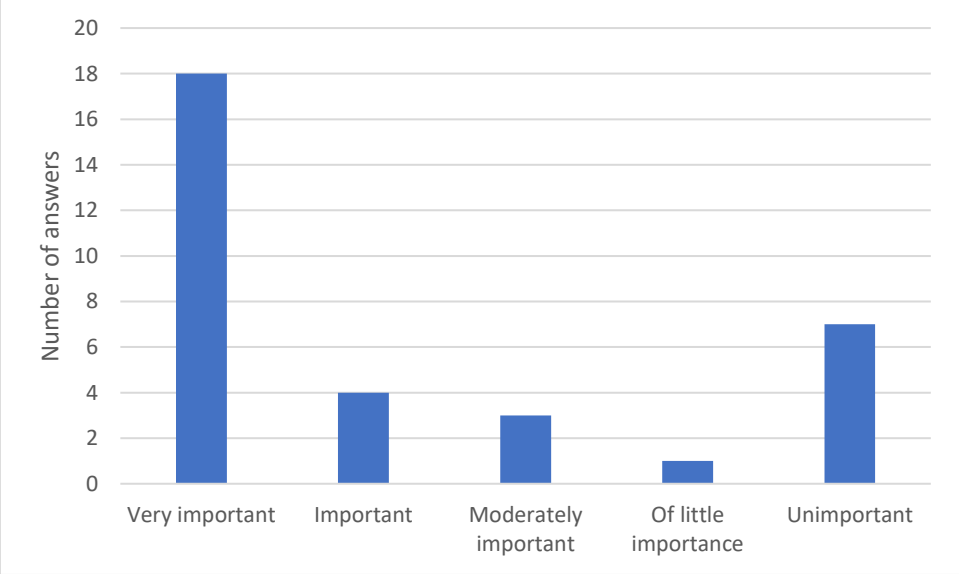

Figure 5. Assessment of the effect of flads on commercial fisheries for respondents that answered Yes concerning whether they think the production of adult fish in flads influence commercial fisheries.

In total, 18 respondents considered the production of fish for commercial fisheries as a very important service provided by flads, and seven answered that they considered the service unimportant. The remaining eight answers were divided between the three categories in-between (Fig. 5).

3.2 Regulation and maintenance services

Stakeholders knowledge of regulation and maintenance services in flads are shown in Table 4. Results for almost all questions were of statistical significance except for 2.2.6.1.

Table 4. Statistical analyses of the results of answers to questions regarding provisioning services offered by flads. Displayed are the related CICES codes, the Yes/No questions in the survey, the sample size (n), χ^2 value and the p-value ($p < 0.05$ significant).

Related CICES code	Question	n	χ^2	p-value	Results
2.1.1.1	Do you think that vegetation and animals can function as natural water treatment plants?	32	52.56	4.17×10^{-13}	Fig. 6
2.2.1.2	Do you think that the restricted water exchange makes the water heat up sooner in the spring and therefore offer better chances of survival for fish larvae?	32	33.06	8.92×10^{-9}	Fig. 8
2.2.1.3	Do you think that the vegetation contributes to clearer waters?	31	6.45	0.01109	Fig. 10
2.2.2.3	Do you think flads are important fish recruitment sites to produce adult fish that can be used as food sources for humans?	32	52.56	4.17×10^{-13}	Fig. 12
2.2.2.3	Do you consider flads important for the ecological balance in the seas?	32	52.56	4.17×10^{-13}	Fig. 14
2.2.5.1	Do you think flads diminish eutrophication outside of flads?	30	19.27	1.14×10^{-5}	Fig. 16
2.2.5.2	Do you think that he lower salinity probably favour appearance and recruitment of fish?	30	24.07	9.30×10^{-7}	Fig. 18
2.2.6.1	Do you think flads are important carbon sinks?	28	0.64	0.42	Fig. 20

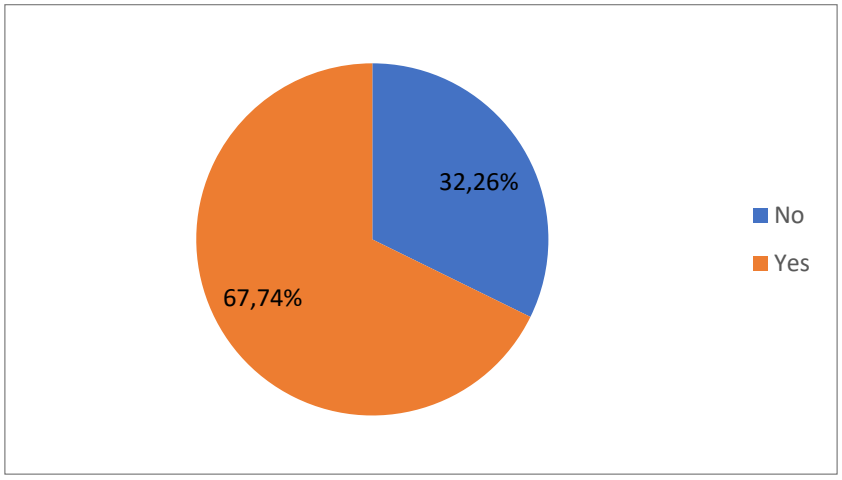

Figure 6. Proportion of Yes and No answers for Question "Do you think that vegetation and animals can function as natural water treatment plants?" (CICES code 2.1.1.1, table 2)

Approximately one third of the respondents are of the opinion that vegetation and animals inhabiting the flads do not play a function for water purification whereas two thirds, a statistically significant part of the respondents, considered they do (Fig. 6).

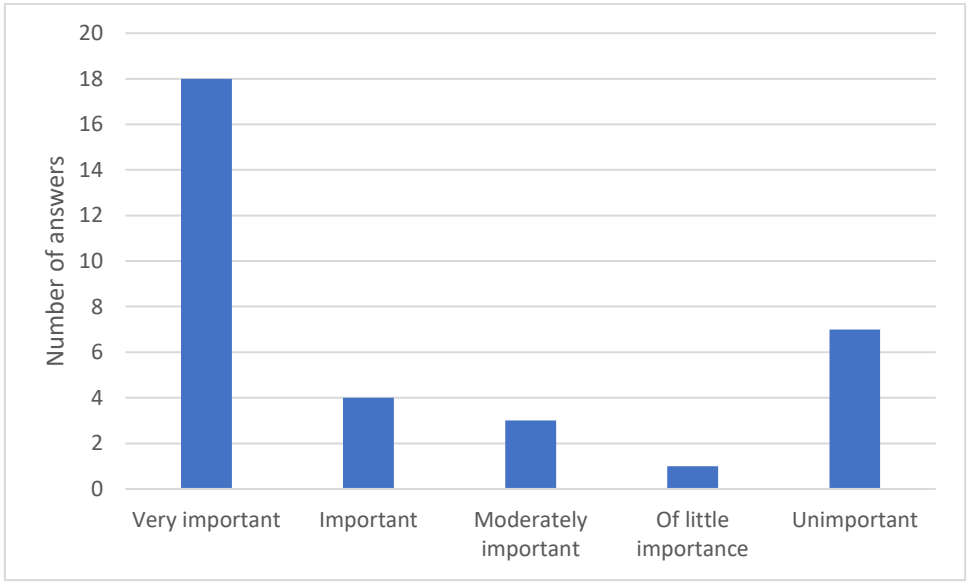

Figure 7. Assessment of the significance of vegetation and animals as natural water treatment plants for respondents that answered Yes concerning whether they think that vegetation and animals can function as natural water treatment plants.

The service of bioremediation and filtration, the water purifying effect of biota was considered very important and important according to two thirds of the respondents. Seven persons considered the importance of animals and plants as nature's "water treatment plants" in flads unimportant or of little importance (Fig. 7).

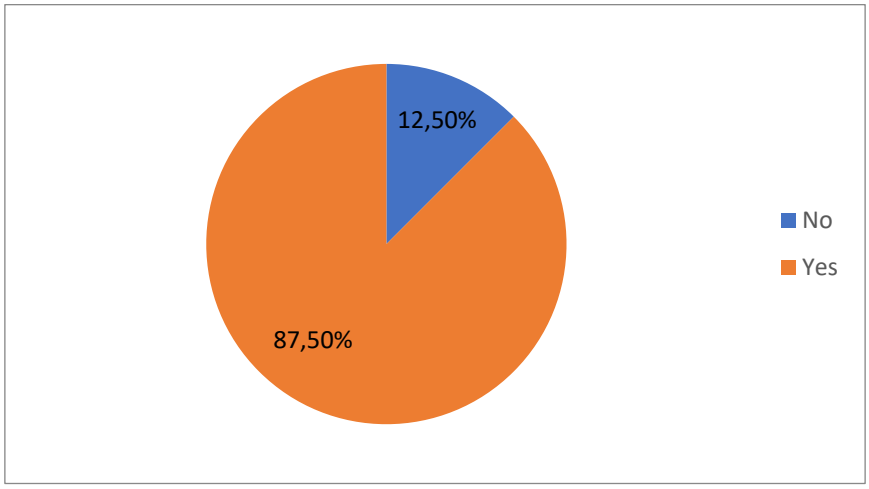

Figure 8. Proportion of Yes and No answers for Question "Do you think that restricted water exchange speeds up the warming of the water in the flad in spring?" (CICES code 2.2.1.2, table 2)

Respondents were asked if they know that fish larvae benefit from the warm spring conditions in the flads. Flads warm up sooner in the spring than surrounding areas because of their shallow nature and limited water exchange. Approximately nine out of ten respondents were aware of this feature (Fig. 8).

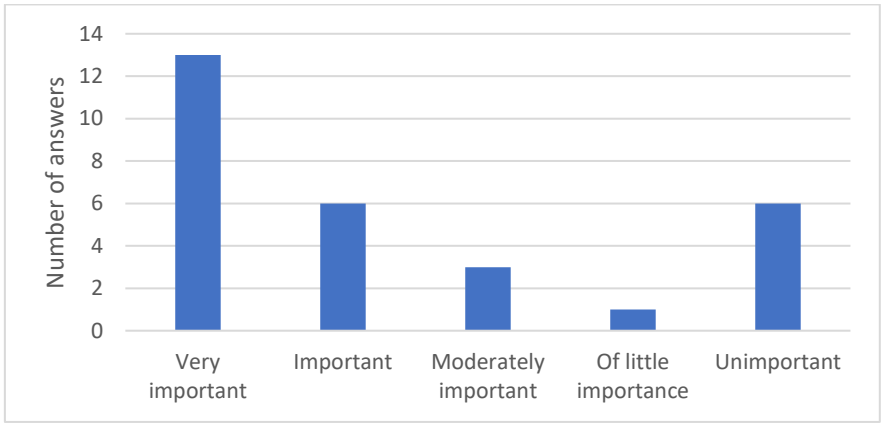

Figure 9. Assessment of the significance of flads as habitats for fish larvae for respondents that answered Yes concerning whether they think that restricted water exchange speeds up the warming of the water in the flad in spring.

Almost two thirds of the respondents assessed flads as important or very important habitats for fish larvae (Fig. 9).

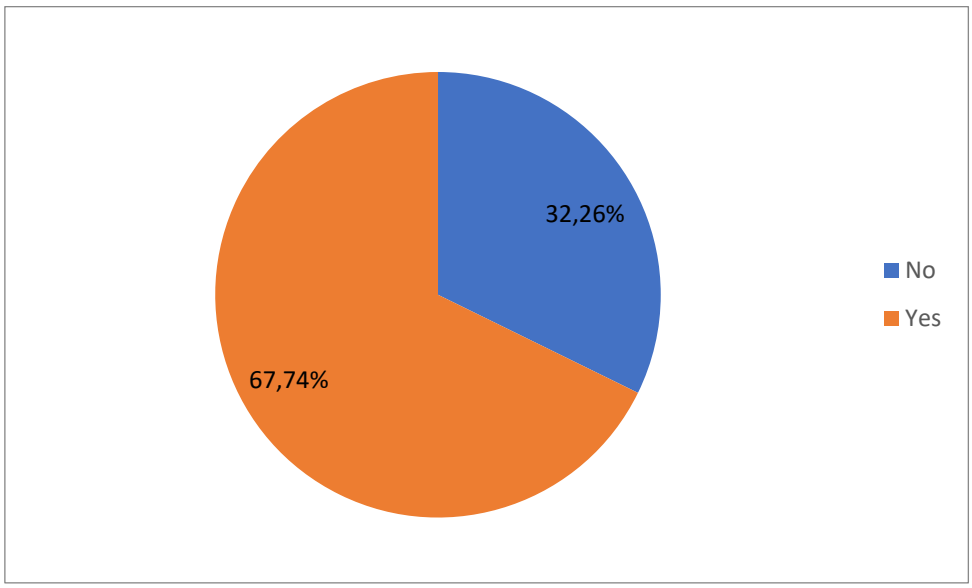

Figure 10. Proportion of Yes and No answers for Question "Do you think that the vegetation in flads contribute to clearer waters?" (CICES code 2.2.1.3, table 2)

Two thirds of the respondents believed the vegetation in the flads contribute to clearer waters and one third thought that vegetation does not affect the turbidity of the water (Fig. 10).

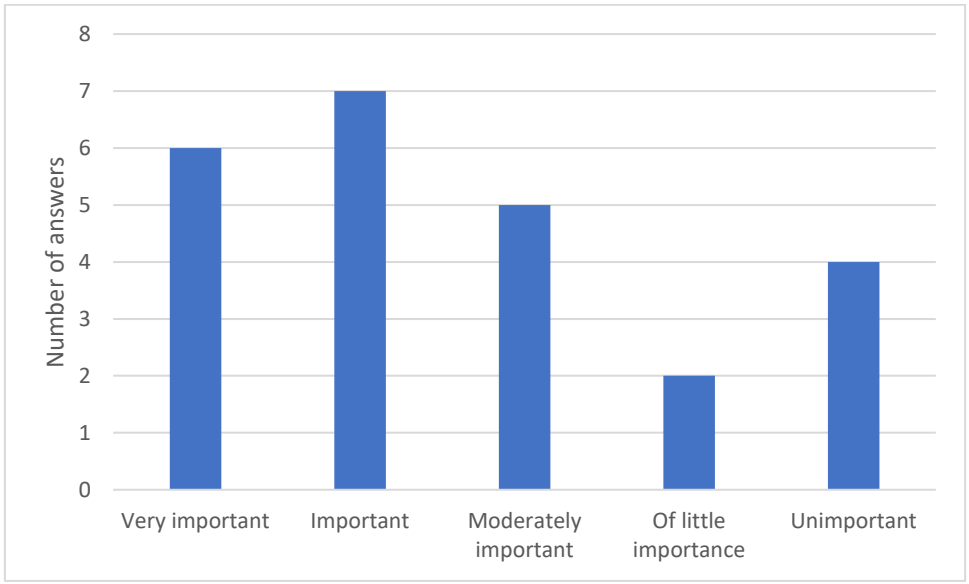

Figure 11. Assessment of the contribution of vegetation for clearer waters for respondents that answered Yes concerning whether they think vegetation in flads contribute for clearer water in the flad.

The service of contributing to cleaner waters, provided by vegetation, was considered unimportant by four respondents and of little importance by two persons (Fig. 11). In total, 13 persons considered the role of vegetation as very important or important (Fig. 11).

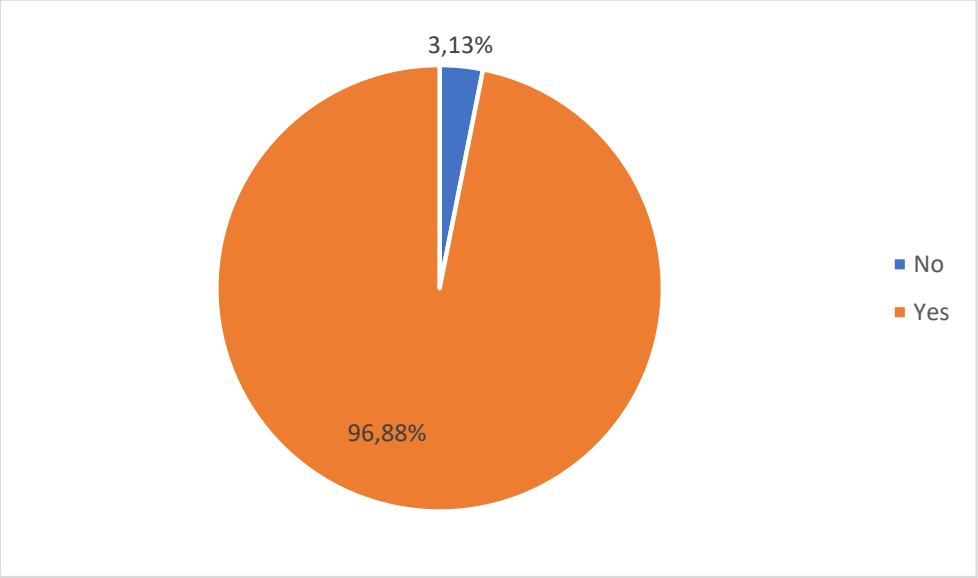

Figure 12. Proportion of Yes and No answers for Question "Do you consider flads important growth areas for juvenile fish?" (CICES code 2.2.2.3, table 2)

The vast majority of the respondents considered flads as important growth areas for juvenile fish (Fig. 12) .

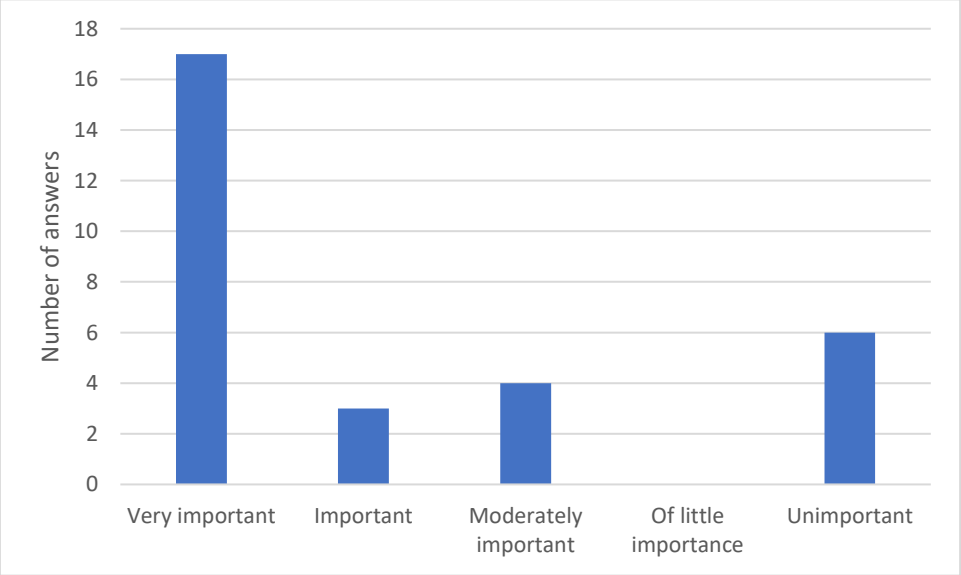

Figure 13. Assessment of flads significance as contributors of adult fish for respondents that answered Yes concerning whether they think flads are important growth areas for fish.

The significance of flads as producers of adult fish was regarded important or very important by 19 persons whereas six persons considered it unimportant four respondents considered it moderately important (Fig. 13).

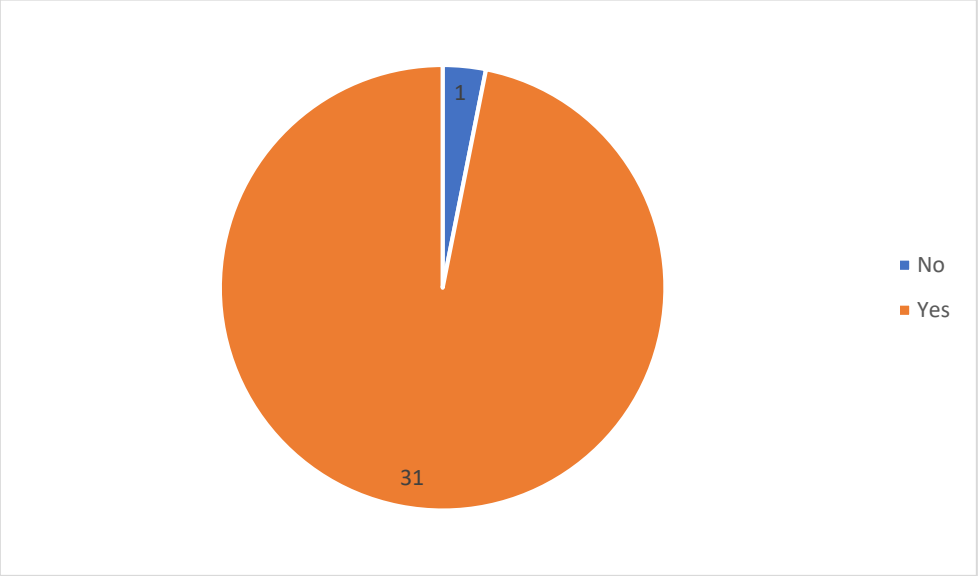

Figure 14. Proportion of Yes and No answers for Question "Do you think predatory fish produced in flads have significance for the ecological balance in the sea" (CICES code 2.2.2.3, table 2)

Almost all respondents, 97%, assessed predatory fish originated from flads important for the ecological balance of the sea (Fig. 14).

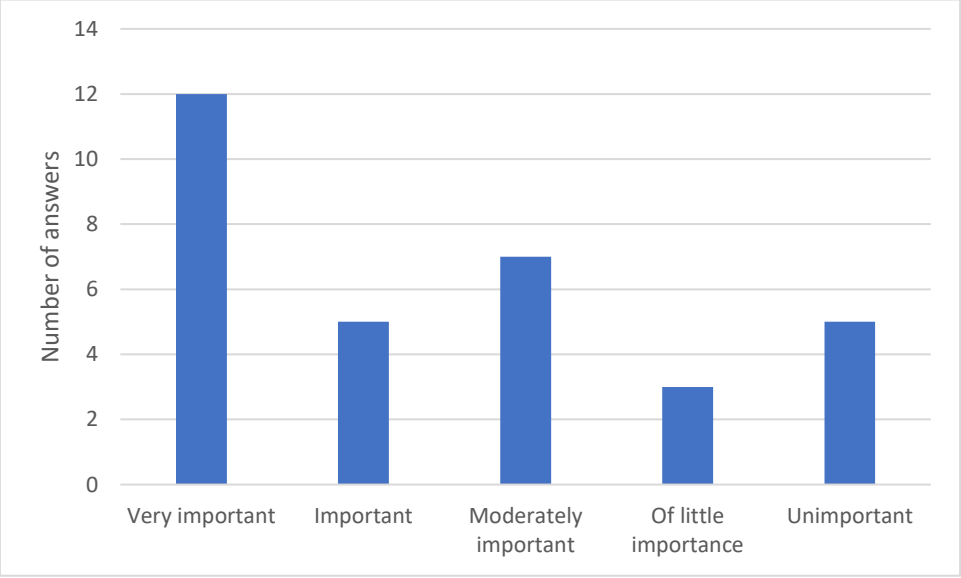

Figure 15. Assessment of production of predatory fish in flads for the ecological balance of the sea for respondents that answered Yes concerning whether they think predatory fish produced in flads have a significance for the ecological balance in the sea.

Seventeen of the respondents conveyed that predatory fish produced in flads play an important or very important role for the ecological balance of the sea (Fig. 15). Eight persons thought that it was of less importance or of no importance at all (Fig. 15).

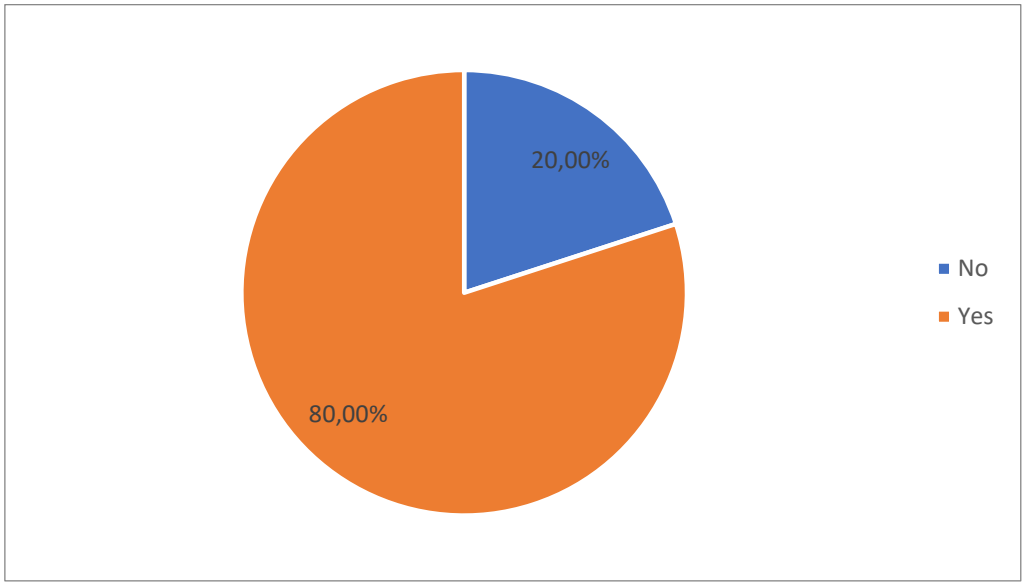

Figure 16. Proportion of Yes and No answers for Question "Do you think flads diminish eutrophication outside of flads?" (CICES code 2.2.5.1, table 2)

One fifth of the respondents conveyed the opinion that flads do not contribute to diminishing eutrophication in the surrounding sea areas, whereas the remaining fifth thought that flads decrease eutrophication of the sea (Fig. 16).

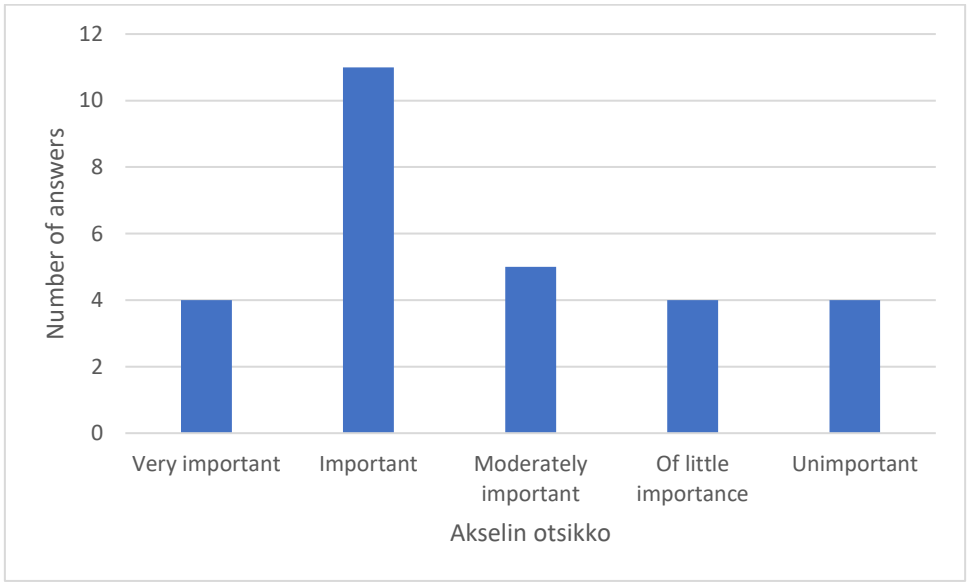

Figure 17. Assessment of flads contribution for decreased eutrophication in surrounding sea areas for respondents that answered Yes concerning whether they think flads diminish eutrophication in surrounding sea areas.

The service of diminishing eutrophication in surrounding sea areas was considered of little importance or not significant by 13 people, whereas 15 considered it important or very important (Fig. 17).

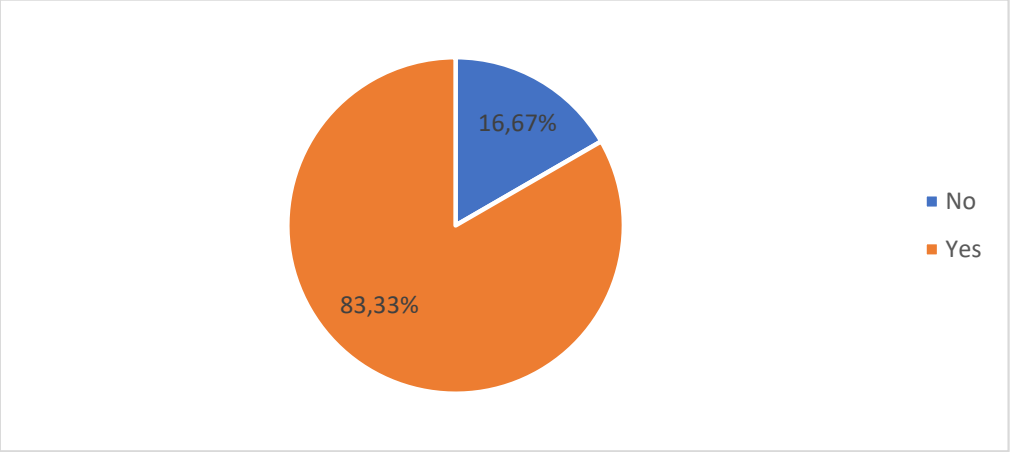

Figure 18. Proportion of Yes and No answers for Question "Do you think that the lower salinity favor appearance and recruitment of fish?" (CICES code 2.2.5.2, table 2)

The respondents were asked if they think that the lower salinity in flads favour the recruitment of fish; 83% of the respondents concur and approximately 17% opposed (Fig. 18).

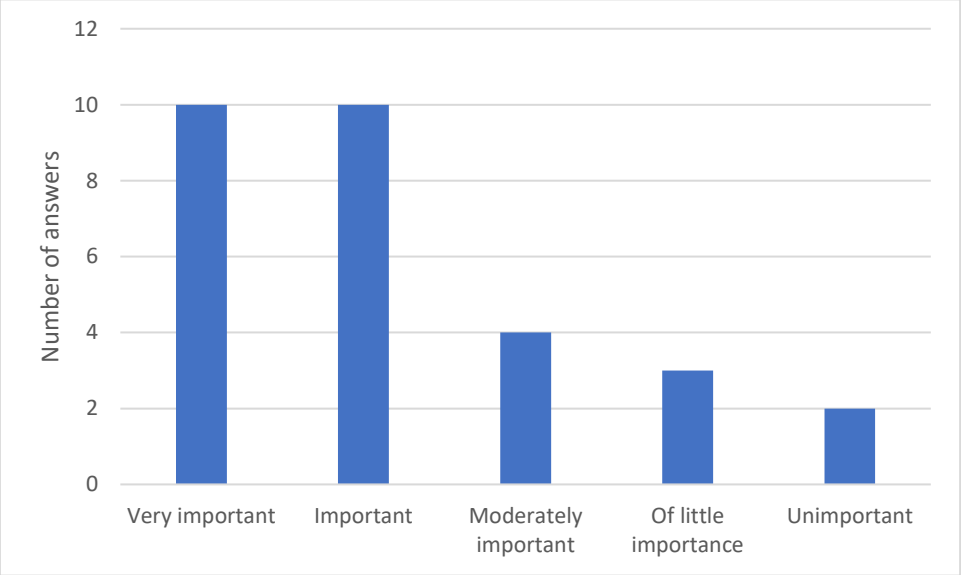

Figure 19. Assessment of importance of low salinity in flads for fish recruitment for respondents that answered Yes concerning whether they think lower salinity favours recruitment of fish.

One third of the respondents regarded that the importance of lower salinity on fish recruitment was very important or important (Fig. 19). Two persons thought that the salinity was unimportant, and three that it was of less importance (Fig. 19).

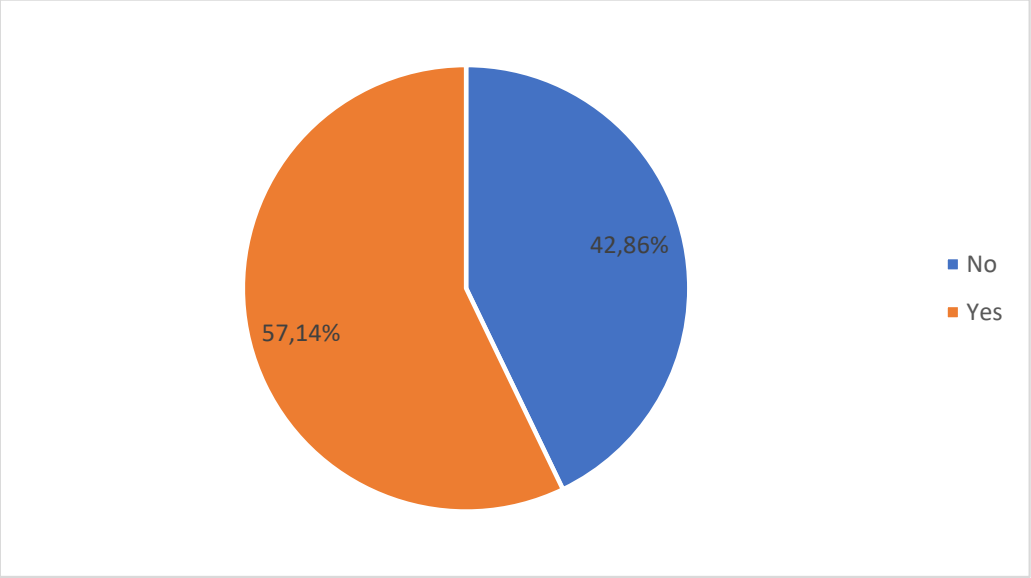

Figure 20. Proportion of Yes and No answers for Question "Do you think flads are important carbon sinks?" (CICES code 2.2.6.1, table 2)

The role of flads as carbon sinks, and thereby playing a role for the chemical composition of the atmosphere and the oceans, was considered important by 57% of the participants of the survey whereas 43% disagreed (Fig. 20), no statistical significance existed.

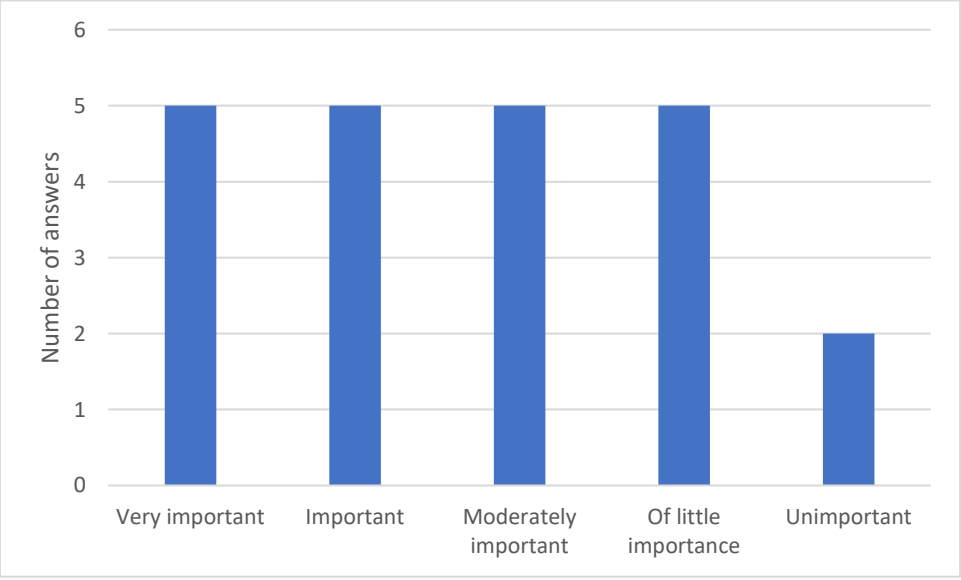

Figure 21. Assessment of flads as carbon sinks for respondents that answered Yes concerning whether they think flads are important carbon sinks.

The distribution of the answers was even regarding the value of flads as carbon sinks. All classes received five answers each, except for class five with two answers (Fig. 21).

3.3 Cultural Services

Stakeholders knowledge of cultural ecosystem services provided by flads can be seen in table 5. All results are statistically significant.

Table 5. Statistical analyses of the results of answers to questions regarding provisioning services offered by flads. Displayed are the related CICES codes, the Yes/No questions in the survey, the sample size (n), χ^2 value and the p-value ($p < 0.05$ significant)

Related CICES code	Question	n	χ^2	p-value	Results
3.1.1.1	Do you think flads affect positively human wellbeing due to active visits on site?	32	22.56	2.034×10^{-6}	Fig. 22
3.1.1.2	Do you think flads affect positively human wellbeing due to passive visits on site?	32	33.06	8.924×10^{-9}	Fig. 25
3.1.2.1	Do you think scientifically studies increase the knowledge of flads?	32	45.56	1.478×10^{-11}	Fig. 27
3.1.2.2	Do you think flads can be used within environmental education?	32	39.06	4.105×10^{-10}	Fig. 29
3.1.2.3	Do you think flads have significance as cultural heritage?	32	27.56	1.521×10^{-7}	Fig. 31
3.1.2.4	Do you think flads offer positive aesthetic experiences?	29	17.66	2.648×10^{-5}	Fig. 33
3.2.2.1	Do you think flads are important landscape elements?	29	33.38	7.583×10^{-9}	Fig. 35
3.2.2.2	Do you think flads make an important part of the local landscape?	29	39.72	2.925×10^{-10}	Fig. 37
3.2.2.2	Do you think flads are something that should be preserved for future generations?	29	39.72	2.925×10^{-10}	Fig. 39

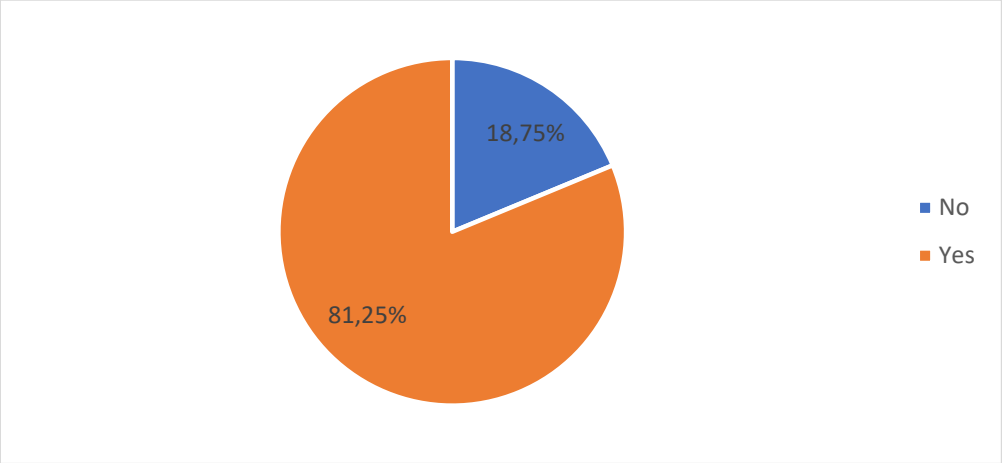

Figure 22. Proportion of Yes and No answers for Question "Do flads have a positive effect human wellbeing thru active interactions on site?" (CICES code 3.1.1.1, table 2)

Four respondents out of five thought that activities in flads (e.g. hiking, swimming) promote human wellbeing (Fig. 22). One person out of five did not think flads have a positive effect caused by active interactions (Fig. 22).

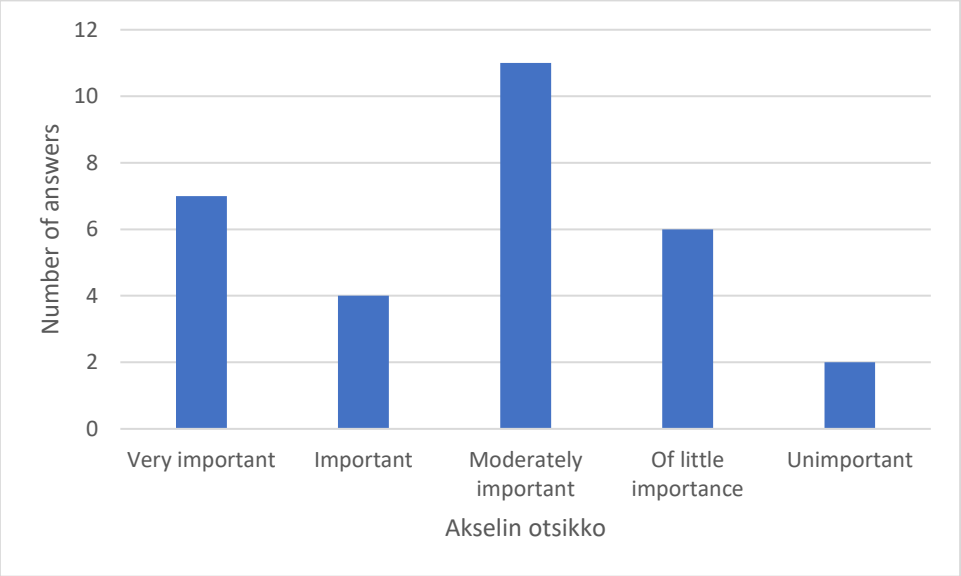

Figure 23. Assessment of the positive effect on wellbeing by active interactions at flads for respondents that answered Yes concerning whether they think flads improve wellbeing by active interactions.

Approximately one third of the respondents assessed the positive effects on wellbeing by active interactions at flads moderately important (Fig. 23). Seven persons assessed the effects of active interactions very important and six of less importance (Fig. 23).

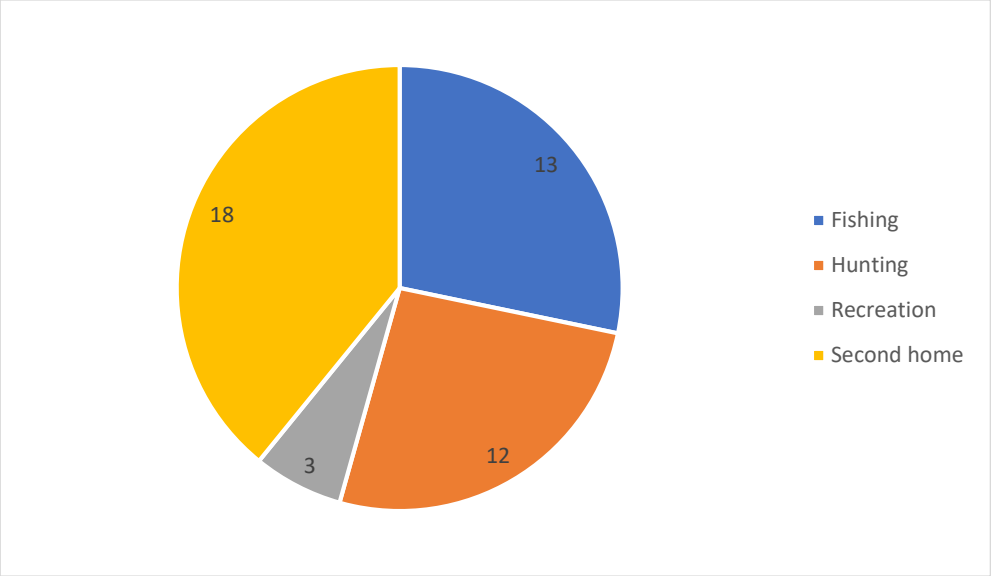

Figure 24. Activities executed at flads. Number indicates number of responses conducting the specific activity; multiple answers/ respondent was possible. Some activities are not shown in the table since they only received one answer (physical activity, presenting the flad environment to children, interest toward flads)

Figure 24 shows reasons why flads are visited. The most common activity is to visit the second home. Slightly over half of the activities regard active interactions related to biota (fishing, hunting).

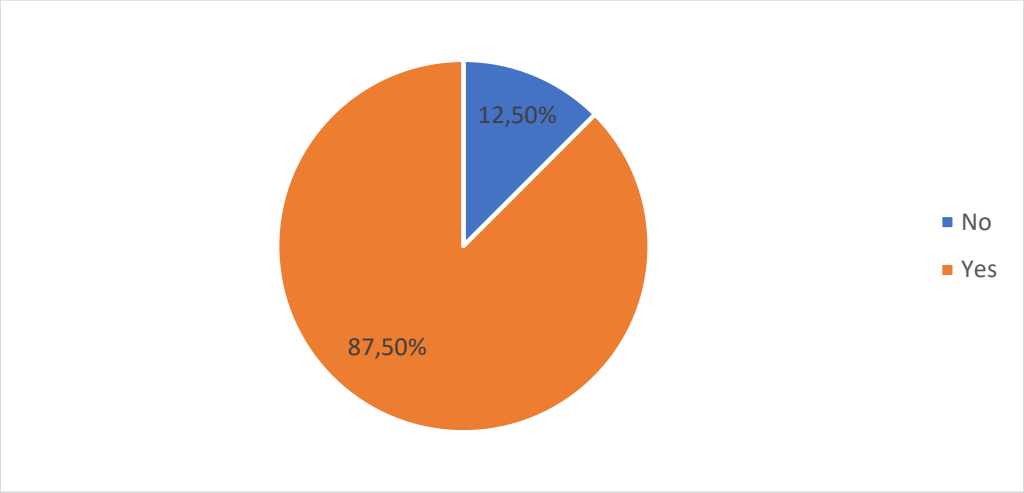

Figure 25. Proportion of Yes and No answers for Question "Do you think flads have a positive effect on human wellbeing due to passive interactions on site?" (CICES code 3.1.1.2, table 2)

Observational or passive interactions conducted at flads were considered health promoting by almost 90% of the respondents whereas approximately 10% disagreed (Fig. 25).

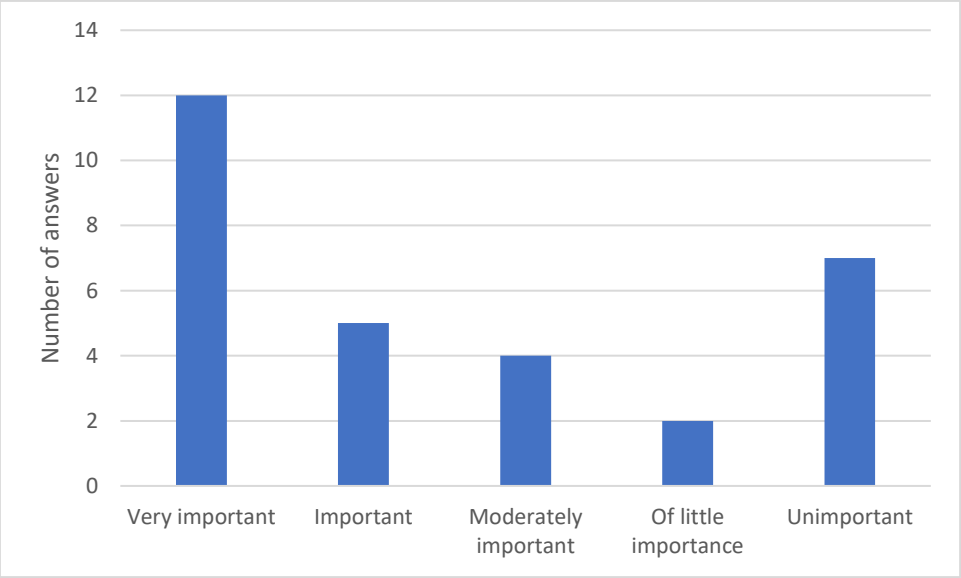

Figure 26. Assessment of the positive effect on wellbeing caused by flads thru passive interactions for respondents that answered Yes concerning whether they think passive activities at flads affect wellbeing.

Passive interactions at flads were valued very important or important by 17 respondents (Fig. 26). Four persons considered the value moderately important whereas the remaining nine persons of less importance or unimportant (Fig. 26).

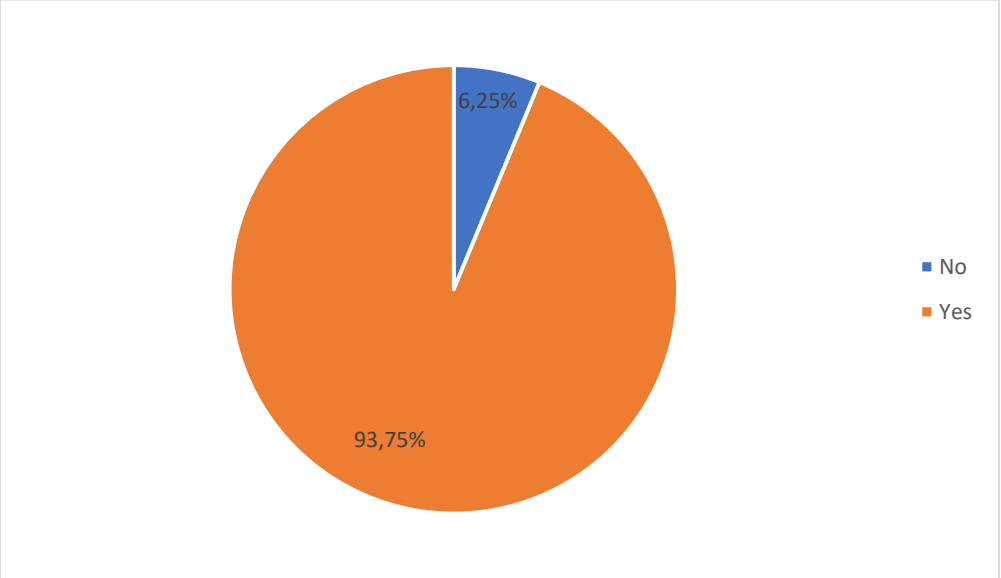

Figure 27. Proportion of Yes and No answers for Question "Do you think scientific studies increase the knowledge of flads?" (CICES code 3.2.1.2, table 2)

Around 6% of the respondents considered that scientific studies of flads do not increase the knowledge about them, 94% agreed that it does (Fig. 27).

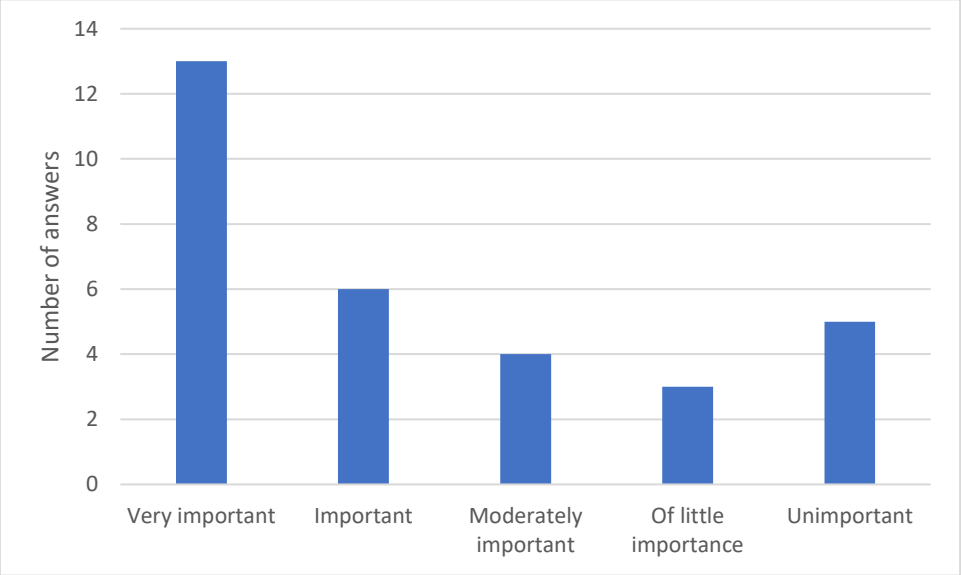

Figure 28. Assessment of augmented knowledge of flads through scientific studies for respondents that answered Yes concerning whether they think scientific studies improve the knowledge about flads.

Approximately one third of all participants in the survey considered it important or very important to study flads for gaining more knowledge about them (Fig. 28). Nine of the respondents did not consider it important (Fig. 28).

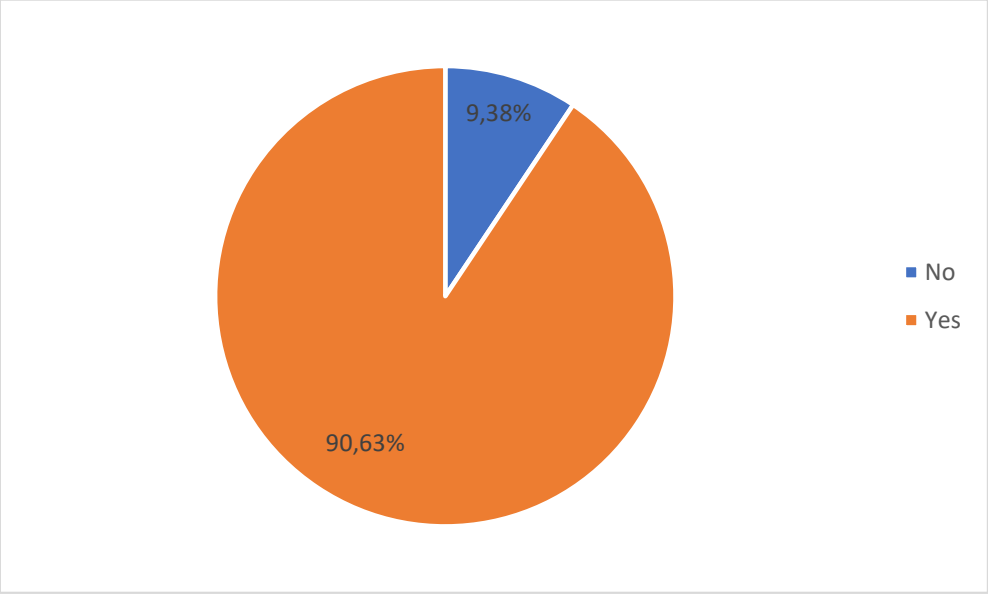

Figure 29. Proportion of Yes and No answers for Question "Do you think flads can be used within environmental education?" (CICES code 3.1.2.2, table 2)

The majority, 90%, of the respondents considered flads suitable environments enabling education and training, 10 % of the respondents disagreed (Fig. 29).

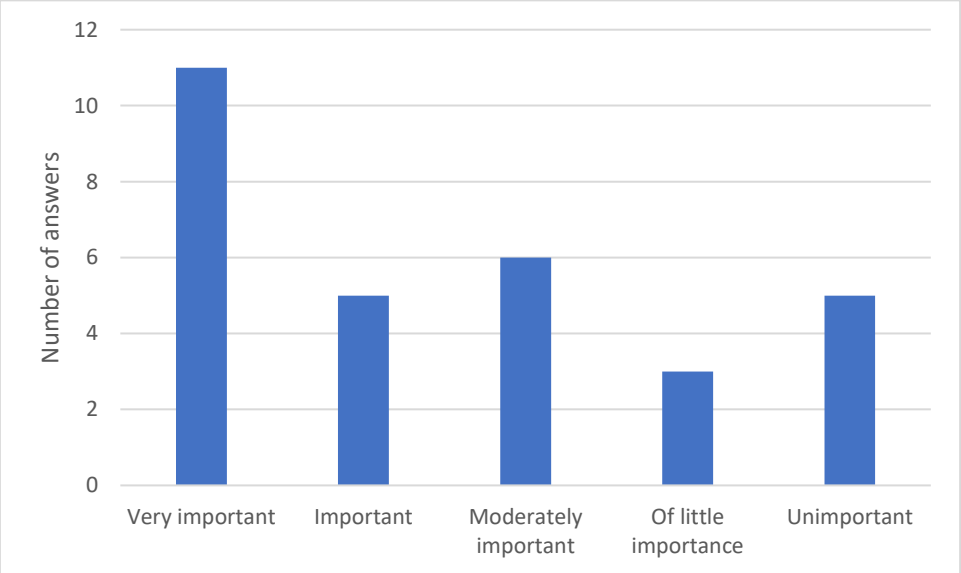

Figure 30. Assessment of significance of flads within environmental education for respondents that answered Yes concerning whether they think flads can be used within environmental education.

The importance of flads within environmental education was valued important or very important by 17 persons (Fig. 30). Six persons considered the importance moderate and eight people believed it is less important or unimportant (Fig. 30).

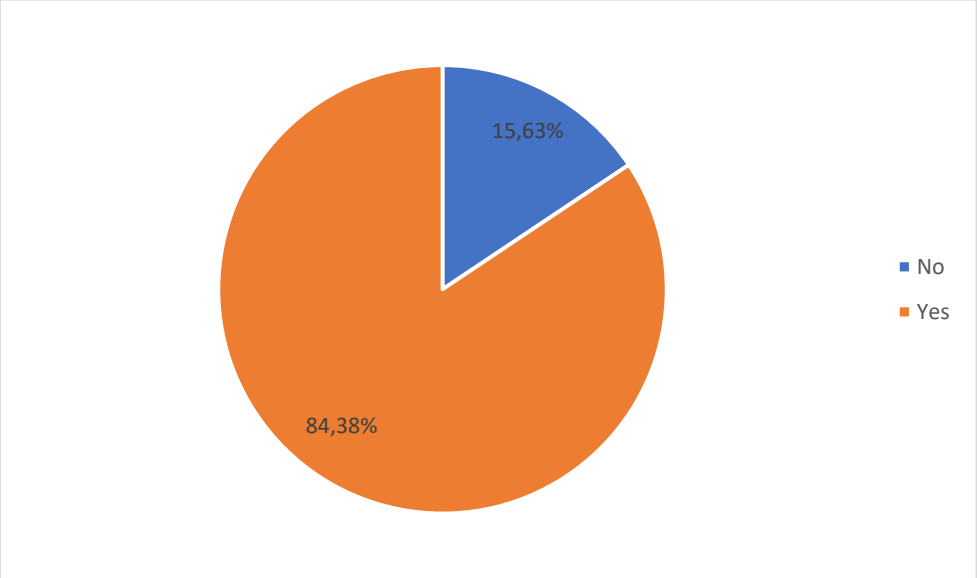

Figure 31. Proportion of Yes and No answers for Question "Do you think flads have a significance as cultural heritage?" (CICES code 3.1.2.3, table 2)

Flads were considered resonant in terms of cultural heritage by 84% of the respondents, whereas 16% disagreed (Fig. 31).

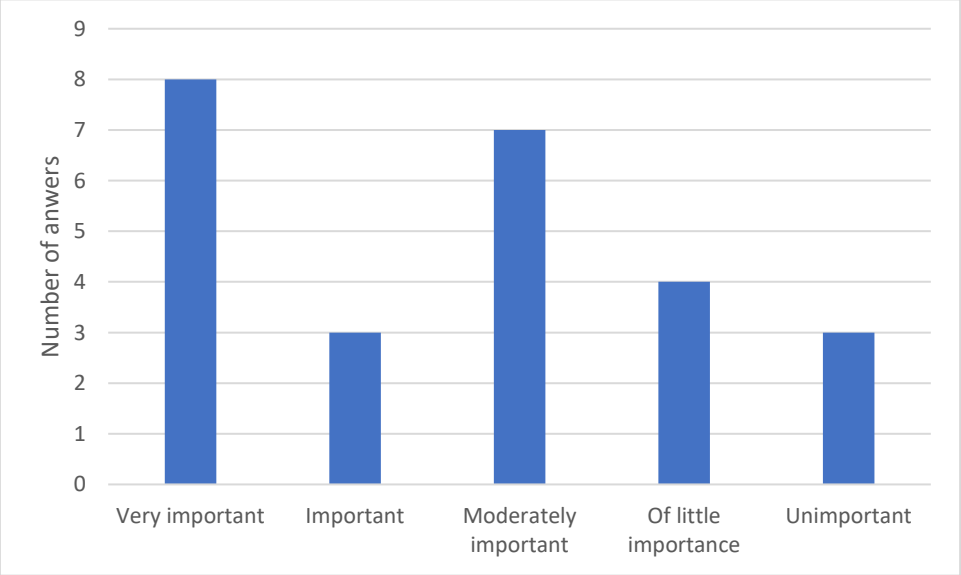

Figure 32. Assessment of significance of flads as cultural heritage for respondents that answered Yes concerning whether they think flads have importance as cultural heritage.

The value of flads as cultural heritage was considered of importance by 11 persons, seven people thought it moderately important and seven people of less importance (Fig. 32).

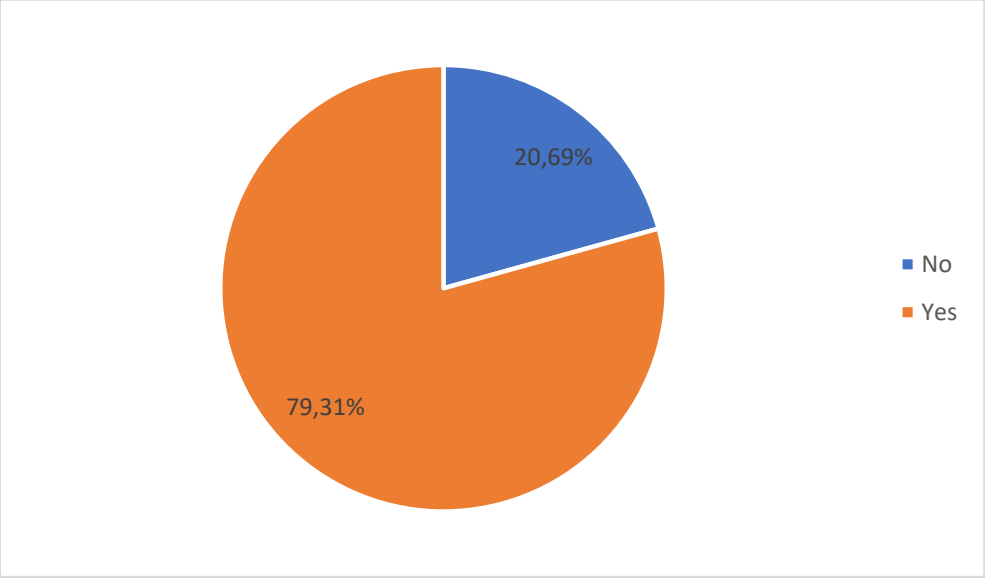

Figure 33. Proportion of Yes and No answers for Question "Do you think flads offer positive aesthetic experiences?" (CICES code 3.1.2.4, table 2)

Four out of five persons had the opinion that the aesthetic appearance of flads can offer positive experiences whereas one out of five disagreed (Fig. 33).

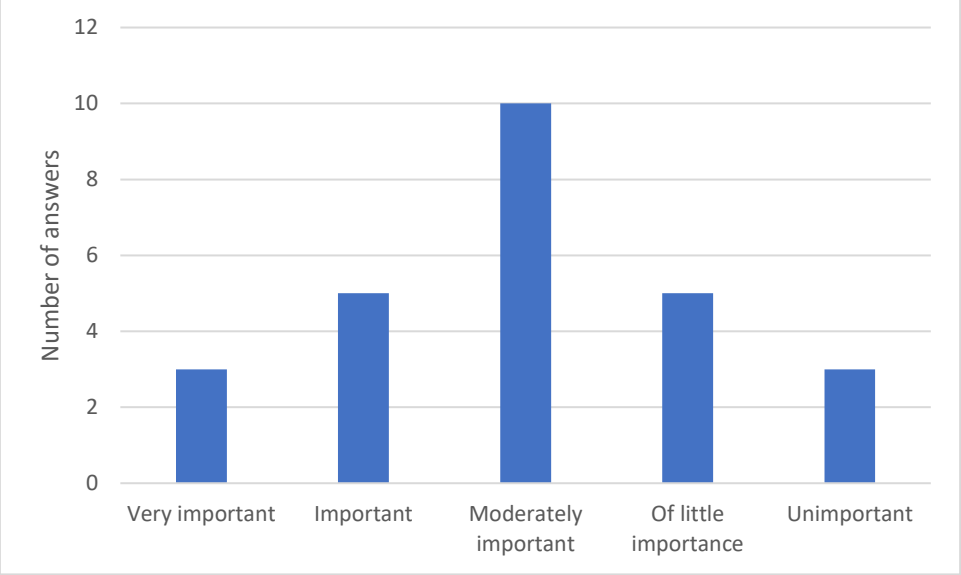

Figure 34. Assessment of the significance of aesthetic experiences offered by flads for respondents that answered Yes concerning whether they think flads provide aesthetic experiences.

The alternative that most of the received answers, 10, conveyed that aesthetic experiences offered by flads are moderately important (Fig. 34). Eight persons thought their value was of importance and eight shared the opinion that they were hardly important or unimportant (Fig. 34).

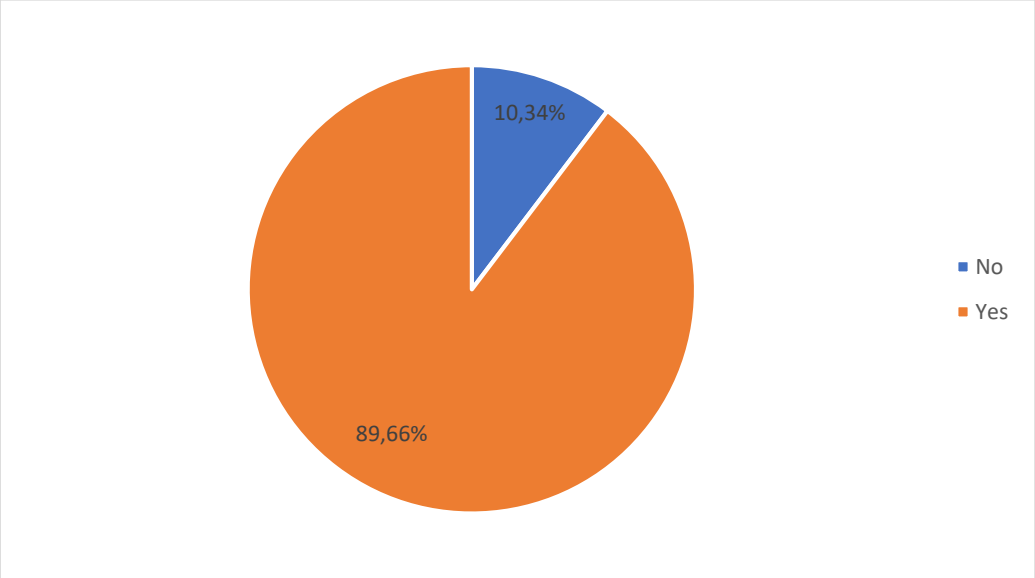

Figure 35. Proportion of Yes and No answers for Question "Do you think flads are important landscape elements?" (CICES code 3.2.2.1, table 2)

Almost 90% of the respondents considered flads important elements in the landscape (Fig.35).

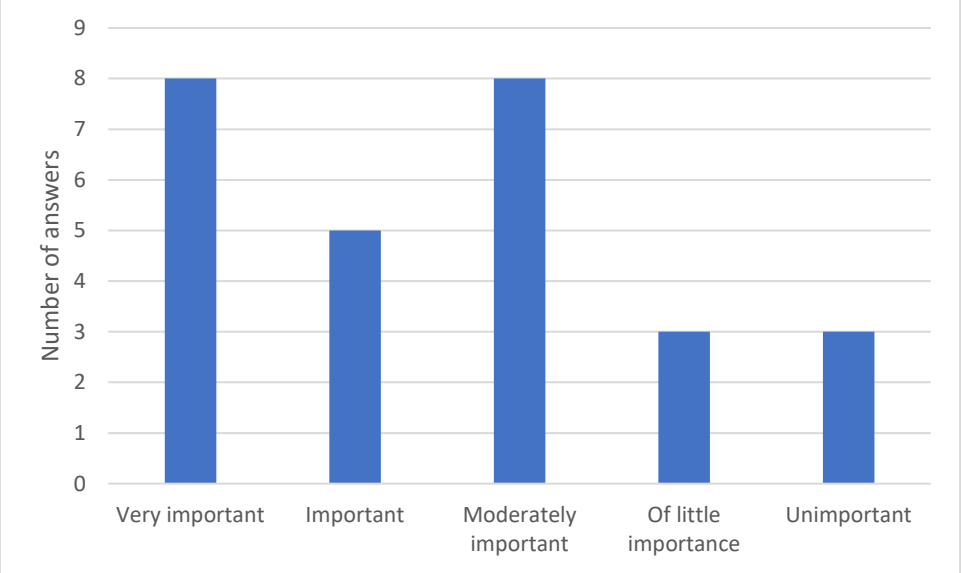

Figure 36. Assessment of significance as landscape elements for respondents that answered Yes concerning whether they think flads are important landscape elements.

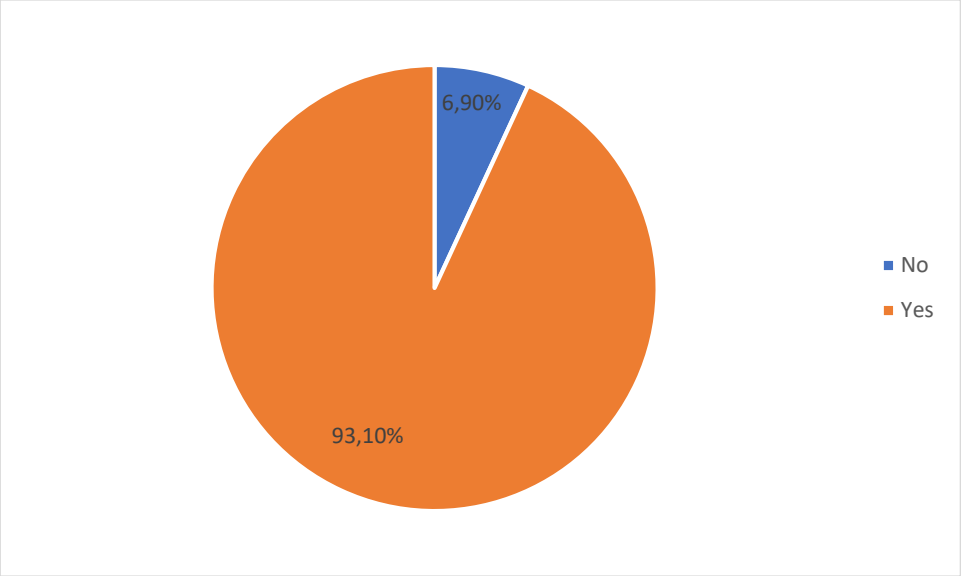

Figure 37. Proportion of Yes and No answers for Question "Do you think flads make an important part of the local landscape?" (CICES code 3.2.2.1, table 2)

Most of the respondents thought that flads are an important part of their local landscape (Fig.37).

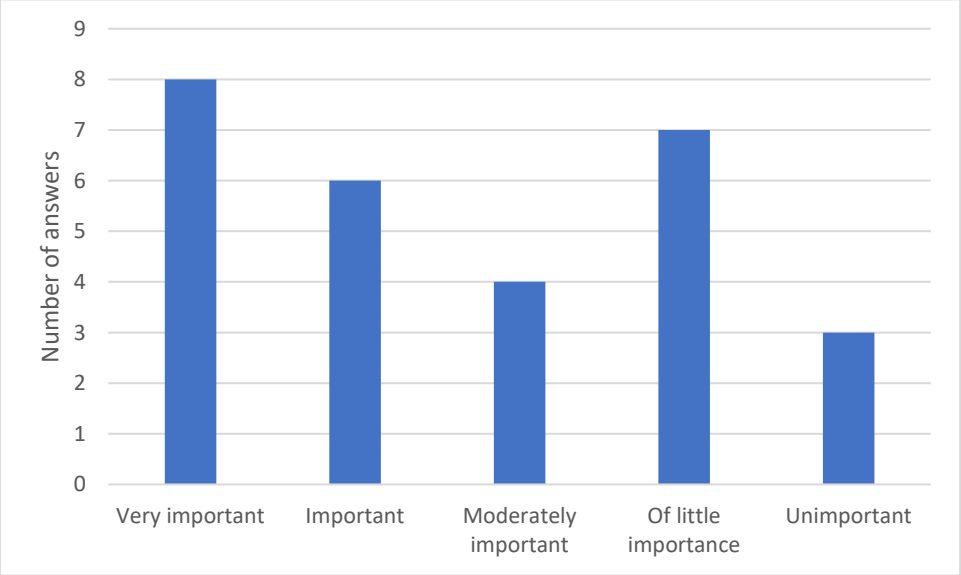

Figure 38. Assessment of the significance of flads as important parts of the local landscape for respondents that answered Yes concerning whether they think flads are an important part of the landscape.

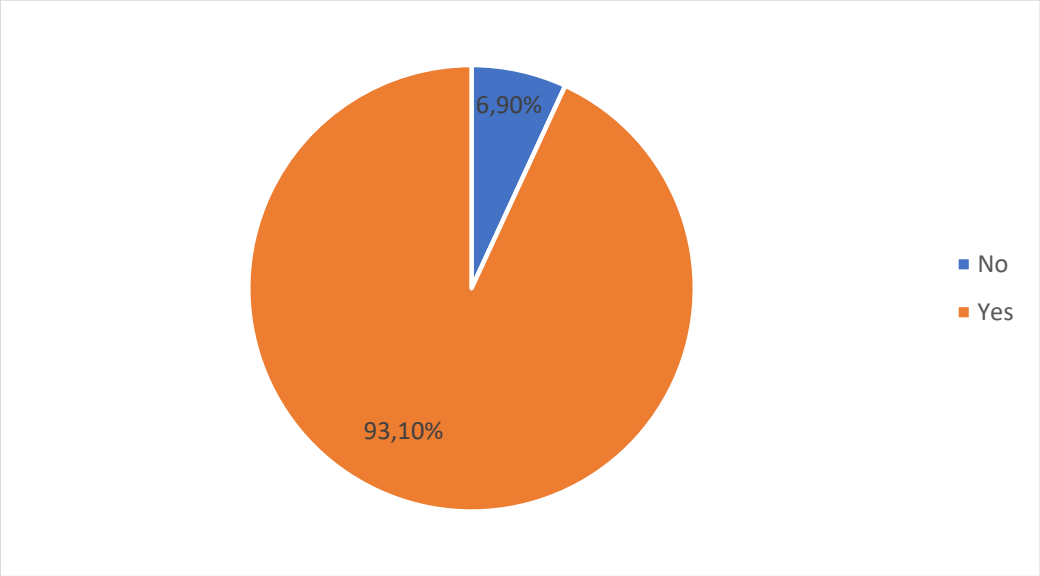

Figure 39. Proportion of Yes and No answers for Question "Do you think flads are something that should be preserved for future generations?" (CICES code 3.2.2.2, table 2)

A significant amount of the respondents, 90%, shared the opinion that flads should be preserved for future generations (Fig.39). Seven percent (%) of the respondents thought that flads are not of any importance for humans in the future (Fig.39).

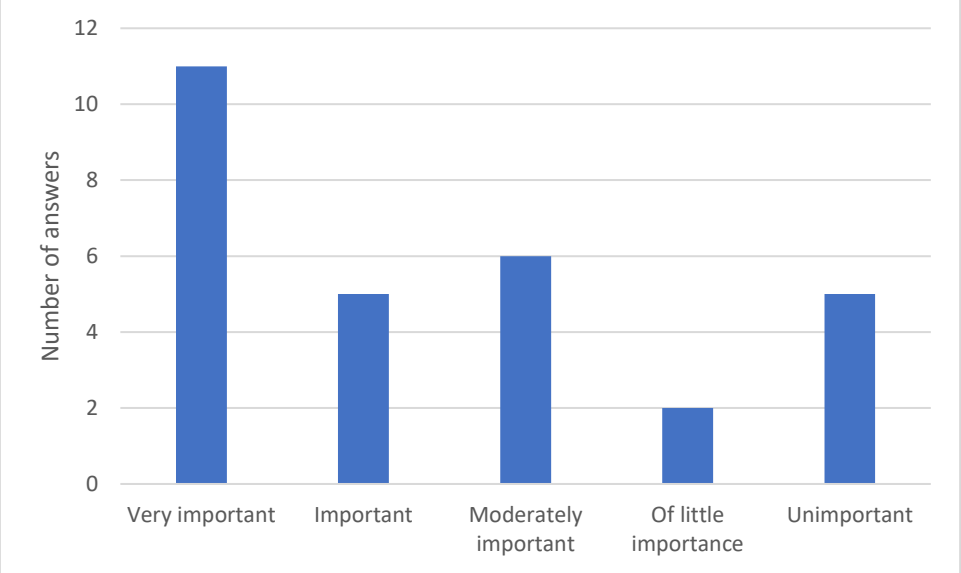

Figure 40. Assessment of the significance of flads being preserved for future generations for respondents that answered Yes concerning whether they think flads are important to preserve for future generations.

The service of the existence of flads as living systems even for future generation was considered very important by 11 respondents and important by five people (Fig. 40). Seven persons considered the importance of their existence unimportant or of less importance (Fig. 40).

4 Discussion

The results of this study clearly show that most of the landowners are familiar with ecosystem services offered by flads and half of them appreciate them highly. The results are in a clear controversy with actual data considering land-use in these fragile environments, only 21% of all flads in Kvarken (Mikkola et al., in press) are without human pressures. Flad-specific ecosystem services (ES) have until the Kvarken Flada project not been studied in detail and my thesis is the first to investigate these from a land-owner perspective. Spettel et al. (2011) did a literature review and found that until 2011 there has been no case studies regarding ES in Finland. It shows how new the field of ES research is in Finland and that implication of results by the administrative organisations is underdeveloped. The concept of ecosystem services has had a national and international breakthrough within management of our seas during the last decade (Bryhn et al. 2015, 16), but studies of coastal and marine ecosystem services are still in minority (Schernewski et al. 2018).

The mean age of the respondents was 56 years and consisted mostly of men (93,94%). The mean age of Finnish forest owners (owning >-5 ha land) is 60 years (Hänninen et al. 2011, 3). It would be essential to gather the opinions of both genders; on the other hand, the sample reflects typical gender and age distribution common in landowner meetings. It seems, that decision making concerning common owned land interests mostly men, as few women were present in the meetings. This is also confirmed by Hänninen et al. (2011) who stated that if partners co-own land, mostly men take care of the issues considering the holdings. In three cases of four men take care of the running things considering the land. Probably more than 25% women own land, but usually men attend meetings considering the holdings (Hänninen et al. 2011, 22). A study made by Agarwal (2009) shows that the condition of the forest improves when women are present in larger proportions in the deciding organs. Tindall et al. (2003) show that women are generally more concerned about nature than men. The coastal zones in Kvarken are under heavy exploitation (Saarinen 2019) and preserving these environments could be facilitated if more women would show interest to participate in matters considering nature conservation. Therefore, the obtained responses represent the knowledge base of those people who decide over common lands.

4.1 Provisioning services

Provisioning services are the direct products that an ecosystem delivers. They consist of adult fish, habitat for sea buckthorn (*Hippophaë rhamnoides*), genetic supply and freshwater for households (Ilvessalo-Lax & Mikkola 2019). By the time of this survey, only the first two mentioned services were identified.

The provisioning services that flads produce were not recognized by all respondents. When considering a flad one may think strictly on the water area, whereas Ilvessalo-Lax and Mikkola (2019) also considered the proximity in their assessment and included the coastal zone within proximity of the flad to their study. Defining boundaries is essential for the identification and classification of ES, since it enables

the understanding of the type of ecosystems present (Sousa et al. 2016, 9). Sea buckthorn (*H. rhamnoides*) is known for its nutritional and medicinal purposes (Li & Schroeder 1996, Suryakumar & Gupta 2011, Hao et al 2019) and wild berries are nutritional valuable resources (Tikkanen 2015, 4). According to the statistics of the Finnish Food Authority (2019), no sea buckthorn was collected for commercial sale in 2018 in Finland. Numbers of picking for own use could not be found, probably to its marginal extent. The land uplift process continuously offers new settlement areas for pioneer species such as the sea buckthorn (Kauppinen 2015, 9), which is one of the reasons why they are common around Finnish flads. The respondents possibly do not associate flads and sea buckthorn with each other. As respondents were asked to value the importance of flads as growth areas, only one out of four considered them of less importance or unimportant.

The vast majority, almost 94% of the respondents thought that flads produce adult fish of importance for commercial fisheries. Surprisingly, one third of the respondents assessed the service as unimportant, or of less importance. One reason could be that other species such as salmon and whitefish are more valued economically as they are caught commercially in larger amounts in Kvarken. According to the Natural Resources Institute Finland (LUKE) the commercial fisheries captured 369 tonnes of perch and 84 tonnes of pike in 2018 in the Bothnian Sea. Estuaries and shallow areas are of importance for production of perch (Urho 1990; Karås 1996), whereas pike prefers sheltered areas (Kallasvuo 2010, Snickars et al. 2010). Perch is considered a local species and does not disperse far from its recruitment area (Berkström et al. 2019; Veneranta et al. 2020). Veneranta et al. (2020) marked perch in Kvarken and 92% of them were found within 10 km distance from the initial marking area. This means that populations are very local and small areas can have a great impact on local commercial fisheries, a fact that should be promoted to local stakeholders, and a fact which might increase the appreciation of this service.

4.2 Regulating and maintenance services

According to Haines-Young and Potschin (2011), regulating and maintenance services "*include all the ways in which ecosystems control or modify biotic or abiotic parameters that define the environment of people, i.e. all aspects of the 'ambient' environment; these are ecosystem outputs that are not consumed but affect the performance of individuals, communities and populations and their activities*". Many of these services can be hard to understand since most of them cannot directly be observed (Brown et al. 2012) but are crucial for our survival (Jansson et al. 1999,363).

Biota play a large role in bio-remediation (Srivastava et al. 2008). Several species are typical for flads but especially the common reed (*Phragmites australis*) (Karstens et al. 2019) is known for its water-purifying effect. Two thirds of the respondents agreed that vegetation and animals affect the water quality and it was also assessed as very important or important by approximately the same number of persons. The same number of respondents also thought that vegetation plays a role in purifying the waters in the flads. Vegetation in a flad often is considered a nuisance and removed, even though its significance is distinguished according to the respondents. It is common that people are aware of the facts but act the opposite. Literature shows that e.g. farmers are aware of environmental problems, but they do not see their farming

as a part of the problem (Ahnström et al. 2009, 42) A study from Silvasti (2003) shows that farmers see their practices in harmony with nature and that it is difficult for them to acknowledge the polluting impact of their work. Many even regard their work as conserving nature and its values. In this mind-set to prove the opposite can be challenging.

Most of the respondents (96.88%) thought that flads are important areas for juvenile fish. Somewhat surprisingly, 6 persons still considered that this service is not important. As some species, such as perch and pike (Berkström et al. 2019; Veneranta et al. 2020) form local populations, the significance of single areas rises, as stated earlier.

Hamberg et al. (2019, 49) highlight that human activities causing resuspension of sediments should be restricted in pristine flads and associated spawning habitats. This recommendation would mean significant restrictions in several cultural services, since they affect the regulation and maintenance services. Trade-offs can be identified between cultural services, where an increase of active cultural services would indicate a decrease in several of the regulating and maintenance services. Hamberg et al. (2019, 49) pinpoint that resuspension causes suffocation of perennial plants and benthic substrate feeders, which have also been recognized by several other studies (Hansen et al. 2019, Torn et al. 2010, Eriksson et al. 2004). Their importance has been featured as the foundation for the ecological balance in flads (Ilvessalo-Lax & Mikkola 2019).

4.3 Cultural services

The water environment has always been important for humans (Nasar & Li 2004, Völker & Kistemann 2011), and the aesthetic aspect is especially appreciated (Lansford & Jones 1995, Corrigan 2007, White et al. 2010). Cultural services can be defined as ecosystems contributions to the non-material benefits (e.g., capabilities and experiences) that arise from human-ecosystem relationships (Chan et al. 2012, 5). Many benefits provided by water have been identified, but the cultural ecosystem services (CES) in marine environments are still poorly studied (Rodriguez et al. 2018, Martin et al. 2016).

The ecosystem services obtained from water ecosystems are health, knowledge, experience and identity (Eskelinen et al. 2018, 7). The benefits can be identified in the high proportion of land use; 59% of the flads in the Kvarken region have buildings and 17% piers (Mikkola et al., in press). The coastal areas in question are desired areas for leisure, but according to the results of my thesis, the valuation of these benefits is not as high as one could expect.

Cultural ecosystem services (CES), provided by flads, are recognized by most of the respondents; however, they do not seem highly appreciated. CES are often considered very subjective (Small et al. 2017, Stålhammar & Pedersen 2017) and they are assessed differently by stakeholders, depending on their own interests (Martín-López et al. 2012, 1). Coastal lagoons are important providers of recreation and tourism (Newton et al. 2018).

The health promoting active and passive visits at flads were recognized by the respondents. Living close to water makes people physically more active, which increases their wellbeing and health (Völker & Kistemann 2011, Grellier et al. 2017). Interestingly, more persons considered passive interactions to have a positive effect on wellbeing than active interactions on the site. The passive interactions were also valued as one third of the respondent have a second home at flads, which they visit. This service provided on land is directly related to the flad, as well as hunting, a very common activity amongst the respondents. Fishing in flads also seems to be an appreciated activity in flads.

Approximately half of the respondents said they visit flads only sporadically, and usually they use the areas for fishing, hunting and recreation. These activities are all health promoting but surprisingly the passive interactions were assessed higher than the active. Diverse cultural services are related to individual well-being (Plieninger et al. 2013,10). The survey targeted exactly the opinion of the responder and these personal values are reflected within the results. Recreation and hunting are all potential threats to biodiversity that can lead to conflicts between stakeholder livelihoods and biodiversity conservation (Young et al. 2005, 1641).

Modern actions, such as nature education, are not considered very important by over half of the respondents, shown by data in my survey (Fig.30). Environmental education is a common service highlighted in many publications (Eskelinen et al. 2018; Hutcheson et al. 2018; Martín-López et al. 2012), but it seems that it is hardly assessed in ecosystem service quantifications (Mocior & Kruse 2016). Education of young people is correlated with the perception of environmental education, as an important ecosystem service (Martín-López et al. 2012, 8). Nature schools provide outdoor education for children. There are two very active Nature Schools in Kvarken, one in Umeå and one in Vasa. This kind of ambulating services have been offered in Finland for 25 years and in Sweden for 35 years, so the service is still quite new. None of the schools provide education directly related to flads (personal communication with Maria Svens, Ilvessalo-Lax & Mikkola 2019) and this might explain why the specific service is not highly appreciated by most of the respondents even though they are not clients of this service.

It seems that even though the respondents are familiar with the services, there exists a fundamental lack of knowledge how human and nature interact and are dependent of each other. Respondents use, some even weekly, flads for different activities, but are not aware of how their own actions might affect the areas. Eutrophication in flads is caused mainly by human activities based on land, such as forestry and agriculture. This can lead to direct deterioration of CES.

Interestingly, approximately 20% of the respondents considered that flads do not provide aesthetic experiences and overall the valuation of their appearance was considered moderately important or even less important by two thirds. The majority does regard flads as important parts of the landscape and as landscape elements, but it seems as they are not valued due to their magnificence but for other reasons that remain unclear. Coherent nature conservation values, such as ones mentioned would be important to identify. Martin et al. (2016) identified that a poor understanding of socio-ecological relationships can be traced back to a lack of knowledge considering the CES that coastal habitats provide.

Kvarken is known for its flads and they have become the emblem for the only Finnish Natural World Heritage Site on the UNESCO World heritage list. The area has been approved on the list due the criteria (viii) "*to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features*". A vast majority thought flads represent important areas to be preserved for future generation but in the assessment only one third of the respondents considered it as important or very important. Seemingly, not all respondents agree with the nomination or do not value it highly. This might be traced to lack of knowledge. A study conducted by Berg (2018) indicates that teachers have difficulties meeting the World Heritage Education aims of UNESCO and only few accomplish to highlight student's commitment to preserving World Heritage sites. Respondents of the survey are a part of a different generation than scholars, but the ground stone should be set at an early stage of life to reassure commitment also in later years.

Svels and Åkerlund (2018) studied 5 commons in the Kvarken archipelago and found that revenue is used according to three logics 1) the community 2) the resource system 3) the part-owners of which the second one is more applied. According to the authors, this fact encases preserving of the recreational value of the system. Statutes are similar for all commons, but the interpretation of them can differ. Divergent views between environmental authorities and landowners regarding use and preservation of natural resources are stated for this area (Svels, 2017). My study shows that most services are recognized but not highly appreciated which can be seen in the low amount of pristine flads in the region.

4.4 Conclusions

My results show, that landowners are familiar with ecosystem services provided by flads. Landowners clearly acknowledge the services, but rates of land use prove, that personal interest is a more important criterion than the vitality of the habitat. The landowners also value quite highly the services that are provided, how is it then possible, that the amount of destructive actions in flads is yet so high? Can authorities be blamed for closing their eyes? Not entirely. The Interreg Botnia-Atlantica project SeaGIS2.0 compared notifications of dredging's in Replot, Kvarken with visible dredging's in satellite pictures. They identified 731 dredging's from pictures but only 63 notifications of them (Matti Sahla, personal communication). The answers in this survey indicate one thing but actions exactly the opposite. Seemingly law is not being obeyed and the local environmental administration lack tools to tackle the severe problem.

As I write these words it is 2020, and the year of the environment. The Finnish government has given 100 million € for nature conservation for public and state-owned land. At the end of 2018, the second Finnish evaluation of the IUCN threatened biotopes was published; 48% of the 400 Finnish biotopes are threatened. Shortly after, in 2019 the third national estimation of the IUCN threatened species was

published: compared with the last evaluation in 2010, the amount of species threatened had increased.

The questions in the survey were not placed in an optimal and clear way, since one entire survey had to be removed from the results as the person had clearly misunderstood the questions (one respondent from Sweden). Almost all other surveys conducted were useful as the author was present. One can assume that the remaining respondents understood the questions since the survey was explained very carefully for the participants.

Pressure to conserve and restore nature increases. Hopefully local governmental nature conservation has learned from their Natura 2000 Odyssey and will not repeat their mistakes. Stakes are high since according to the Finnish Ministry of the Environment the preparation of legislation for protected areas in Kvarken will start in 2020, which will probably create confrontations between locals and government. Landowners in the Kvarken region seem to be aware of the ecosystem services provided by flads and this knowledge should not be neglected, but instead emphasized. Activation of women in issues considering landowning matters could also be a solution to improve the situation as several studies show, that the environment gains when women are included in decision-making processes. The coastal areas of Kvarken are under heavy human pressure, and to achieve a sustainable future for these areas both the government and landowners are needed, working hand in hand finding mutual solutions to restore degraded nature values.

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Appendix 1: Survey

Det treåriga Interreg Botnia-Atlantica projektet Kvarken flada undersöker grunda havsvikar i hela Kvarken området. Med denna enkät karteras de nyttor som lokala upplever sig få av flador samt de tjänster som lokala känner till. Svaren ur denna enkät kommer att användas till ett magisterarbete i Yrkeshögskolan Novia samt till slutrapporten av projektet Kvarken Flada.

Bakgrund

Kvarken är känt för landhöjningen. Ett fenomen förorsakat av den konstanta landhöjningen är uppståendet av flador. Flador är grunda havsvikar, som sakta blir avsnörda från havet och har därmed ett begränsat vattenutbyte. De uppvärms snabbt på våren eftersom de är mycket grunda och har ett skyddat läge. Därför prefereras de av fisk som lekplatser men även som vilo- och födoställen för fåglar.

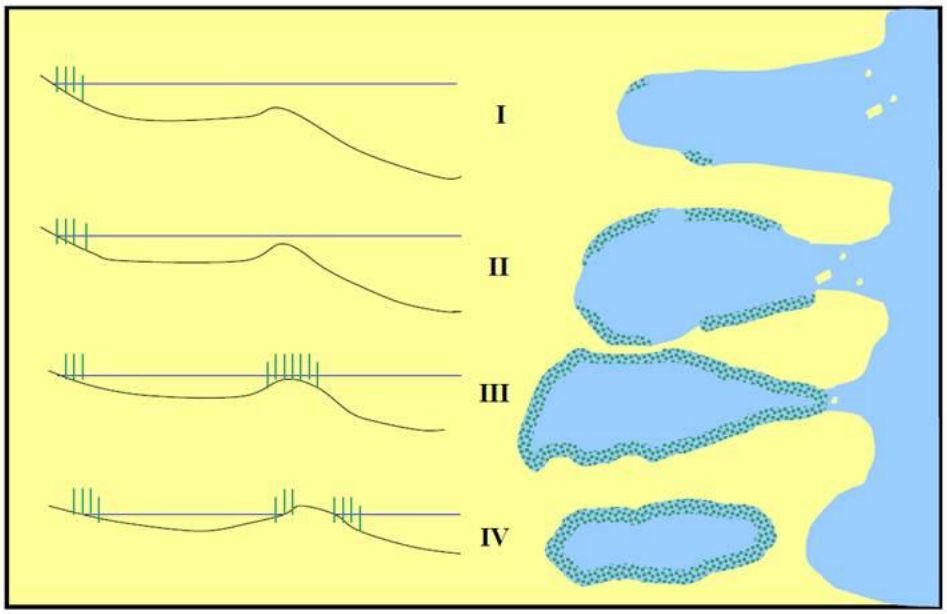

Bild: Munsterhjelm 1997

Basuppgifter om svararen

Kön:

Ålder:

Kommun:

Har du hört begreppet flada förr?

Ja Nej

Kände du till hur de uppstår?

Ja Nej

Kände du till att de är viktiga lekområden för fisk?

Ja Nej

Brukar du besöka flador?

Ja Nej

Om nej så hoppa över de två följande frågorna

Ungefär hur ofta brukar du besöka flador?

Varje vecka

Varje månad

Varje år

Vad brukar syftet med ditt besök vara?

Rekreation

Fiske

Stugbesök

Annat; vad? -

_____
_____

Ekosystemtjänster

Ekosystemtjänster är alla produkter och tjänster som naturens ekosystem ger människan och som bidrar till vår livskvalitet. Ett ekosystem är en avgränsad mark- eller vattenyta där levande växter, djur, insekter och mikroorganismer lever i ett kretslopp och är beroende av och påverkar varandra.

Ekosystemtjänster delas i fyra grupper

Ekosystemtjänster kategoriseras oftast som försörjande, reglerande, kulturella och stödjande tjänster.

Följande frågor handlar om olika direkta och indirekta nyttor flador erbjuder människor. Varje fråga består av två delar. Första delen av frågan presenterar en nytta och du skall berätta om du känner till denna nytta (ja eller nej). I andra delen av frågan skall du värdesätta nyttan enligt din åsikt (1 - jätte viktigt 5 inte alls viktigt).

OBS! Om du svarar nej på frågan skall du inte ge ett värde åt nyttan!

1. Känner du till, att flador är bra livsmiljöer för havtorn?
   Ja *Nej*

   Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

   1 2 3 4 5

2. Känner du till att fiskproduktion i flador påverkar kommersiellt fiske?
   Ja *Nej*

   Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

   1 2 3 4 5

3. Känner du till, att växter och djur fungerar som naturliga reningsverk mot luft- och vattenföroreningar och på detta sätt ökar förekomsten på rent vatten?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

4. Känner du till att det begränsade vattenutbytet i fladan gör att vattnet värms upp snabbare och förbättrar på detta sätt överlevnaden för fiskyngel?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

5. Känner du till att vegetationen i fladan bidrar till klarare vatten?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

6. Kände du till att flador är viktiga för tillgång på vuxen fisk som kan utnyttjas till föda

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

7. Kände du till att flador producerar rovfisk (abborre och gädda) som är viktiga för den ekologiska balansen i havet?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

8. Kände du till att flador minskar eutrofiering utanför fladan? (Fladan binder närsalter och organiska ämnen som annars skulle rinna ut i havet)

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

9. Kände du till att den lägre salthalten i fladan troligen gynnar förekomst och förökning av fisk?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

10. Kände du till att flador är viktiga kolsänkor (och på detta sätt erbjuder människor en tryggare miljö att leva i)

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

11. Kände du till att flador har positiv inverkan på människors välmående genom de aktiv vistelse som kan göras vid flador (tex att simma, att ro, att fiska)?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

Vilken slags fysiskt aktiv vistelse brukar du göra vid flador?

_____

12. Kände du till att flador har positiv inverkan på människors välmående genom fysiskt passiv vistelse vid flador (njuta av utsikterna, avkoppling)

Ja Nej

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (*1 - mycket viktig 5 - inte alls viktig*)

1 2 3 4 5

Vilken slags passiv vistelse brukar du göra vid flador?

_____

13. Kände du till att vetenskaplig forskning görs vid flador för att öka förståelsen om dem?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

14. Kände du till att flador kan användas vid miljöuppfostran? Tex. Bland naturskolor och/eller grundskoleutbildningens undervisning om istid.

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

15. Tycker du att flador har betydelse som kulturarv?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

16. a) Kände du till att flador kan erbjuda positiva estetiska upplevelser och därför fungera hälsobefrämjande?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

b) Tycker du att flador är viktiga lansdkapselement?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

17. Tycker du att flador har symboliskt värde?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

18. Tycker du att flador är en viktig del av det lokala landskapet?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5

19. Tycker du flador är något som borde bevaras för framtida generationer?

Ja *Nej*

Ifall du svarade ja, värdesätt nyttan enligt din åsikt (1 - mycket viktig 5 - inte alls viktig)

1 2 3 4 5