Gap analysis of situation picture information sharing between Arctic and North-Atlantic Region SAR authorities

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The purpose of the thesis was to determine the possible gaps in sharing of information that is related to operative situation picture. The target group was the partners of ARCSAR (Arctic and North Atlantic Security and Emergency Preparedness Network) project. The thesis was part of Laurea University of Applied Sciences International RDI (research, development and innovation) program. The results of the research will be used as support in the future development of ARCSAR project.

SAR operations in the Arctic and North-Atlantic region is demanding due to the environment. Effective sharing of information to create situation picture would make the operability of SAR units easier. However, at these regions multiple authorities might operate in same situation but use different technologies. This creates difficulties in building the situational picture. Objective was to find the existing gaps in the information sharing, so that those deficiencies could be detected and fixed in the future.

Theoretical framework was based to already existing reports, legal requirements, findings of earlier projects related to the topic area, and familiarizing to the topic through seminar.

The thesis includes results of the gap analysis, that was based to the results collected via questionnaire. The gap analysis revealed several gaps, and recommendations were created based on them. The most important notions were the gaps in sharing contact details, and the lack of sharing information about existing resources. The limited collection of necessary information in one accessible place was also observed.

Recommendations rose out from the findings are regular communication checks, sharing of contact details, sharing knowledge of available resources, gathering relevant links to the ARCSAR platform, joint exercises with NGOs (Non-Governmental Organizations) and other relevant instances, possible utilization of the finding from another project called CISE (Common Information Sharing Environment), and possible implementation of mandatory sailing plans. The recommendations may be utilized in the ARCSAR project and they may result to more specified studies about the sections that had gaps.

Opinnäytetyön tarkoituksena oli selvittää, onko ARCSAR (Arctic and North Atlantic Security and Emergency Preparedness Network) projektipartnereilla aukkoja tiedonjaossa, kun puhutaan operatiivisen tilannekuvan vaatimista tiedoista. Opinnäytetyö tehtiin osana Laurea Ammattikorkeakoulun kansainvälistä tutkimusohjelmaa. Opinnäytetyön tuloksia käytetään ARCSAR projektin tukena tulevaa kehitystä ajatellen.

Arktisen ja Pohjois-Atlantin alueen meripelastustoiminta on haastavaa olosuhteiden vuoksi. Tilannekuvan tehokas jakaminen helpottaa pelastusyksiöiden toimintaa, mutta alueella usean eri maan yksiköt saattavat toimia samassa tilanteessa käyttäen eri teknologioita. Tavoitteena oli löytää kipupisteet tiedonjaossa, jotta aukkoja siinä voidaan kaventaa. Tietoperustana käytettiin olemassa olevia raportteja, laissa määriteltyjä vaatimuksia, aikaisempia projekteja aihepiiriin liittyen ja niistä nousseita löydöksiä, sekä perehtymistä aiheeseen seminaarin kautta.

Tämä opinnäytetyö sisältää tulokset kyselylomakkeen pohjalta suoritetusta puuteanalyysistä. Puuteanalyysissa selvisi useita puutteita, joista on koostettu suosituksia. Tärkeimmät huomiot olivat puutteet yhteystietojen jaossa, sekä resurssitietojen jakamisen puute. Vajavainen tietojen kerääminen yhteen paikkaan helposti saataville nousi esiin yhtenä olemassa olevana puutteena.

Kehittämisehdotuksina opinnäytetyön tuloksena syntyi säännölliset yhteystietotarkistukset, yhteystietojen jakaminen laajemmin ja vastuuhenkilöiden määrittäminen, resurssitietojen jakaminen, tarpeellisten linkkien kerääminen ARCSAR alustalle, yhteisharjoitusten pitäminen siviilijärjestöjen ja muiden toimijoiden kanssa, mahdollinen uusi tiedonjakoalusta toisen projektin hengessä, sekä mahdollinen pakollinen alusten reittisuunnitelmien käyttöönotto Arktisella alueella. Tuloksia voidaan hyödyntää ARCSAR projektissa, sekä niiden pohjalta voidaan lähteä toteuttamaan mahdollisia tarkentavia tutkimuksia eri osa-alueista, joissa on havaittu puutteita.

Asiasanat: Tilannekuva, Tiedonvaihto, Arktinen alue

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Abbreviations

ACGF	Arctic Coast Guard Forum
ACOPE	Arctic Operational Emergency Agency Innovation Platform
AECO	Association of Arctic Expedition Cruise Operators
AIS	Automatic Identification System
AMSA	Arctic Marine Shipping Assessment
ANA	Arctic and North Atlantic
ARCSAR	Arctic and North Atlantic Security and Emergency Preparedness Network
Barents SRS	Barents Ship Reporting System
CISE	Common Information Sharing Environment
ICAO	International Civil Aviation Organization
IAMSAR Manual	International Aeronautical and Maritime Search and Rescue Manual
IMO	International Maritime Organization
JRCC	Joint Rescue Coordination Centre
JRCC NN	Joint Rescue Coordination Centre of Northern Norway
MARPOL	International Convention for the Prevention of Pollution from Ships
MRCC	Maritime Rescue Coordination Centre
MRSC	Maritime Rescue Sub Centre
NGO	Non-Governmental Organization
OSC	On-Scene Coordinator
Polar Code	International Code for Ships Operating in Polar Waters
RCC	Rescue Coordination Centre
SRR	Search and Rescue Region
SRS	Search and Rescue Sub-Region
SAR	Search and Rescue
SPOC	SAR Point of Contact
SRU	Search and Rescue Unit

1	Introduction

The Arctic region is a multinational operating environment, and the cooperation between countries is especially valuable in Search and Rescue (SAR) operations. The need for better SAR capabilities and infrastructure is recognized widely (Sydnes et. al. 2017, 110). This goal of efficient cooperation is already stated in the agreement page of the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011). The authorities in the Arctic region have noticed the need for more communication and coordination (Ikonen 2017, 1). In the thesis, current gaps in the information sharing when forming a situation picture, are researched. Therefore, the research question posed is: "What are the gaps in information exchange for creating a situation picture between Arctic and North-Atlantic region Search and Rescue authorities?".

During rescue operations, the decisions made are mainly based to the information received and analyzed from the field. This collected information is then used to create a situation picture, which is constantly updated. Information contained in the situation picture is used as a tool to make decisions (Maanpuolustuskorkeakoulu 2008 and Valtioneuvosto 2010 cited in Koistinen 2011, 25; Huovila et. al 2010, 19). Good leadership requires forming of situation picture (The Security Committee 2017, 15), and efficient leadership is important when lives are at stake. Therefore, this topic was seen important as a background work to the EU project, ARCSAR (Arctic and North Atlantic Security and Emergency Preparedness Network), which aims to develop cooperation between Arctic countries. ARCSAR is an EU funded 5-year project that started in September 2018 and ends in August 2023. ARCSAR has received funding from the Horizon 2020 research and innovation program under grant agreement No 786571. The project coordinator and leader is JRCC NN (Joint Rescue Coordination Centre of Northern Norway). ARCSAR aims to develop a webpage, communication platform and innovation arena for the project partners. The focus is at increasing the interaction between international networks in the Arctic region. The project has 21 partners at the time of writing the thesis, participants in the project are from the EU, USA, Canada, and Russia. Partners include SAR practitioners, universities, industry players and other related entities. One goal of the project is to gather more partners to establish a wider network for sharing information. (ARCSAR n.d.)

Laurea University of Applied Sciences is a ARCSAR project partner through the Laurea International RDI (research, development and innovation) programme. The ARCSAR project is divided into different WPs (work packages) and each WP has tasks. Laurea University of Applied Sciences is responsible for certain work packages and tasks in the project, and development of the communication platform is one of them. The thesis focuses to doing groundwork in establishment of the platform, by researching the current gaps in operational situation picture information sharing. The ARCSAR project is planned to continue, based partially to the results

received from the thesis. The limitation of the thesis was chosen to be the operational side of creating a situation picture.

The research subject was mapping the current level of information exchange when creating situation picture and comparing it to the optimal level. The questions were based to the Maritime Search and Rescue Manual (2010) published by Finnish Border Guard. This manual is designed to complement the IAMSAR Manual (n.d) and offers more detailed instructions for SAR operations. By creating a questionnaire to pinpoint the current situation of information exchange regarding the situational picture, and comparing it to the ideal, it provided information concerning existing gaps. Doing a gap analysis and collecting free answers resulted in further suggestions and comments.

2 Theoretical framework

Search and Rescue (SAR) operations at the Arctic region are demanding because of the harsh and vulnerable environment. The risk of environmental disaster or major incident is rising as the polar ice is melting and maritime traffic is increasing (Ikonen 2017, 23). One large fear of the SAR community in the Arctic is a mass-rescue operation of a cruise ship (Fountain 2017). It was a strong reminder that accidents may happen even to state of the art ships, when the Viking Sky accident at the Norwegian coast happened in March 2019. There a two years old luxury passenger ship lost all power of its engines and started to drift towards rocks. At the Barents Observer article Quinn (2019) brings out the unfavorable reality of problems if the accident had happened in the Arctic region.

2.1 Key concepts

This chapter goes through the key concepts, that are opening up the complexity of the operating environment. Understanding the environment and characteristics that effect SAR, especially in the Arctic, will give more insight to the subject. The concepts are chosen to be most relevant according to the thesis writer but does not include all factors that play role in the Arctic, as that would have exceeded the thesis limitations.

2.1.1 Arctic region and North-Atlantic region

There are multiple definitions of what is Arctic region: it could be defined by the arctic tree line, the temperature, the region over Arctic Circle, by political agreements or by sea ice. Depending on the context or the used source, different definitions may be used, as is shown

in the Figure 1 from Nordregio (Nordic Centre for Spatial Development).

Figure 1: Arctic region definitions

(Nordregio n.d.)

The Arctic region it is mostly ice and water, not continent, but the Arctic countries are in proximity of each other. This situation leads to the fact that international laws play a critical role in the region. Disputes over territory and resources have in most cases been settled by following the internationally approved laws and regulations, such as the UN Convention on the Law of the Sea (Buyers 2013, 5-6). Law of the Sea states the full rights to the seabed resources and fish, and regulatory power over foreign shipping within 12 nautical miles range from a state's shore. From twelve nautical miles to 200 nautical miles, the area is called EEZ (Exclusive Economic Zone), and the coastal state still has the rights to seabed resources and fish, but less rights concerning international shipping. After 200 nautical miles, the right to the fish is lost, but if the seabed is scientifically proven to be a natural prolongation of their landmass, there is right to the seabed resources. (Buyers 2013, 6) Only the Hans island is

exception in defining the rights for the land, as there is 875 meters of unclaimed territory. (Buyers 2013, 14). The melting of the multi-year ice, which reveals and enables access to un-discovered natural resources, might cause some future resource claims (Rostom & Migliozzi 2017).

The ANA (Arctic and North-Atlantic) region consists of the Arctic Ocean, the North Atlantic Ocean, and the countries around the oceans. An exact definition of what belongs to the ANA region is difficult to conclude as it is not clearly stated anywhere as a concept. According to EU (2005, 4) and the ARCSAR project (N.d.), in Europe, the Atlantic region includes Great Britain, Ireland, and coastal areas of Denmark, Germany, Netherlands, Belgium, France, Northern Spain, and small section of Northern Portuguese coast. In the USA, the range is from Maine to Virginia (NOAA 2019). In Canada the Atlantic region is known as "Atlantic Canada", and it consists of the provinces of New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island (Natural Resources Canada 2019). In the context of the thesis, the ANA region is including the abovementioned states and areas, as the ARCSAR project is including both regions, the Arctic and North Atlantic. Since the Arctic region is including all the same traits regarding rescue mission and cooperation needs but may be considered as a more complicated operating environment than the North Atlantic region, in the thesis mainly term "Arctic region" is constantly referred to. If the communication issues are resolved in the Arctic region, that same or similar model may be utilized in the North Atlantic as well.

2.1.2 Search and rescue operations

Search and Rescue (SAR) include tasks of searching and rescuing people that are in distress at sea, providing emergency medical assistance, and conducting radio communications related to the emergency. Also, telemedical assistance, maritime assistance, use of emergency signaling devices, and emergency medical services at the sea are included in the search and rescue definition. (Maritime Search and Rescue Manual 2010.) Operations may include equipment that operates on the water or in air, in the Arctic region, it is often combination of both means of transportation since the distances are great and aeronautical equipment is often faster than nautical. Unfortunately, the problem with helicopters for example, is the fact that in case of large cruise ship accidents, the person transport capacity is quite low and therefore would potentially be too slow. (Ikonen 2017, 17.)

2.1.3 Situational awareness

The term situational awareness originates from military aviation, where it meant the crews' ability to acknowledge the surrounding elements during air fight and predict how the situation would develop (Nissinen 2009 cited in Koistinen 2011, 25). The term has spread to other sectors of society but is nowadays often referred to in demanding and pressuring situations that require decision making, and where the decisions have consequences. In its simplest

form, it is knowledge of what is happening and how the situation will develop in the future. Therefore, situational awareness is not a static state, but more dynamic. (Koistinen 2011, 22).

2.1.4   Situation picture

Situation picture is not so defined as a concept like situational awareness is. As Koistinen (2011) refers to the Maanpuolustuskorkeakoulu (2008), the situation picture might mean anything from map description to a full understanding of the situation all-around. Common to all the different descriptions, however, is the fact that situation picture is always seen as a support to the decision-making process, making it essential for adequate and well-founded decisions (Maanpuolustuskorkeakoulu 2008; Valtioneuvosto 2010; Huovila et. al 2010 cited in Koistinen 2011, 25).

Authorities create a situation picture based to the received information from the incident site and previously existing information. According to the VTT study (Huovinen et.al 2010, 19), the situation picture is not formed just from the technical data and camera pictures, but also from the awareness and understanding of unmeasurable and undetectable circumstances, such as estimation regarding reasons for and possible development of the situation. In the context of disaster management, the pre-existing information is called secondary data, and the information received from the field during the situation is primary data (UNDAC Field Handbook 2018, 11). In the context of the thesis, secondary data could include maps, local knowledge of the area, weather predictions based to previous years, assessment reports and other similar relevant information to help decision making. Primary data is received from the field and could consist of the number of injured, affected areas, changes in the situation etc. Primary data is built up on top of secondary data. When concerning the situation picture, secondary data may be considered as the general situational picture and primary data is the data that happens out in the field and is received from the field during situation. When these are combined, a situation picture is formed.

2.1.5   Rescue Coordination Centers

There are RCCs (Rescue Coordination Centre) and JRCCs (Joint Rescue Coordination Centre). RCC and JRCC both handle the search and rescue coordination, but JRCC consists of different authorities that have joined their resources in one operation center. When centers are focused merely to maritime search and rescue, they are called MRCC (Maritime Rescue Coordination Centre) and MRSC (Maritime Rescue Sub Centre). Different countries have different division between the responsibilities of authorities, so that defines which type of Coordination Centre is used. Despite the name, the function is same; to coordinate the actions, and provide and process information.

2.1.6 Exercises

Since practicing during a live emergency situation is far from optimal, it has been beneficial to conduct different types of exercises to improve the skills of Search and Rescue operatives. There is no education program that would focus to SAR in arctic operating environment, so each country is having their own courses and trainings (Ikonen 2017, 26). When having multi-national exercise, the SAR operatives have a chance to train together. One detected problem with the national training is the fact that most of them are offered only in the native language, which makes international cooperation more complicated (Hario & Norvanto 2018).

There are different types of exercises: walkthroughs, workshops, and orientation seminars, table-top exercises, functional exercises and full-scale exercises (Ready N.d.). These types may be segregated or named slightly differently depending of the source but in the thesis, this separation is presented.

Walkthroughs, workshops and orientation seminars are meant to introduce the idea of emergency management, as well as the guidelines that are created for emergency situations (Ready N.d.). These are often the beginning of a training, as it does not require deeper knowledge of the subject yet.

Table-top exercises are a cost-effective and rather quick way to have people gather together to train (Ready N.d.). These table-top exercises give clarification of the roles and possible obstacles that must be considered in live situations, and they might help in improving the communication between participants during live situations through the experiences collected during the exercise.

Functional exercise is already slightly larger in scale, as it includes the simulation of a particular event. It is a good opportunity to test procedures and resources. (Ready N.d.)

Full-scale exercise is the most time-consuming, but often the most revealing type of exercise. Performing in a live environment with actual people and real equipment can provide valuable notions of what works well and what needs improvement.

After an exercise, a report is created, which serves to describe the exercise and determine the lessons learned. Valuable information is collected and analyzed in the reports. This data will help in the next exercise, or in the real-life case, to avoid the mistakes that already occurred and were detected from the previous exercise.

2.1.7 Cooperation

In the context of business English, the Cambridge Dictionary (2019) defines the word cooperation as "the process of working with another company, organization, or country in order to achieve something". So, as the Arctic authorities wish to achieve more effectivity in rescue

operations, they should cooperate. In the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011) cooperation is strongly advised, and specific information exchange points are offered. These include for example details of facilities, such as airfields, fuelling points, medical facilities, and exchange of experience and knowledge for instance by having meetings, regular communication checks and exercises etc. Cooperation is a familiar term, but the exact meaning might differ between situations. In the thesis, the Cambridge Dictionary definition is kept as a guideline.

2.2   Environmental factors

Due to the ever-rising temperatures in the world, the areas in question have experienced an increase in the melting of ice in last few decades, which would suggest that the melting will only continue as the open sea absorbs more heat (AMAP 2012, 35). The traffic has grown exponentially, as there are more cruise ships and tankers using the opening shipping routes (ARCSAR 2019, 1). Natural reserves, such as oil and gas, are interesting to companies, and activities related to natural reserves will likely contribute to the traffic increase (Ocean Conservancy 2017, 16). Authorities have recognized these changes, and the ARCSAR project is expected to increase the communication and information sharing between the partners which will improve the readiness for responding to an accident (CORDIS N.d.; ARCSAR 2019, 1). Due to the remote locations, lack of infrastructure and scarce resources, communication and information sharing between the operators in the region is essential.

The lack of proper communication networks causes dead spots for transmissions, which makes information sharing difficult. Satellite coverage for GPS (Global Positioning System) usage is insufficient (Dubois 2018), and the broadband network is poor (Safety4sea 2019). In the Arctic Guardian 2017 exercise, for example, the email proved to be a useful tool alongside VHF (Very High Frequency) for sharing lengthy information without using radio time for long (ACGF N.d., 24), but if the connections are not reliable, the information might not find the receiver at all. Issue regarding the ARCSAR project is also the fact that different partners in the respective region have different requirements for information, depending on whether they are authorities or, for example, universities. The thesis focuses to the operative side, more specifically to the operational situation picture information sharing and the existing gaps. The majority of SAR authorities in the Arctic recognizes the poor communications network as one of the largest challenges for maritime and aeronautical SAR (Ikonen 2017, 20).

2.3   Exercise reports

Multiple reports, such as the SARC (Ikonen 2017) survey, and the report of Third Joint Arctic SAR TTX tabletop exercise held in Reykjavik 2018 (AECO 2019) recognizes the challenges of the arctic environment and the benefits of solid cooperation between countries. AECO (Association of Arctic Expedition Cruise Operators) reports of tabletop exercises held in last three

years proved to be valuable for gaining insight to the subject of the thesis, as well as SAR operations in general. The report of the "Arctic Guardian" exercise from Reykjavik in year 2017 (ACGF n.d) is related to the project, therefore it was used as background research material. This report was supplied by the ACGF (Arctic Coast Guard Forum) and is generally not publicly available, but only on request. In the Arctic Guardian exercise, cooperation between authorities was trained, and the lessons learned section provided more insight to the thesis context. Live exercise and table-top exercise reports give valuable information, but they are difficult to find due to the limited distribution. The thesis focused to establishing a set of relevant questions to map out the current state of information sharing when forming an operational situation picture. Maritime Search and Rescue Manual (2010) has mapped out the relevant information for creating situation picture, and that was used as basis to creation of the questionnaire.

2.4 Legal requirements for SAR in Arctic

International conventions guide maritime activities in general and include minimum requirements for SAR activity. Countries may have their own legislation, for example, Finland has the Maritime Search and Rescue Act (1145/2001), and the Government Decree on Maritime Search and Rescue (37/2002) (The Finnish Border Guard 2019). These national laws and guidelines are to be in compliance with the international legislation. In Finland, the Maritime Search and Rescue Manual (2010) is based to the above-mentioned national legislation and therefore was used as relevant material in the thesis. These regulations do not however state the form for communication between SAR authorities. There is neither international standard for rescue equipment nor to exact communication equipment that SAR authorities should use for communicating with each other.

Considering globally, The International Convention on Maritime Search and Rescue, also known as the "Hamburg Convention", which was adopted by IMO conference in 27th of April 1979 (Maritime Search and Rescue Manual 2010), is the most important convention in maritime SAR and is legally binding. MARPOL (International Convention for the Prevention of Pollution from Ships) is essential in the Arctic region, as natural disaster would have enormous and long-lasting effects in the area. As addition to the MARPOL Convention, there has been an adoption of the Polar Code (International Code for Ships Operating in Polar Waters) on the 1st of January 2017. The Polar Code is targeted at vessels that operate in certain polar areas where ice is present. These areas around the Antarctic area and Polar waters are defined in the Polar Code with coordinates. Additionally, the UN Convention on the Law of the Sea and the International Convention for the Safety of Life at Sea (SOLAS) serve as international legal framework.

IMO (International Maritime Organization) and ICAO (International Civil Aviation Organization) published the IAMSAR Manual (International Aeronautical and Maritime Search and Rescue

Manual), which is aimed for all SAR operators internationally. This manual provides guidelines to the operators, and is an international standard, but not a binding one. IAMSAR Manual is based to the Hamburg Convention. There is also the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011), which was accepted by Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and USA.

2.5   Arctic region SAR authorities

Arctic region is divided into certain SAR responsibility areas, which are called search and rescue regions (SRR), and the borderlines were defined in the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011). These regions are illustrated in the Figure 2, as they are presented in the Arctic Search and Rescue Capabilities Survey (Ikonen, 2017, 15).

Figure 2: Arctic SAR agreement areas
(Ikonen 2017, 15)

The responsibility areas shown in Figure 2 do not correspond exactly with any of the Arctic region definitions that were presented in key concepts (Figure 1). These clear borderlines offer clarity to the jurisdictional questions when concerning SAR, but these are "not related to and shall not prejudice the delimitation of any boundary between States or their sovereignty,

sovereign rights or jurisdiction", as is stated in the Article 3, section 2 of The Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011). Abovementioned sentence is good example of the importance of sensitivity in all agreements or other obligating documents in the Arctic.

3 Research process and methodology

The thesis commissioner, ARCSAR partner Laurea University of Applied Sciences, wished for an assessment of the current gaps in information exchange between ARCSAR partners. Due to the limitations of the thesis scope, the operative situation picture was chosen as the research target area. To understand more about the operating environment and SAR operations, the literature and other material was researched. The thesis writer visited the ACGF (Arctic Coast Guard Forum) Seminar 2019 held in Turku, Finland, 4th to 5th of April, where the opportunity to meet some of the ARCSAR partners for preliminary opinions of the thesis subject was seen beneficial by the thesis writer and commissioner. ACGF is defined in their website as following: "The Arctic Coast Guard Forum (ACGF) is an independent, informal, operationally-driven organization, not bound by treaty, to foster safe, secure, and environmentally responsible maritime activity in the Arctic. All Arctic countries, Canada, Denmark, Finland, Island, Norway, Russia, Sweden and the United States are members of the forum. Chairmanship duties of the ACGF rotate every two years in concert with the Chairmanship of the Arctic Council. Iceland is the chair for the Forum in 2019 - 2021." (ACGF n.d.). The response for the thesis subject was positive during said conversations, and seminar presentations from representatives of different sectors and countries gave insight to the Arctic area and SAR operations.

Concerning the method used for conducting the research, a qualitative approach was chosen primarily, since the thesis subject is rather difficult to be illustrated by numbers alone. Numerical values or quantitative data is used to support the qualitative data. As Hesse-Biber & Leavy (2011, 4) state, qualitative study is after the meaning of why, and the reasons behind the why are the interest in the thesis. As the Trumbull & Watson (2010, 64) state, the qualitative study is trying to discover as much as possible about the subject under study by providing detailed narrative descriptions instead of statistical calculations. This approach often leads to smaller sampling groups under study, which in the case of thesis was preferred as the ARCSAR partners are not many in numbers.

When conducting qualitative research, multiple methods may be used and a case study is one of them (Hesse-Biber & Leavy 2011, 5). The case study method may be qualitative or quantitative in nature (Yin 1989 cited in Trumbull & Watson 2010, 72). The focus on one event or phenomenon and the possibility to gain in-depth view to it, is the strength of case study (Feagin, Orum & Sjoberg 2010 cited in Miles & Taylor 2010, 129), and that led to the choice of qualitative case study.

A multi-method approach, that qualitative research is in focus (Trumbull & Watson 2010, 62), includes multiple approaches for conducting the research. For the thesis the questionnaire and the gap analysis were chosen. The research started by sending out a questionnaire that consisted of quantitative questions, which were opened with optional qualitative answers. Collecting a general view through the comparable numeral values and collecting more detailed information through the specifying open questions. The results of the questionnaire data were used for the gap analysis.

3.1 Questionnaire

A questionnaire was chosen as the method, since interviews would have been difficult to conduct due to scheduling difficulties, and the distance between thesis writer and different partners. Questionnaire is one of the most common methods used in the sociological studies (Ojasalo, Moilanen & Ritalahti 2014, 121). Kothari (2004, 103) states in his text, that questionnaire has two main types of questions, multiple choice and open questions. There is also possibility for a closed question, which often refers to the options "yes" and "no", that may be considered as specific type of multiple choice question. Multiple choice questions have only certain options for answering, and the open questions are for example free text. Using multiple choice, or closed, questions, the analysing of the answers is more efficient and there is no room for interpretations. However, open questions offer the possibility for a free response, and that is the advantage of open question. Going through open answers requires more effort in the analysing stage, nevertheless. Rarely a questionnaire relies only to a one type throughout the whole questionnaire, but rather by combining the types, it is possible to gain more insight to the subject. (Kothari 2004,103). Unless a questionnaire is based to certain sample group, it may not be used to resemble the whole target group (Ojasalo et. al 2014, 129).

Aim of the commissioner was to determine the current state of information exchange and existing gaps within the system. With additional sub-questions, the answers would be more specified to the actual method of receiving the information. Sub-questions would also clarify for reasons behind in case the partner is not receiving the information. These specified answers would then be analyzed to extract more data of where the information is received from. When the source of information is acknowledged, the source could hopefully be integrated in the platform instead of recreating it. The duplicate work would be minimized, if the platform could use that already existing data or at least have guidance concerning where to find it from. The analysis would also give guidance in what information is seen beneficial by which partners.

In the study "A Meta-Analysis of Response Rates in Web- or Internet-Based Surveys" (Cook C., Heath F., Thompson R. L. 2000, 821-828), it is argued that the response representativeness may be seen more valuable than the response rate. Since the respondents represents a

certain group, the answers are more useful to the research. This view is also supported by Miles & Taylor (2010, 129) as they describe the Case Study Methodology to be different from random sample surveys, because they focus only to a certain phenomenon studied and thus should avoid generalization. In the thesis this was seen important, since the partners were represented mainly in similar proportions as they are currently involved in the project. Majority of the ARCSAR partners are Academia (7) or Practitioner (10) and they were the majority in responses, but the Practitioner response rate could have been larger so it would have corresponded more with the current partner dispersion. The other partners in the project are Industry (2), and Organization (2) who were represented in the questionnaire as well.

The questionnaire was based to the Maritime Search and Rescue Manual (2010) chapter 3. The thesis commissioner originally requested questions based to the IAMSAR manual, but with consent of the commissioner, the Maritime Search and Rescue manual was found more beneficial for forming questions. The manual is based to the Finnish legislation and on the IAMSAR (n.d.) Manual, so the original request was partially fulfilled, nevertheless. After collecting from the Manual, the minimum standards of the necessary information when forming a situation picture, these standards were transformed to questions. They were then used in the questionnaire sent later to ARCSAR partners. The questions were tested before sending to ARCSAR partners with Laurea representative Mr. Isto Mattila, who has extensive background in maritime safety and security (Mattila n.d.). The questionnaire was also approved by the ARCSAR project leader JRCC NN before sending out to get an opinion from the actual target group. As the questions only focused to the situation picture, they were not extremely relevant to all partners. This downside was acknowledged beforehand, but the variety of answers was recognized as potentially useful information. In discussion with the ARCSAR project leader and the thesis commissioner, the respondents were selected to be 30 ARCSAR partners or other associates to the project from all the partner categories. With different views from the partners, the information could be analysed and divided between operative and other answers during the data analysis phase. This would give two sets of information, the one that operative side requires, and what the other partners see beneficial.

After collecting feedback from the prototype version of the questionnaire, the final questions were selected. The questionnaire layout may be seen in full at Appendix 1. The questionnaire was divided into three different sections: first, the background information of the partners, second, the general situation picture, and the third was about emergency phase situation picture. In the first section, there were 2 general questions: what ARCSAR partner type they represent, and country that they represent (optional). Additionally, in the first section was a mandatory tick-the-box question that included acceptance that these results will be used at the project and as a part of the thesis. The second section had questions related to the situation picture that is permanently ongoing, such as the contact details of other organisations. The third section had more specific questions related to the emergency phase situation

picture, which included for example the amount of people in distress. In the third section, an open comment field was included at the end of the questionnaire, which was not mandatory. Therefore, in total there were 2 background questions, 20 questions about information sharing in total, and 1 open question. The exact questions and layout are represented in appendix 1, and chapter 4.1 represents the analysis of answers to each question.

The questions were sub-divided with 4 different reply options related to if they receive that information or not. Numbers 1-3 were about the amount of received information: "1. No information is received", "2. Some information is received but not enough", and "3. All necessary information is received". As for the 4th option, the statement: "4. I don´t need this information" was used, which was provided for the partners that do not need that information to perform their work. For example, academia does neither receive nor in most cases need the information about emergency phase situation picture when the situation is active. After each reply, there were open field for comments and specification why some information is received/not received. In case the reply was number 1 or 2, addition question was used to ask if they would need that information to perform their tasks more efficiently. As mentioned, this questionnaire was focused to the operative authorities, so not all answers were that informative since the replier might have not found the question related to their tasks.

The questionnaire was sent out at Wednesday morning, and had a deadline at next Tuesday evening, so the respondent had 5 full working days and a weekend to give out their responses. The questionnaire was open until Wednesday morning to avoid any inconveniences caused by time zone differences. By giving short reply time, the risk of questionnaire disappearance into the email folders of partners was decreased, since it was one possible concern detected in advance. One notification email was sent 24 hours prior to the closing of the questionnaire to encourage the answering if they had not yet done it. After the closing of the questionnaire, 9 answers were collected out of 30 partners. 2 were from the operative practitioners, 6 from others.

The questionnaire was conducted with Google Forms, and the internal analytics provided by Google were used for creating visualization charts. Pie charts showed the differences in answers in easily readable form. Open and optional answers were collected and analysed for similarities or development suggestions. Main objective was to analyse the differences in the answers and use them to create the gap analysis and priorities list. The result of the analysis was reflected upon to the theoretical background research that was done concerning the research subject. By using the collected information, suggestions were created of how to overcome the gaps.

3.2 Gap analysis

A gap analysis is a tool that may be used for detecting the necessary steps to arrive from the current state to the desired state (Smartsheet 2019). The desired state is defined and then the current state is measured by using adequate method. When the current state is not matching the desired state, the gap is detected and actions necessary for fixing the situation are decided upon. A gap analysis often includes the priority scale as well, which is used to classify the gaps according to their importance.

In the thesis, the analysis of the gaps was performed after the answers were collected through questionnaire. A table was created where the answers were divided between the "Operative" answers that included the operative level answers and the "Others" that included academia, industry, organization and management level practitioner answers. This method was chosen, as the situational picture was identified in advance to be more relevant to the operative partners. By dividing the answers in two categories, classifying the information importance to the partners was seen more purposeful. The information is more relevant during the event to the operative side than, for example, the academic side, since the academic side often need the data only after an emergency for research purposes. But as the one goal of ARCSAR project is to share information more efficiently between all partners, this gap analysis table shows the differences in information receiving state, and the gap analysis may be utilized when concerning what information to share with partners.

3.3 Timetable of the thesis

Thesis work started in December 2018. During the spring 2019, the questionnaire and background research was conducted to create the most useful question set for the project. During May the questionnaire was sent to partners with 5-day response time. The results were analyzed, and gap-analysis performed during June-July. The final version was returned in November 2019. Publication of thesis was in November 2019.

3.4 Reliability and ethical issues

As Taylor & Welch (2010, 7) elaborate, there are four main considerations regarding the ethical side of a study. They are consent, harm, privacy, and deception. Going through these four in the context of the thesis, they become more defined. The consent is the choice to answer or not to answer the questionnaire, so there should not be any contradictory. It is also clearly stated in the questionnaire form, that it is part of the thesis and therefore used for the ARCSAR project as well. Concerning harm, there should be no harm to be caused for answering the questionnaire, as the results will only be used for the platform development. Privacy is protected through the anonymity of the questionnaire, and no names are mentioned in the thesis. Complete privacy however could not be maintained for certainty, if the answer given by the partner for example reveals their country or other significant detail that may be

traced due to the small sample. The importance of the answers and the possible benefits in the future gained from the detailed analysis was seen extremely beneficial in the thesis, so the answers were published mostly according to the details that were given by the partners, but edited to more general terms if seen necessary. This possibility of losing anonymity was one critical reason why all respondents had to understand that the responses are used in public thesis work. Deception might be the most severe possible issue, meaning that the respondents could have misunderstood the use of the results of the questionnaire. Should this issue arise, it has been unintentional and cause of unfortunate misunderstanding.

From ethical perspective, a questionnaire as a method is not very problematic, since severe ethical issues often rise if humans are the direct subject of the research. Good example of unethical study is the Tuskegee Syphilis Study where the experiment was done without the patients consent or knowledge of the nature of the research and this led later to the creation of the notion of informed consent (Hesse-Biber & Leavy 2011, 60). Therefore, to avoid ethical issues, the questionnaire was voluntary and had information about the use of the results of the questionnaire. The email sent to the partners, which included the link to the questionnaire and request to answer to it, the thesis writer was named as the contact person if the partner would have questions regarding the questionnaire and the use of it.

4   Results

Hypothesis for the research was that there is lack of information sharing in situational picture during SAR operations. The objective was to define the current situation and compare it to the ideal where all information is shared with all participants. Establishing recommendations and goals for the partners and identifying the gaps was completed.

The main contribution of the questionnaire to the research subject, are recommendations for the platform content, based to the gap analysis. The results may be used in the later stages of the ARCSAR project, as the actual platform is being created.

After closing the questionnaire and observing the answer rate, it was considered reasonable. Out of 30 partners that had the chance to answer, 9 answers were received, resulting in 30% answering rate. It was expected to not get answers from all partners, so the answering rate was representative enough. The answers of the project leader JRCC NN in the testing phase were not included in this number, and they were excluded from the actual results, and used more as extra comments when seen necessary, since they replied during the testing phase. When analyzing the answers, it stood out that information sharing is very situation based. Between same country operating units, the information sharing works fine, but when externals are inserted the matter changes. This was not an unexpected result, however, as the focus was on the gaps on international information exchange. Naturally, some of the non-

operational partners do not even need this kind of information, as they are not participating actively in the creation of situation picture.

4.1   Questionnaire answers

Answers in detail are presented in this chapter. After each figure, answers to open questions are briefly analyzed. Question A1 stated: "A1. I have understood that the results will be used in the ARCSAR project and as a part of openly published Thesis", and it was mandatory to answer "yes" in order to finish the questionnaire. This was to clarify the intended use of the answers, so recognizing the answers in later stages of the project would not be a surprise to any on the partners answering. This was seen necessary due to the public use of the answers in the thesis as well. If they were to not accept to this, they could choose not to answer the questionnaire.

In addition to these questions, the questionnaire testing answers from JRCC NN will be mentioned if necessary, but they were not in the final version of the form, so they are not included in the results of the questionnaire. They might have answered the questionnaire however, since it was anonymous, but that cannot be verified. This separation was caused by the fact that the prototype questionnaire had invalid prototype test answers, which would had been included in the results. Therefore, an identical copy of the final test round questionnaire was formed, and this resulted in the separate collection of the test answers and answers due to the Google Forms operability.

A2. Which ARCSAR partner type do you represent?
9 responses
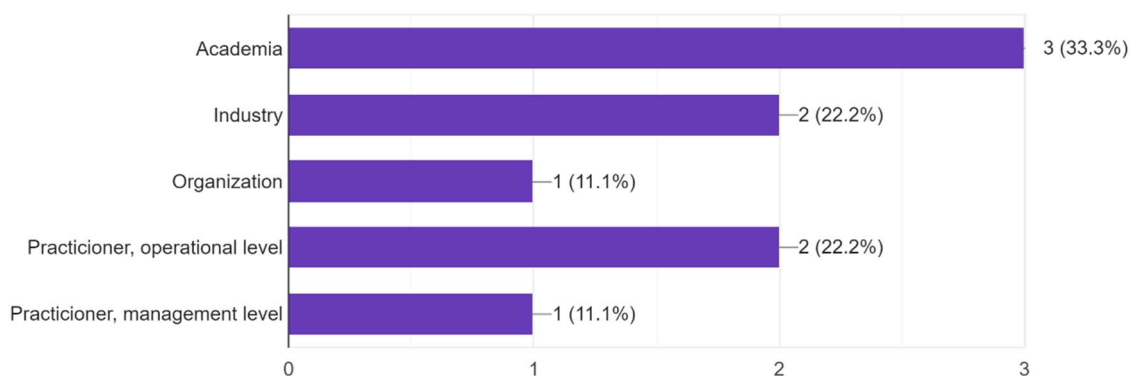
Figure 1: Question A2
N=9

The respondents' dispersion in the partner type shows that a higher number of operational level responses would have been beneficial to gather more insight from their view. But since the respondent pool was quite small, this may be seen as representative enough.

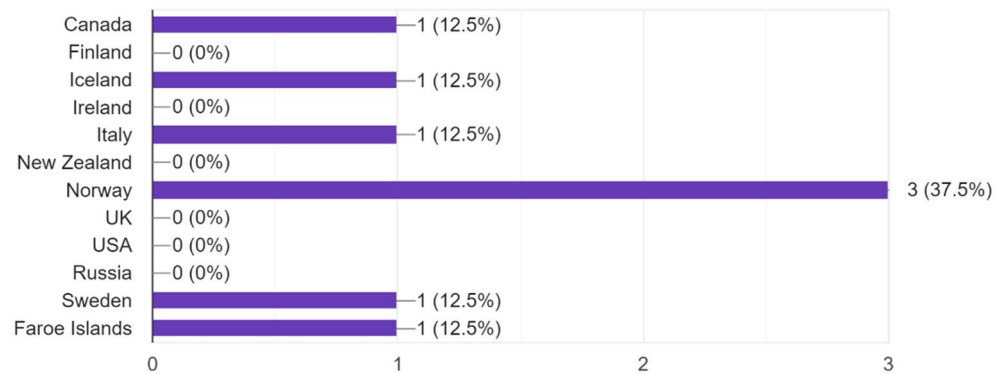## A3. Which country do you represent? (Optional)
8 responses

Figure 2: Question A3

N=9

The answer rate suggests that Norwegian partners were most active, which might be due to the fact that the Norwegian JRCC NN is the leader of the project.

B1. Do you have up to date contact details of other SAR (Search and Rescue) authorities in ANA (Arctic and North Atlantic) region?
9 responses

- 1. No
- 2. Some, but not all
- 3. Yes
- 4. I don´t need this information
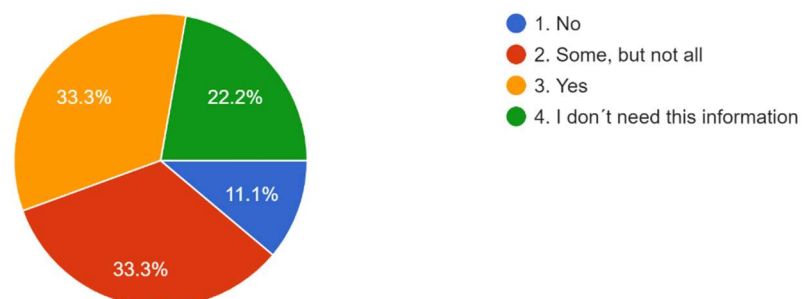
Figure 3: Question B1

N=9

Question B1 was one of the most critical, since without contact information, reaching other operators proves rather difficult. 4 partners answered that they have none or not enough of this information, they represented Academia (2), Organization (1), and Industry (1). One industry partner mentioned ARCSAR as a reason they have contact information. Other academia partner mentioned that they do not know of any one place in the internet, where information would be collected. It was also mentioned by an academia partner that they are not the target group and therefore they are not in the mailing lists. One organization partner mentioned that they have not been involved in such area before lately, but they would see this information as beneficial and would prefer having an overview.

Two partners had chosen that they do not need this information, they represented industry (1) and practitioner, management (1).

Positively, the operational practitioners (2) did have all the necessary information, and as a one reason they mentioned a monthly communications test. Other mentioned source was "sarcontacts.com", which is interpreted to mean "sarcontacts.info" where it is possible to search SAR authorities contact information around the world. Also, one academia partner answered that they have the information through websites and email conversations.

When going through the answers, some partners say that they do not need these contacts, other partners say that they do not have the knowledge of where to find this information. Those who have regular contact with others have the necessary information. It would be strongly advisable to provide the contact information to all partners, industries and management level included. Recommendation based to these answers is to have active contact with these authorities and inform the partners of where to find the contacts from. One solution would be to have brief introduction of this matter in the next ARCSAR meeting.

B1.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
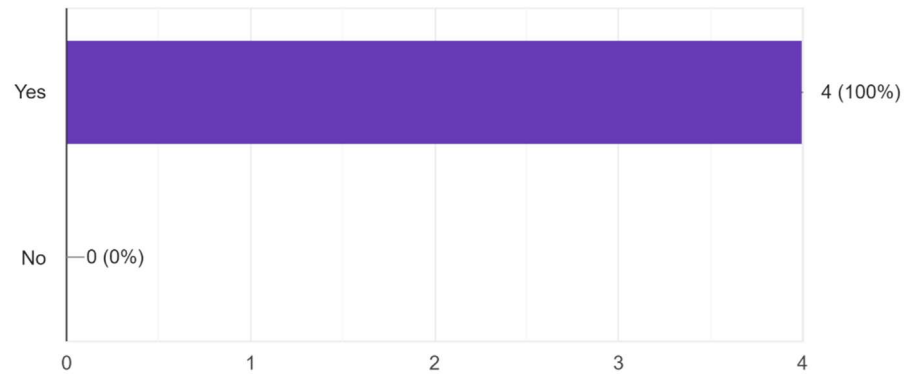
4 responses

Figure 4: Question B1.3

N=4

All partners who had either no information, or only some, would see this as a relevant asset to perform their work more efficiently. One recommendation for the partners would be to set up more easily accessible contact information listing to the ARCSAR website for example, or to raise awareness of where to find the contact details.

B2. Do you have up to date contact details of SAR related relevant NGOs (Non-Governmental Organizations) in t... ANA region (such as Red Cross etc.)?

9 responses

- 1. No
- 2. Some, but not all
- 3. Yes
- 4. I don´t need this information
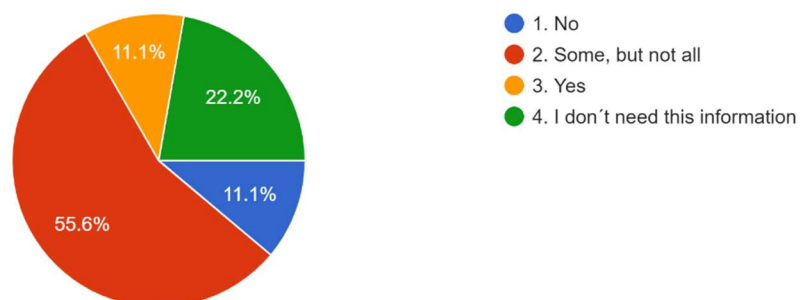
Figure 5:Question B2

N=9

This was similar question to the first, but the focus was to the relevant NGOs that could play a large role in case of a disaster. Quick response time to an accident has a lot to do with the efficient contact of the participants, therefore it was seen as necessary question.

The answers were very similar to the previous question, but the difference was in the operational practitioner level. There the both (2) respondents had only some information but not all. This already shows the difference and implicates a gap in the information exchange. In the open field, it was stated that they do have all information domestically, but in case of foreign NGOs, they would contact their own RCC, which would then again contact the relevant RCC. Management level practitioner (1) does not see this information necessary.

Two (2) Academia partners receive some information, and one (1) receives all from websites or email. From Industry, one (1) states that they do not need this information, and the other (1) stated that they receive some thanks to the ARCSAR project. Organization (1) states that they do not receive any information at the moment as they have just been involved lately in this kind of area but would like to in the future.

B2.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

5 responses
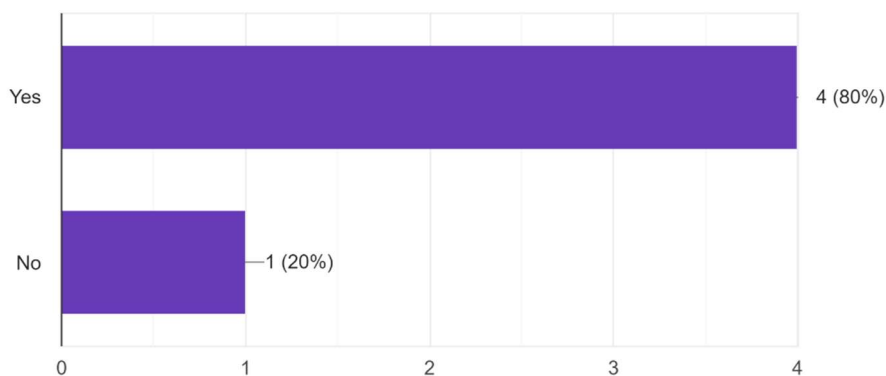
Figure 6:Question B2.3

N=5

There were five answers to the sub-question, out of six answers to option 1 or 2. From Academia, two (2) partners, and from Industry one (1), and from Organization one (1) stated that they would see this information beneficial. Operational level practitioner (1) did not see this as beneficial but stated that the land SAR operations are under the Police. When observing this answer, it does not tell if the partner has the contact details of the police. One recommendation would be collection of the updated contact details of the land-based authorities.

B3. Do you receive information of other Arctic countries' search and rescue unit positions in your operational region?

9 responses

- 1. No information is received
- 2. Some information is received but not enough
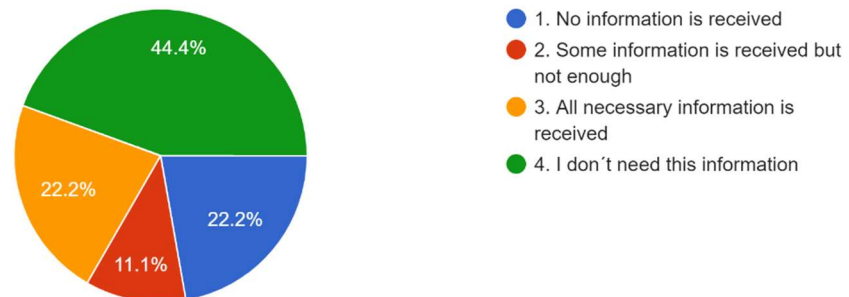- 3. All necessary information is received
- 4. I don´t need this information

Figure 7:Question B3

N=9

This question was to determine the state of awareness of possible assets that could be included in operations. As the results show, the diversity was clear. Academia either does not need this information (2), or they receive some (1). Industry is not needing this information (1), but the other Industry (1) reply states that they don´t receive this information, but they should expand their networks to receive it in the future. Organization (1) would like to receive this information, as at the moment they do not receive any. Practitioner in the management level (1), stated that they do not need this information, when in the operational level (2) they receive all necessary information. Operational level receives this information from regular exchange with JRCC and from the internet, also an agreement about cooperation between two countries was mentioned.

B3.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

4 responses
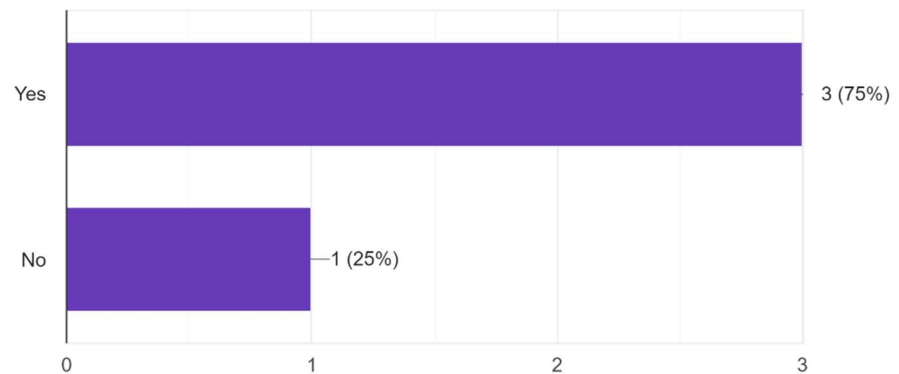
Figure 8:Question: B3.3

N=4

As (1) Academia has no need for this information, other (1) Academia would see this information beneficial. Industry (1) and Organization (1) would as well have use for this information.

B4. Do you receive information of other Arctic countries' search and rescue unit preparedness state (active/under ...enance etc.) in your operational area?

9 responses
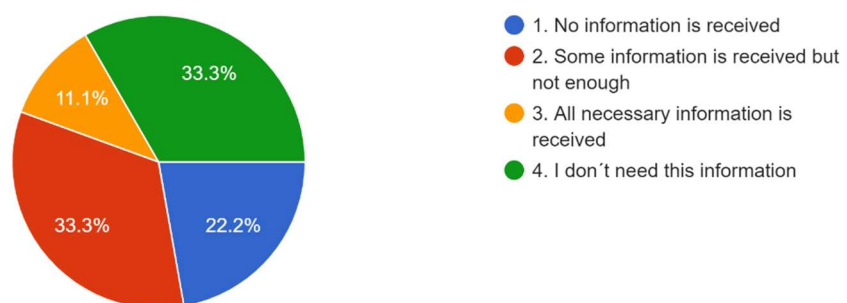
Figure 9:Question B4

N=9

This question is to determine the state of awareness of possible lack or availability of foreign equipment. When RCC dispatches units, the information of all available nearby foreign and national units, could have effect on the decision making. From Academia two (2) either

receive or receives only some information, and one (1) does not need this information. Reasons for not receiving the information, the different systems are mentioned. The fact for not being target group and not being at the mailing lists are mentioned as well. Industry either does not need (1) or does not receive (1) the information. As for not receiving the information, it is mentioned that receiving it would "help to expand the market and provide technological state-of-art tools". Organization (1) receives some, but not all information. However, they would like to have such overview. Management level practitioner does not need the information (1). At the operative level, the practitioners receive all (1) or at least some information (1). Again, at the operative level the abovementioned agreement of cooperation between countries is mentioned, as well as receiving information from JRCC.

B4.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

4 responses
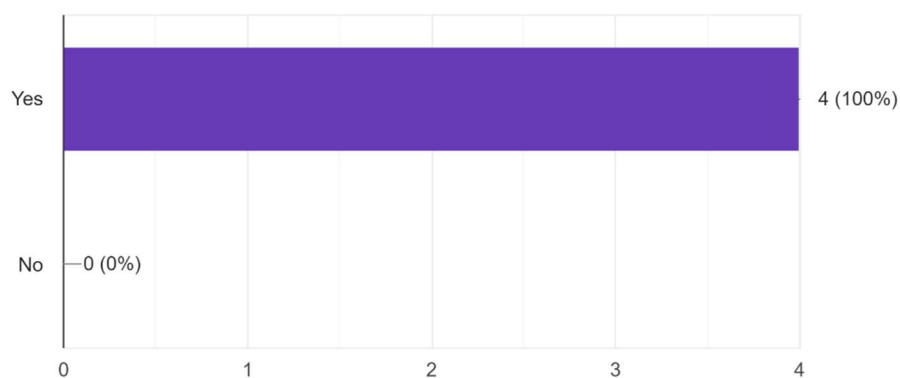
Figure 10:Question B4.3

N=4

All the respondents would see the information sharing as beneficial. They were Academia (2), Organization (1) and Industry (1).

B5. Do you receive information of other Arctic countries' search and rescue units in your operational area that have special rescue equipment on board?
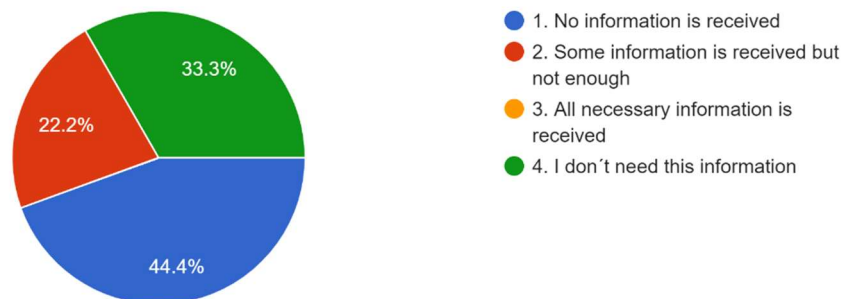
9 responses

- 1. No information is received
- 2. Some information is received but not enough
- 3. All necessary information is received
- 4. I don´t need this information

Figure 11:Question B5

N=9

This question was chosen, as some operations may require special equipment, and information of the availability of it is rather crucial in operations. As stated before, neighbouring country units may be closer to the scene than the national units, and knowledge of the equipment onboard might result more effective results for the rescue operation.

Academia had again very diverse answers, one (1) stated that they don't need the information, one (1) receives some, and one (1) receives none. They also state in comments that they are not the target group, or the information is not available. This comment for not being the target group is important, as the question is quite specific and may be seen irrelevant for Academy.

From Industry, one (1) does not need this information and the other (1) does not receive any. At the Management level Practitioner, they do not need the information, but the operational level is not receiving (1) or receiving only some (1). The operational answer comments reveal, that they receive information through the agreement mentioned earlier in questions B3 and B4, and some voluntary sailing plans from certain coast guard vessels when they come to refuel.

B5.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
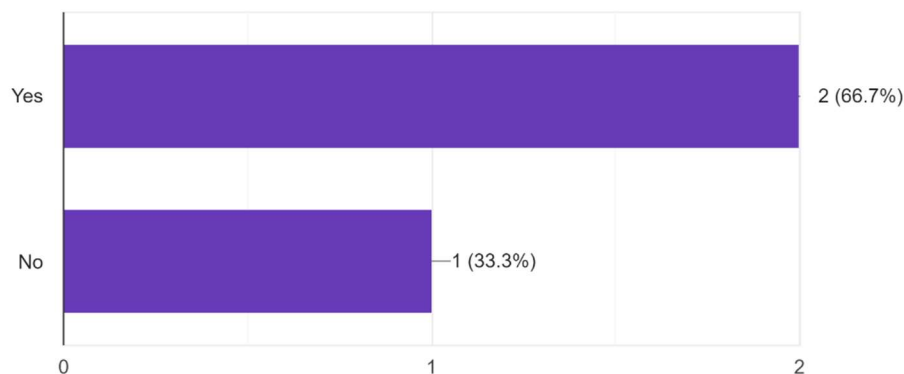
3 responses

Figure 12:Question B5.3

N=3

One answer for option "no" is from the academia (1), and as discussed earlier, this is rather specific question and could be seen more aimed to the operational side. The other two "yes" answers come from Industry (1) and Organization (1). It is debatable if they would actually need it in real time, but would it be still beneficial only as accessible information. When considering the variety of for example industrial accidents, some specific equipment could be needed on the site, and if it would be nearby onboard a SAR vessel, the real time information is suddenly very critical.

B6. Do you receive regular traffic data (routes, schedules etc. of cruise ships)?

9 responses

- 1. No information is received
- 2. Some information is received but not enough
- 3. All necessary information is received
- 4. I don´t need this information
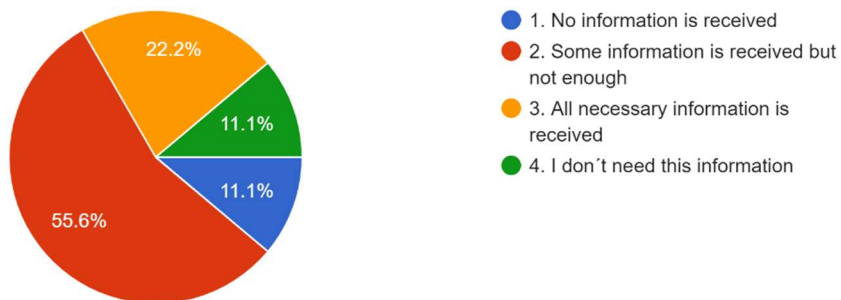
Figure 13:Question B6

N=9

This question is relevant in the sense that a large-scale cruise ship accident would be huge challenge for SAR operatives in the Arctic, and the beforehand knowledge of the routes and schedules would benefit the execution of possible operation.

Over half of the replies stated that they receive only some information. In Academia two (2) receive some, but one (1) none. At Industry, other receives all (1), and other only some (1). They mention AECO as a source, and AIS (Automatic Identification System (MarineTraffic 2018)) system as well. Organization receives all necessary information (1), they collect it from their own database and vessel tracker. Management practitioner does not need the information (1). At the operational level, only some information is received. Mentioned as source is SafeSeaNet, which tells the ports but not routes, but the vessels are seen through AIS as long as they have access to it. One reason for not receiving all data, is mentioned to be the fact that providing this information is not mandatory for the vessels.

AIS is mentioned several times as a source of the information. As AIS however is its own internationally used digital platform, it would not be beneficial to replicate it. One issue with AIS is the fact that only when vessel has activated their AIS transmission, it is possible to follow it.

B6.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
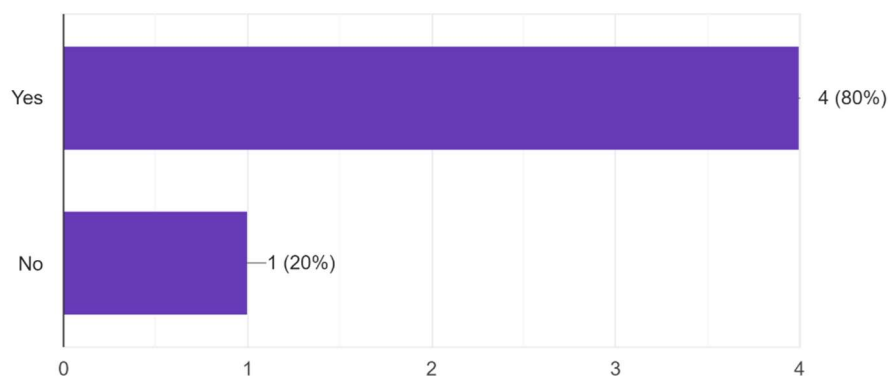5 responses

Figure 14:Question B6.3

N=5

As one of the Academia (1) stated, they are not the target group and therefore they do not see the need for the information. Other Academia (2), Industry (1) and Operational level practitioner (1) however would see benefits from this information.
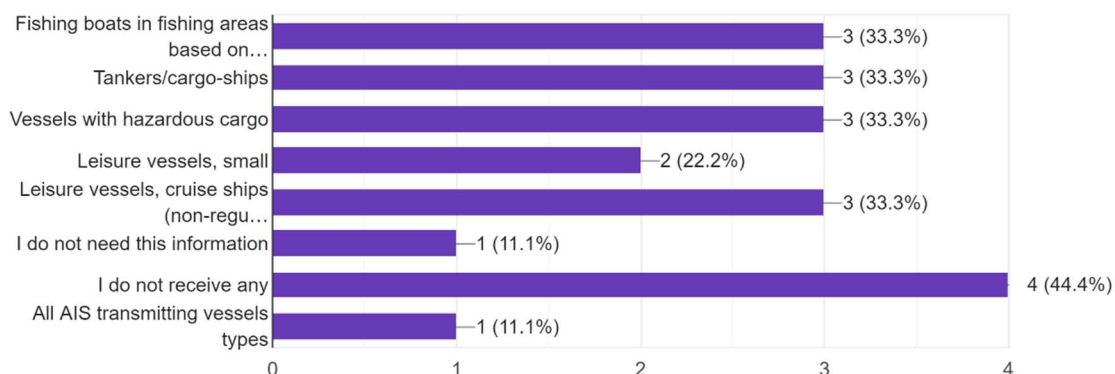
B7. Do you receive other traffic data?
9 responses

Figure 15:Question B7

N=9

This question was to determine roughly what kind of information is received about other vessels in the area. Academia did not receive any (3), the Industry did not need it (1), or they received information that is available through AIS. Other Operative partner (1) did not receive this information. Practitioners at Operational (1) and Management (1) who receive information mentioned the general websites, directorate of fisheries and AIS as the biggest sources. EMSA SEG satellite, AIS, Long Range Identification Tracking, SafeSeaNet for SOLAS, and VMS for fishing ships were also mentioned. It was mentioned that ships send arrival report ISPS report at minimum 24 hours before coming to first port of call. There are multiple sources for the information. These would be beneficial to collect at one place for easy viewing.

B7.3. If you do not receive information, would you need it to perform your tasks more efficiently?
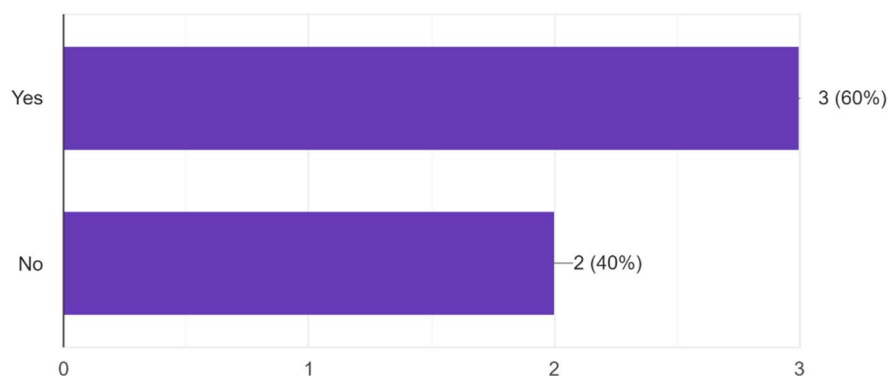
5 responses

Figure 16:Question B7.3

N=5

One of the Academia would need this information (1), as would the Organization (1) and the Operative practitioner who did not receive the information (1). Two other Academias (2) would not need this information.

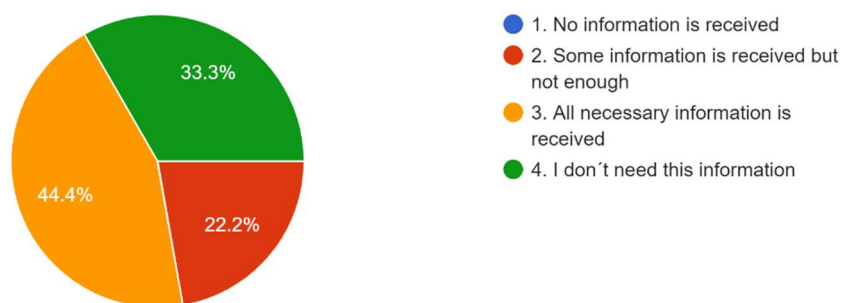## B8. Do you receive relevant weather broadcast data in your operational area?

9 responses

Figure 17:Question B8

N=9

Weather may have large effect on a rescue operation, so the current state of weather broadcast data was to be determined. All partners received some amount of data, or they do not

need it. Academia does not need the data (2) or they receive all (1). Industry receives some (2), and they collect it from open weather broadcast websites. Other Industry partner (1) mentions that there is lack of clients asking for those solutions. Management level practitioner does not need this information (1), and the Operational level partners receive all (2) from their National Weather Broadcast Institutes.

B8.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
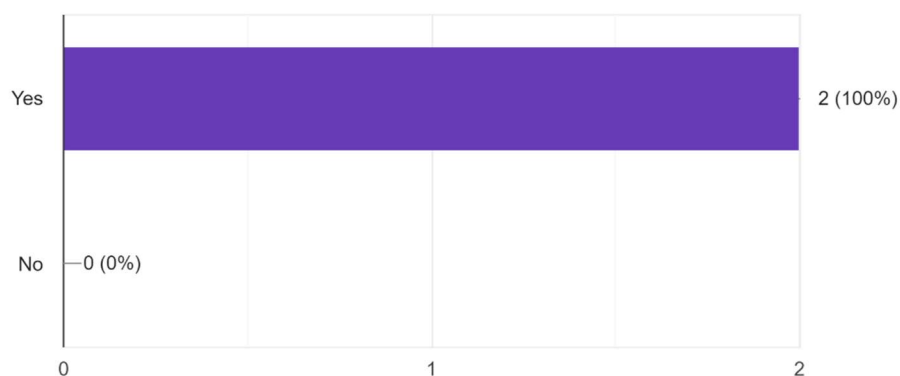2 responses

Figure 18:Question B8.3

The Industry (1) and Organization (1) partners would like to receive more data about meteorological broadcasts.

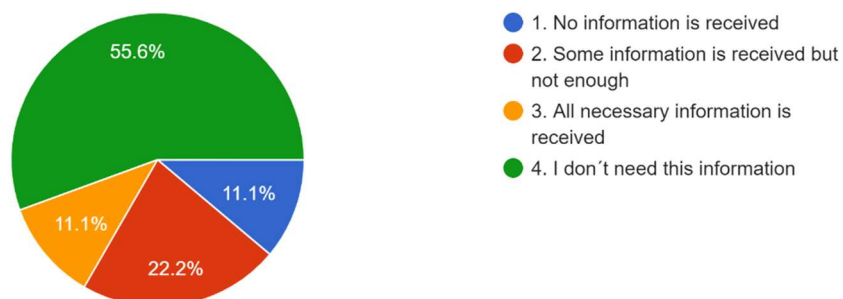## B9. Do you receive avalanche warning data for your operational area?
9 responses

Figure 19:Question B9
N=9

Avalanches are one cause for rescue missions, and this question was therefore included as the operational area at the Arctic may constitute of terrain prompt to avalanches. Avalanche prediction may not be possible, but in case there is one, the information would be beneficial to receive quickly. Majority of the partners stated that they do not need the information. From Academia two (2) does not need it, but one (1) does receive some. Industry does not receive (1), due to the lack of clients asking for those solutions, and other (1) does not need the data. Organization (1) knows of where to find the information in their own country but has no knowledge for other countries. Management level practitioner does not need the data (1), other operational level also states that they do not need it (1). But the other operational level partner states that they receive all necessary information from a land based authority.

B9.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
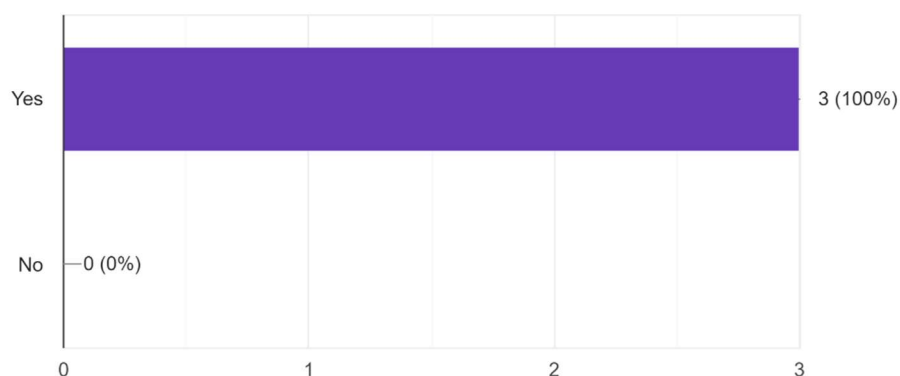3 responses

Figure 20:Question B9.3
N=3

All partners that did not receive all or none of the data, would see it beneficial, Academia (1), Organization (1) and Industry (1). This is rather specific data, but important information if it is for example related to evacuation area. Therefore, this information must be available at least when planning evacuation site to a potential avalanche area, if there is no other site available logistically.

B10. Do you receive current ice formation data of your operational area?

9 responses

1. No information is received
2. Some information is received but not enough
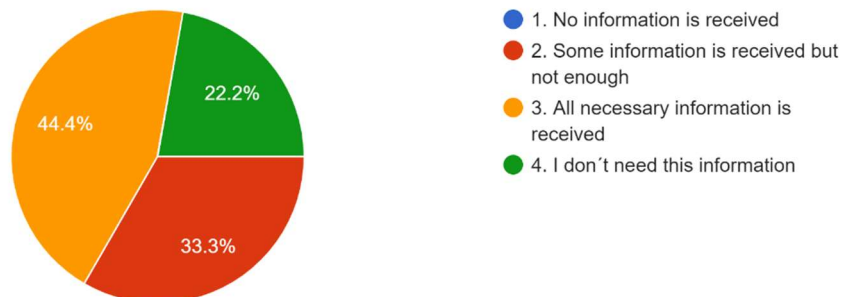3. All necessary information is received
4. I don´t need this information

Figure 21:Question B10

N=9

Ice formation data is rather important, since collision with icebergs is one of scenarios that could cause a massive accident. Academia (1), Industry (1), Management practitioner (1), and other Operative practitioner (1) receives all necessary information. Information is received from the national Meteorological Institute, or from a specified website. One recommendation would be to raise awareness of the places where this information is available, and in what language. Academia (1) in not needing this information, or they receive only some (1). Industry (1) is only receiving some information, as is the Organization (1). Other of the Operative practitioners is not needing the data (1).

For an extra comment, there is need for an innovation of sensors that can read ice.

B10.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
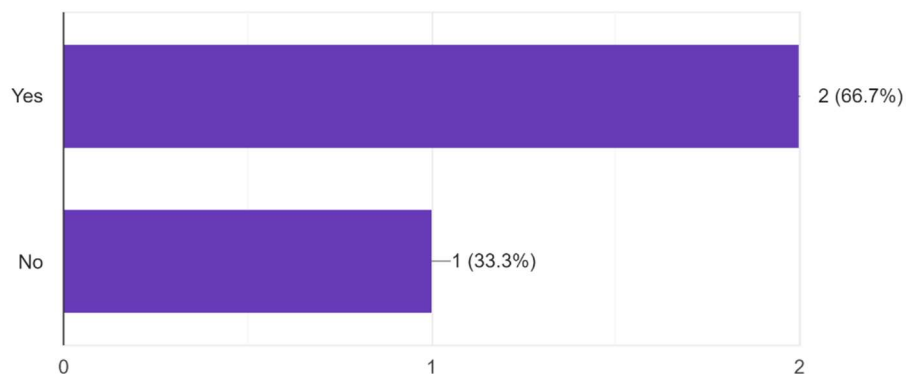
3 responses

Figure 22:Question B10.3

N=3

The Academia (1) would ne see this information as beneficial for more efficient task performing, but Industry (1) and Organization (1) would.

C1. Do you receive information of preliminary situation assessment (what type of emergency etc.)?

9 responses

1. No information is received
2. Some information is received but not enough
3. All necessary information is received
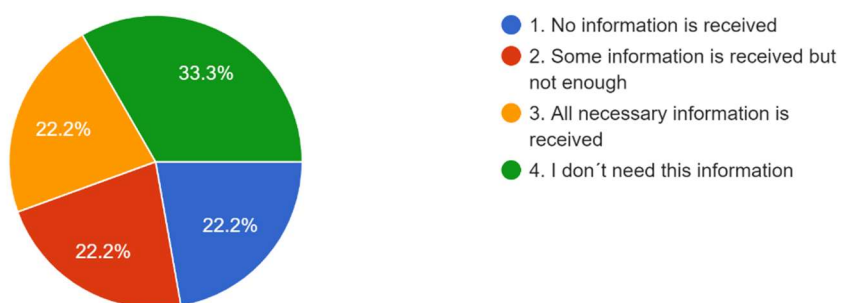4. I don´t need this information

Figure 23:Question C1

N=9

This was the first question of section C, and the theme is situation assessment of ongoing accident. This was to determine how much info is received when the situation has occurred, and the units are dispatched to the area. For the Academia, information is not relevant (1),

or it is not received (2). Academia mentioned that they do not receive information, since there is no common platform for receiving the information. The Industry does not need (1) the information or they only receive some (1). The Organization receives some (1) information but mentions that they would like to receive more. The Management level practitioner does not need this information (1), and the Operational level practitioners both receive all necessary information (2).

Operational level partners mention as a source for this information the DSC (Digital Selective Scanning), which send predefined distress signal when activated. DSC (Digital Selective Calling) is one international solution and signals are received in RCCs. DSC sends predefined distress signal when activated and may be used at other limited communication purposes as well (Navigation Center 2018). The method is not extremely detailed or useful in all situations, as the messages are predefined, but this gives the initiative that a situation is on when the signal is sent out. Other source mentioned for detecting the distress, is if the AIS signal is lost for 10 minutes. When the signal is lost, it is interpreted to be an emergency.

C1.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
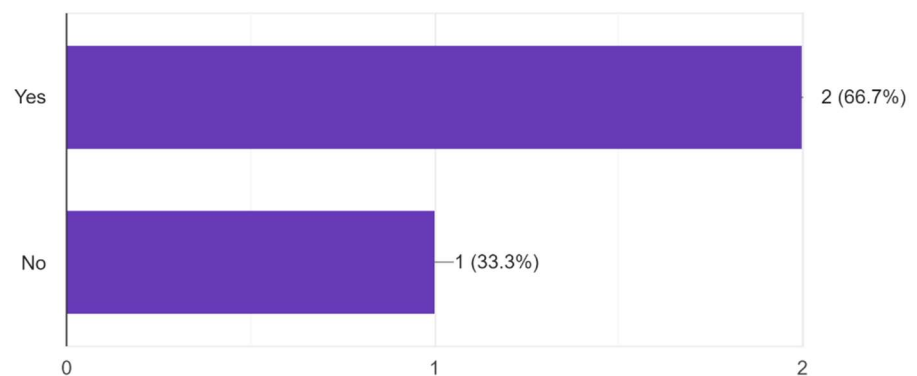
3 responses

Figure 24:Question C1.3

N=3

Academia did not receive any information, and they did not see it useful to them either (1). This is not surprising, as the C section was aimed more to the operative side of rescue operations. Industry (1) and Organization (1) that received some information would like to get more, since they see it would be beneficial to their work.

C2. Do you receive information about the developments in the distress situation (changes in distress vessel condition etc.)?
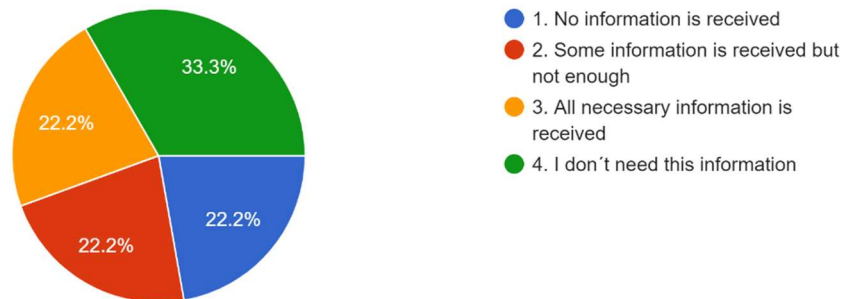
9 responses

Figure 25:Question C2

N=9

Academia had different situations, as they did not need the information (1), did not receive it (1) or received only some (1). As one reason for not receiving the information, the fact that this information is sometimes limited even in official reports was mentioned. Industry does not need (1) the information, or they only receive some (1). Organization did not receive any information (1), and the Management Practitioner did not need any (1). The Operational practitioners did both receive all (2). For the source they mentioned the vessel in distress itself, either direct communication with it, or communication with the on-scene coordinating rescue vessel that is in direct contact with the vessel in distress.

C2.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
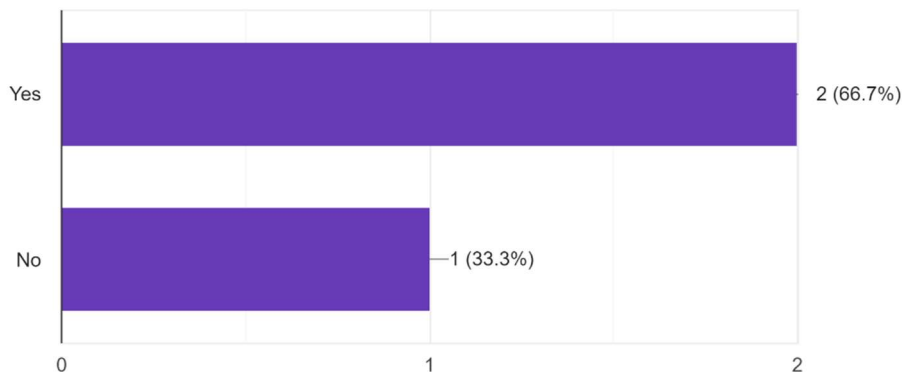
3 responses

Figure 26:Question C2.3

N=3

The Academia (1) did not see this information that useful, but the Industry (1) and Organization (1) would like to receive more of this information.

C3. Do you receive information of who is the distress vessel owner? (through boat register for example)
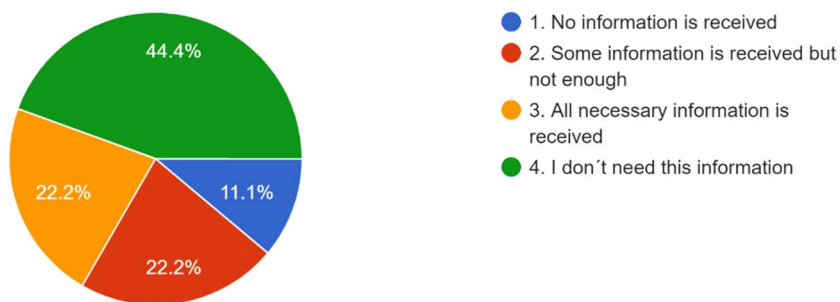
9 responses

Figure 27:Question C3

N=9

Reaching information from the vessel owner, might help in the rescue operation, so the question was included. Academia did not need the information (2) or did not receive any (1). The Industry did not need (1) or they only received some information (1). All information was

received by the Organization (1). Management level practitioner did not need the information (1). At the Operational level answers, they received either all (1), or only some (1). Few sources for this information was mentioned, a operations centre that provides data of maritime operations, and the AECO if the vessel is part of AECO.

C3.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
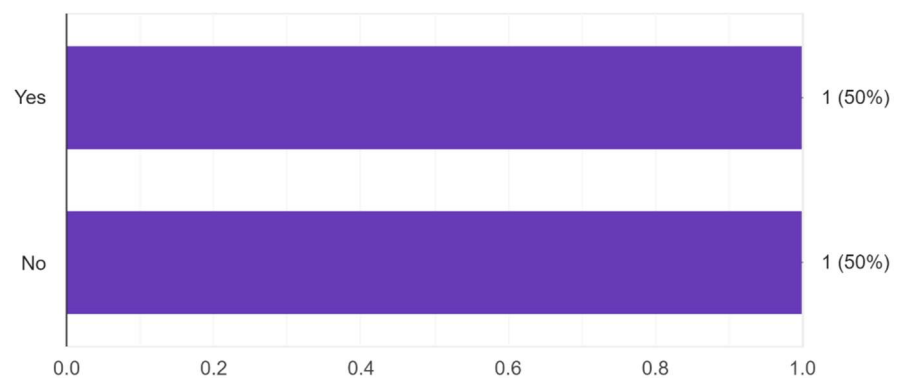2 responses

Figure 28:Question C3.3
N=2

The Academia did not receive any information and did not see it useful (1). The Industry received some information but would see the complete information as beneficial. (1).

C4. Do you receive information/details of the SAR plan of the vessel in distress?
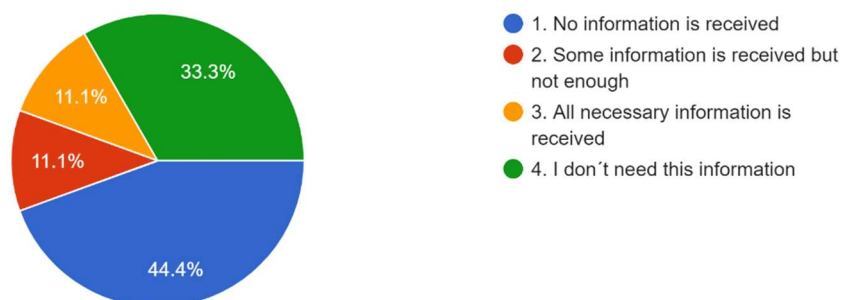9 responses

Figure 29:Question C4

N=9

The Academia is not receiving the information (2) or do not need it (1). Industry has similar answers, as they do not need it (1) or they do not receive it (1). Organization is not receiving (1) the information. Management practitioner is not needing the information (1), but the Operational practitioners either receives some (1) or receives all (1). For the Operational practitioners, the information is available from the IMO (International Maritime Organization), or from the flag state of the vessel. AECO was mentioned as one potential source for this information again.

C4.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

5 responses

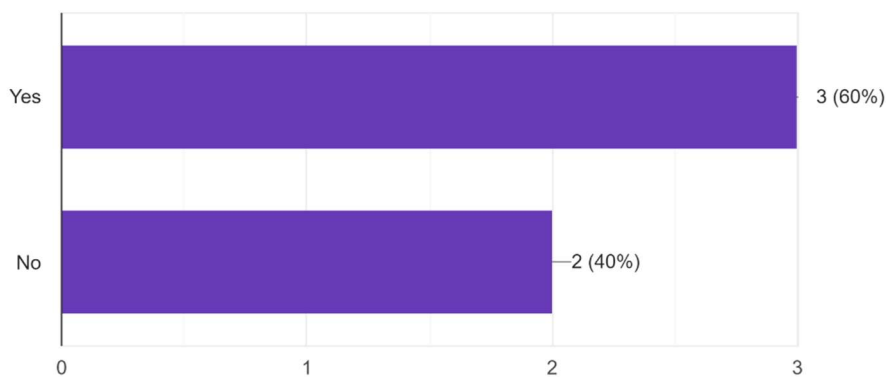Figure 30:Question C4.3
N=5

Other Academia (1) and Organization (2) did not receive any information and they would not need it either. But the other Academia (1) along with Industry (1) and the Operative practitioner that received only some information (1) would like to get more of it. Vessel SAR plans may be very useful in distress situation, so the access to them is beneficial for the rescue operation.

C5. Do you receive information of the rescue operation coordination structure (what countries/vessels are p...ting, changes in operating units etc.)?

9 responses

- 1. No information is received
- 2. Some information is received but not enough
- 3. All necessary information is received
- 4. I don´t need this information
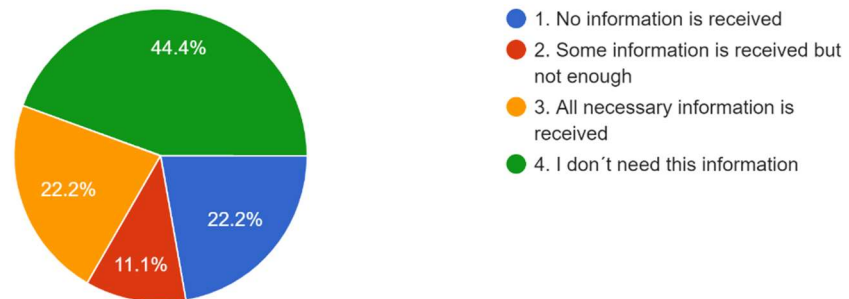
Figure 31:Question C5
N=9

The Academia is not receiving (1), receiving only some (1) or does not need the information (1). The Academia that receives only some, mentions the evaluation reports having too general descriptions. From the Industry, other does not need the information (1) and the other does not receive any (1). The Organization does not need this information (1), as does not the Management level practitioner either (1). At the Operational level practitioner, they both receive all necessary information (2). The other mentions however, that they only receive all information in their domestic SAR region. The other mentions that they would contact directly the RCC if necessary.

C5.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
3 responses
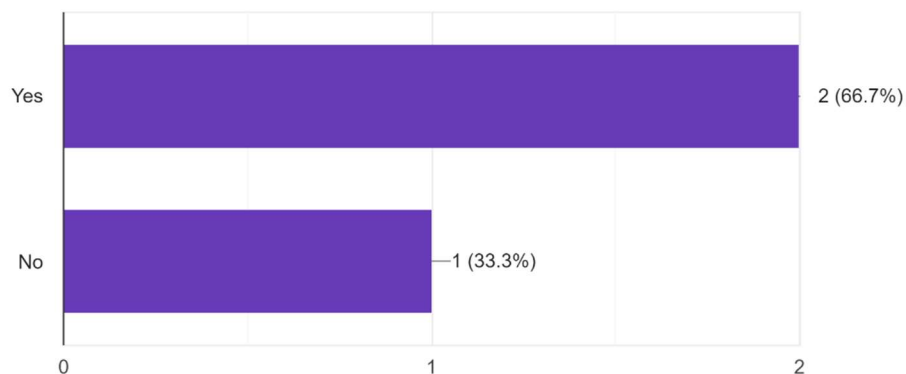
Figure 32:Question C5.3

N=3

One of the Academia (1) would like to receive more detailed information. The Industry (1) would as well like to receive more information. But from the Academia one (1) would not need this information, even as they are not receiving any.

C6. Do you receive information of the already assigned rescue measures to the site?
9 responses

- 1. No information is received
- 2. Some information is received but not enough
- 3. All necessary information is received
- 4. I don´t need this information

Figure 33:Question C6

N=9

In the Academia, diversion is again visible in the answers, one is receiving only some information (1), one is not receiving any (1) and one is not needing the information (1). For the

reason of receiving only some information, the crisis communication priorities is mentioned. The Industry is not needing the information (1), or they do not receive any (1). The Organization is not needing the information (1), and the Management level practitioner is not needing the information (1). Both the Operational level practitioners receive all necessary information (2). For the source is mentioned to take direct contact to the coordinating RCC if necessary. It is also mentioned that if the emergency is in the borders of SAR region, the information is shared in the handover procedure.

C6.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

3 responses

Figure 34:Question C6.3
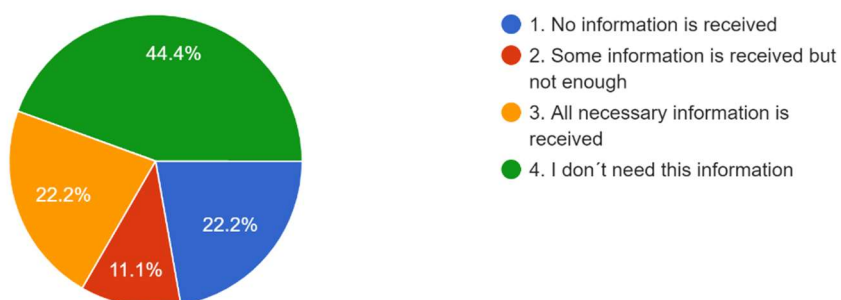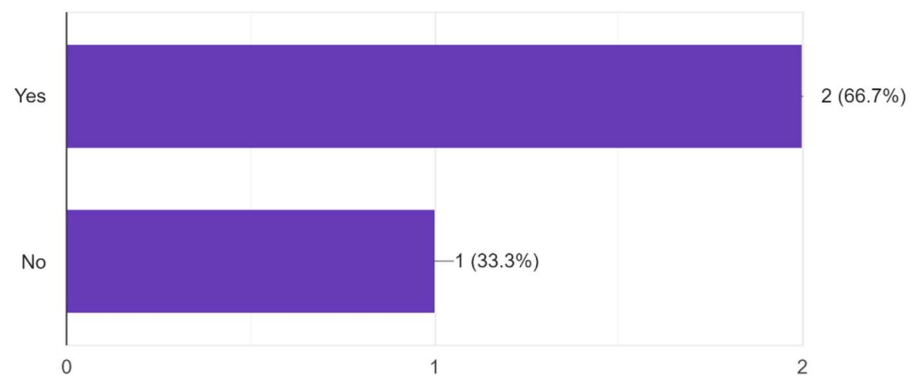
N=3

The Academia that received some information (1) would like to get more, but the Academia not receiving any, would no need it either (1). The Industry would also like to get the information (1).

C7. Do you receive information of the amount of rescued people and where they are being evacuated?

9 responses

Legend:
- 1. No information is received
- 2. Some information is received but not enough
- 3. All necessary information is received
- 4. I don´t need this information

Pie chart values: 33.3%, 22.2%, 22.2%, 22.2%
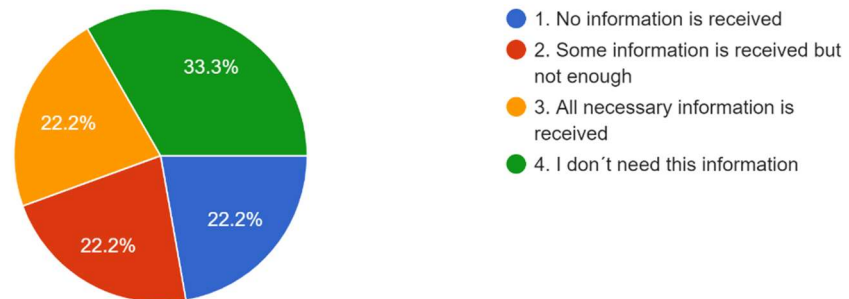
Figure 35:Question C7

N=9

The Academia is receiving some (1), or none (1) of the information, or they do not need it (1). When they receive the information partly, it is only sometimes. The Industry does not need (1) the information, or they do not receive any (1). Organization is receiving some (1) and the Management level practitioner does not need (1) the information. The Operational level practitioner receive all the information (2). For the source they mention the fact that if they are coordinating, they receive the numbers. They also receive information from the distress vessel and response units, and they also mention that they apprehend the survivors to hospitals, local police or red cross upon coming to land.

C7.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

4 responses
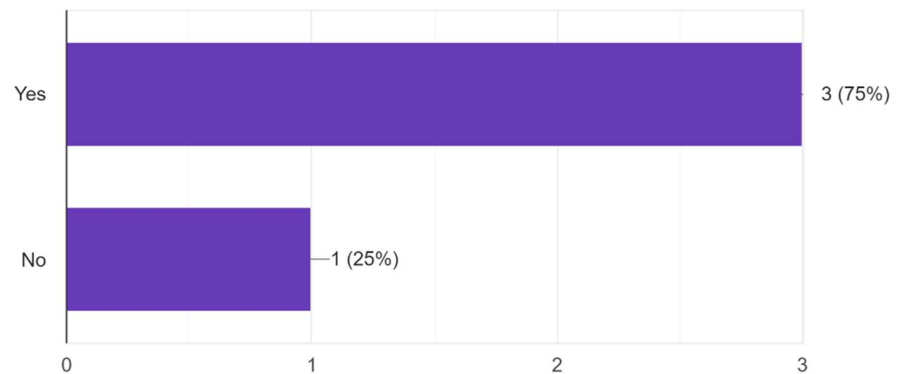
Figure 36:Question C7.3

N=4

The Academia (1) would not like receive the information, as they are not currently receiving any. The other Academia (1), Industry (1) and Organization (1) would like to receive the information.

C8. Do you receive information of the health status of the rescued people that need transferring? (Triage classification for example)

9 responses

- 1. No information is received
- 2. Some information is received but not enough
- 3. All necessary information is received
- 4. I don´t need this information

Figure 37:Question C8

N=9

The Academia is receiving some information (1), no information (1) or they do not need it (1). The Industry is not receiving (1), or do not need the information (1). Organization is not

receiving any information (1) and mentions as a reason the fact that such info is not communicated between them and the SAR operation. The Management level practitioner is not needing the information (1), and the Operational level practitioners receive some (1), or all necessary information (1). As for the reasons for only receiving some information, the shortage of information might happen if there are not trained people that are able to do the triage classification. The other operative mentions that if the situation allows such information to be shared, then everything is received.

C8.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
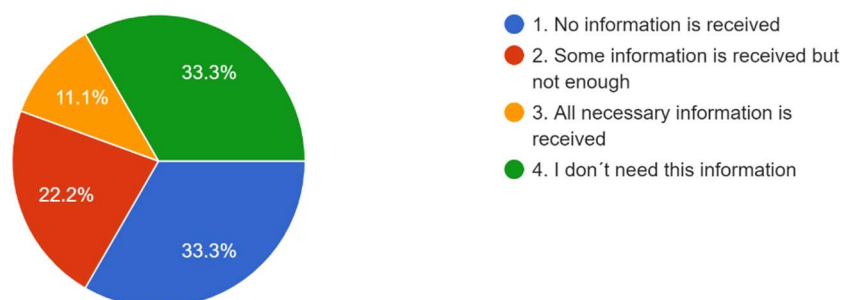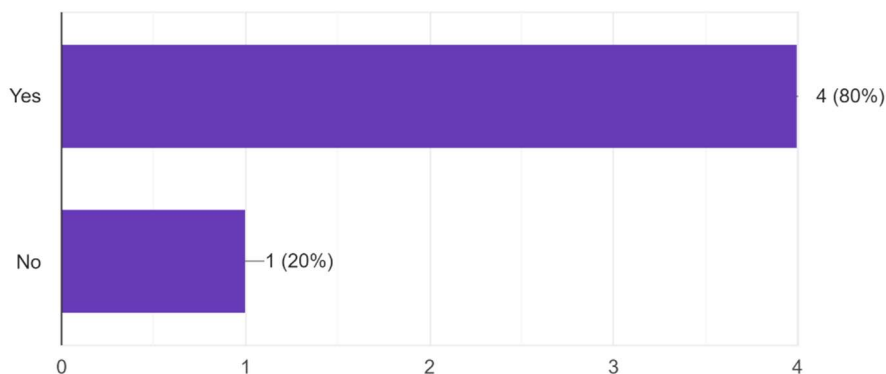
5 responses

Figure 38:Question C8.3

N=5

Only the Academia that did not receive any information (1) would not need it either. The others, Academia (1), Industry (1), Organization (1) and Operational level practitioner (1) would like to receive the information.

C9. Do you receive information of the amount of people searched for (in case there is people in the water for example)?

9 responses

Legend:
- 1. No information is received
- 2. Some information is received but not enough
- 3. All necessary information is received
- 4. I don´t need this information

Slices: 44.4%, 22.2%, 33.3%
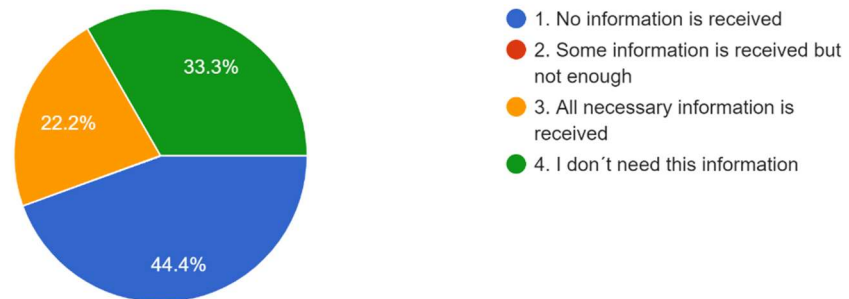
Figure 39:Question C9

N=9

The Academia is not receiving the information (2) or they do not need it (1). The Industry is not receiving information (1) or they do not need it (1). The Organization is not receiving the information (1) and mentions as a reason the fact that such information is not shared between them and the SAR operation. The Management level practitioner is not needing the information (1). The Operational level practitioners receive all necessary information (2) and mentions OSC (On-Scene Coordinator) as the source. The crew and passenger numbers are known of commercial vehicles. If there is information about missing people, that information is received in RCC.

C9.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

4 responses
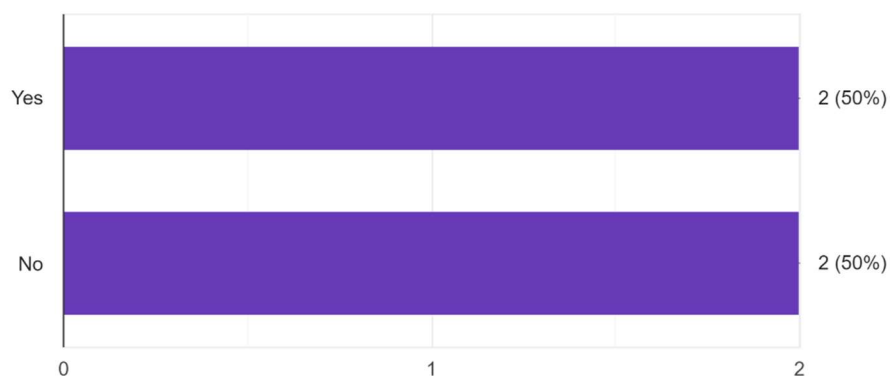
Figure 40:Question C9.3

N=4

The Academia (2) did not receive any information and would not need this information. Industry (1) and Organization (1) would see this beneficial.

C10. Do you receive information of objects related to the accident (floating containers etc.)?

9 responses

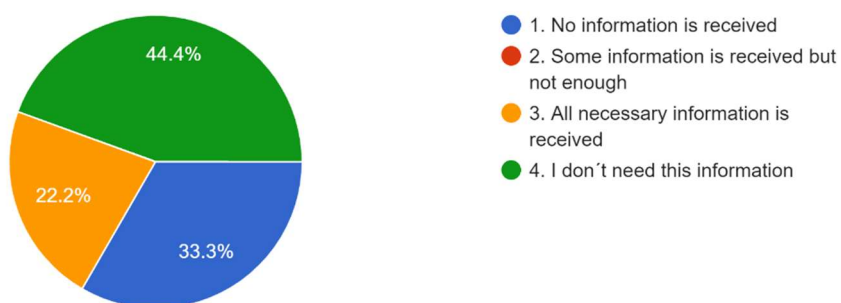Figure 41:Question C10

N=9

The Academia is not receiving (2) or they do not need the information (1). Industry is not receiving (1) or does not need (1) the information. Organization (1) and Management level practitioner (1) does not need the information. At the Operative level, the practitioners receive

all necessary information. For the source, they mention the OSC, or the vessel in distress. It is also mentioned that response units may provide this information, and it is used also to give navigational warnings by JRCC.
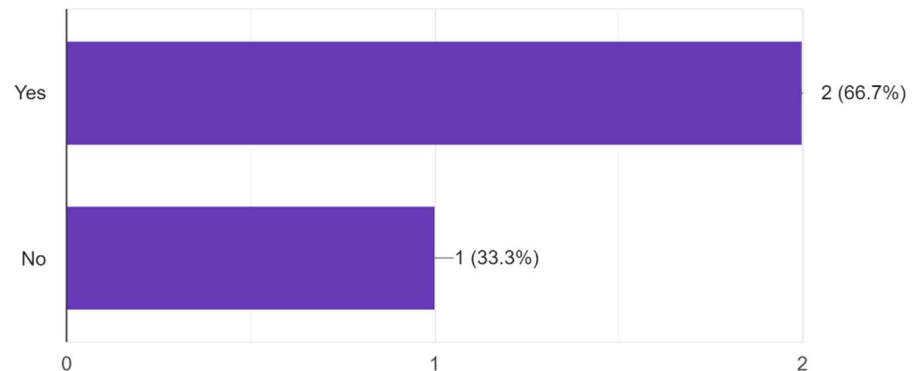
Figure 42:Question C10.3

N=3

One of the Academia would not need this information (1), but the other Academia would (1), as would the Industry as well (1).

For the final and voluntary question, few answers were provided. The question was "C11. Do you have anything to add, that would be beneficial to the questionnaire related research?". One partner mentions that this information is often relevant to them only after the event, since they use the data for analyzing the events. Other partner mentioned that they will receive usually all information from JRCC if they participate in the operation, but in other cases they only need the information that might cause danger or have other effect to the vessels nearby. Third partner mentioned that having all this information available in single web-based platform would be desirable and useful. Fourth and fifth had nothing to add, or they mentioned the hurry of answering from their mobile phone.

4.2   Gap analysis

After reviewing the questionnaire answers, the gap analysis was performed. The partners were divided between the Operational partners and Others. This was done to visualize the differences and gain more purposeful priority classification, as the need for information

receiving rate is varying between different types of partners. Levels Low, Medium and High were used to state the significance of the information.

The desired state in all the sections was set to "All information received", as that would be the optimum level. Colors are used for visual presentations, and they are also written out in the table to provide accessibility in case the reader uses reading program or has visual difficulties. The coloured sections show the priorities of where to start with the information sharing efforts. Red means that actions are needed, and it is top priority. When going to orange, it is still a recognized gap, but not so acute as the red. Green states that it needs no response at this point and there is no gap, since the information is received, but green sections may still may include comments or recommendations.

Table 1: Gap analysis

INFORMATION	PARTNER	PRIOR-ITY	CURRENT STATE	DESIRED STATE	PRIORITY COLOR	ACTION REQUIRED	NOTES
Having up to date contact details of other SAR (Search and Rescue) authorities in ANA (Arctic and North Atlantic) region	Others	Medium	Some or no information received	All information is received	Orange	Collecting all information in one available place. Regular contact and communication checks.	Possibly the sar-contacts.info could serve this purpose
	Operative	High	All information is received	All information is received	Green	No actions required	
Having up to date contact details of SAR related relevant NGOs (Non-Governmental Organizations) in the ANA region (such as Red Cross etc.)	Others	Medium	Some or no information received	All information is received	Orange	Collecting all information in one available place. Regular contact at least with RCCs would be useful.	Linking the information to the ARCSAR platform, updating it
	Operative	High	Some information received only	All information is received	Orange	Collecting all information in one available place. Regular contact and communication checks.	Linking the information to the ARCSAR platform, updating it

Receiving information of other Arctic countries' search and rescue unit positions in their operational region	Others	Medium	Some or no information received	All information is received	Orange	Following through AIS or similar solution	Closed or limited info
	Operative	High	All information is received	All information is received	Green	No actions required	RCC/JRCC provides the info
Receiving information of other Arctic countries' search and rescue unit preparedness state (active/under maintenance etc.) in their operational area	Others	Medium	Some or no information received	All information is received	Orange	Arctic SAR Agreement includes the development of information sharing efforts. The RCC/JRCC should have information of foreign vessels preparedness state	Different systems cause difficulties. Technical interface solutions are needed
	Operative	High	Some or all information is received	All information is received	Orange	Sharing the information through JRCC or other source. Agreed intervals for information sharing.	RCC/JRCC provides the info, or through agreed information sharing schedules

Receiving information of other Arctic countries' search and rescue units in their operational area that have special rescue equipment on board	Others	Medium	Some or no information received	All information is received	Orange	Listing the special equipment capabilities in one place, so the information is available when needed.	Regular contact and sharing information if some equipment is unavailable
	Operative	High	Some or no information received	All information is received	Red	Information should be received from JRCC or collected in one place	Special equipment may be critical under some circumstances and available asset list increases having the right equipment at right place
Receiving regular traffic data (routes, schedules etc. of cruise ships)	Others	Medium	All, some or no information is received	All information is received	Orange	This information should be collected to one accessible place. Larger cruise ships should provide a sailing plan or SAR plan when arriving to Polar waters. It could be made mandatory to provide a sailing plan, since the risks are present in the area.	Cooperating with the shipping companies

	Operative	High	Some information received only	All information is received	Red	It is no mandatory for the ships to provide the information, but there should be agreement for it. Similar than in Barents sea, Barents ship reporting system (SRS).	Cooperating with the shipping companies, notifications of large cruise vessels with large amount of passengers
Other vessel data	Others	Low	Some information received	All information is received	Orange	Collecting the mentioned links in the answers for finding the information, these should be collected to ARCSAR platform.	Making a research of where to find and receive information.
	Operative	Medium	Some information received	All information is received	Orange	Collecting the links for finding the information to ARCSAR platform	
Receiving relevant weather broadcast data in their operational area	Others	Low	Some or all information is received	All information is received	Orange	Information available in one place. Possibly links of different links at the ARCSAR platform	Meteorological Institutions should be contacted. More users for specific data could lead to new solutions

	Operative	High	All information is received	All information is received	Green	No actions required	
Receiving avalanche warning data for their operational area	Others	Medium	Some or no information received	All information is received	Orange	Collection of links for finding the data to the ARCSAR platform, or co-operation with the information providing party. Mapping out where the information would be available.	Data not relevant to all
	Operative	High	All information is received	All information is received	Green	No actions required, but JRCCs should be aware of where to find the data	

Receiving current ice formation data of their operational area	Others	Medium	Some or all information is received	All information is received	Orange	Cooperating with the Meteorological Institutes or other parties that provide the data. Collecting the related information to one easily accessible place. Awareness of the possible changes in the ice behaviour, could be included in the ARCSAR platform.	The climate warming will increase the need for the information about changes in ice situation in the recent future
	Operative	High	All information is received	All information is received	Green	Monitoring and informing the changes in ice that have effect to the operative activities. Regular situation checks to stay on top of the situation	Changes in ice formation could effect accessibility of areas
Receiving information of preliminary situation assessment (what type of emergency etc.)	Others	Medium	Some or no information received	All information is received	Orange	The information not necessary on the spot. Collecting information and reports on one platform	

	Operative	High	All information is received	All information is received	Green	RCC/JRCC should provide the information to the operative actors. Recording the information in to a platform for following up	DSC or AIS or direct contact.
Receiving information about the developments in the distress situation (changes in distress vessel condition etc.)	Others	Low	Some or no information received	All information is received	Orange	Classified information may restict some details, but reports should be available afterwards in one place	For research and lesson learned purposes
	Operative	High	All information is received	All information is received	Green	Vessel in distress provide the information to OSC or RCC most often, but it should be collected so that all active participants receive it	Information might get lost during radio transmission dead spots or for other reason
Receiving information of who is the distress vessel owner? (through boat register for example)	Others	Low	All, some or no information is received	All information is received	Orange	Information should be collected to one place, it should include vessels that have voyage in the Arctic waters	Useful for research purposes

	Operative	High	All or some information received	All information is received	Red	Collecting the information to one place, or links to ARCSAR platform for where to find the info	Vesselfinder etc.
Receiving information/details of the SAR plan of the vessel in distress	Others	Low	No information is received	All information is received	Orange	Collecting the information to one place, or links to ARCSAR platform for where to find the info	For research purposes later on
	Operative	High	Some or all information is received	All information is received	Red	Collecting the information to one place, or links to ARCSAR platform for where to find the info	Essential when planning rescue operation
Receiving information of the rescue operation coordination structure (what countries/vessels are participating, changes in operating units etc.)	Others	Low	Some or no information received	All information is received	Orange	Having the information collected in one place in reports	For research use later
	Operative	High	All information is received	All information is received	Green	Having a live situation picture view and situational awareness, through RCC.	For keeping track of the circumstances on the field

Receiving information of the already assigned rescue measures to the site	Others	Low	Some or no information received	All information is received	Orange	Having the information collected in one place in reports	For research use
	Operative	High	All information is received	All information is received	Green	RCC provides the information, collecting this to one platform	List of assets helps determining the capabilities
Receiving information of the amount of rescued people and where they are being evacuated	Others	Low	Some or no information received	All information is received	Orange	Collecting the reports to one place	For research purposes later on
	Operative	High	All information is received	All information is received	Green	Keeping track of the numbers	Coordination with land-based units
Receiving information of the health status of the rescued people that need transferring (Triage classification for example)	Others	Medium	Some or no information received	All information is received	Orange	If participating to the operation or transferring of the people, being in contact to the RCC	For non-participants of operation, general information should be available later without personal details of patients

	Operative	High	Some or all information is received	All information is received	Red	Triage (and other) information received from RCC	Not always triage trained people on site
Receiving information of objects related to the accident (floating containers etc.)	Others	Medium	No information is received	All information is received	Red	Navigational warnings or other system for all who move around the area. Collecting the information for reports	Objects may pose threat to environment or people. Reports could be used later for research
	Operative	High	All information is received	All information is received	Green	Contact with OSC and observations on-site and around	

The table shows multiple gaps at the red area that need attention. Some recommendations are based to the findings. They are listed as following:

- Receiving information of other Arctic countries' search and rescue units in their operational area that have special rescue equipment on board is showing up in red, since the Operational partners are not receiving all the necessary information. The capabilities of the neighbouring countries vessels should be listed and provided to RCCs, so they could guide more efficiently the rescue operations and ask for assistance if necessary.

- Receiving regular traffic data (routes, schedules etc. of cruise ships) was also noted at red as the Operational partners do not receive all. By having situational awareness all the time and having general view of the routes, the potential risk situations could be predicted more efficiently. Mandatory ship reporting system, similar to the Barents Sea region, Barents SRS, could provide this information, as now it is voluntary and not all ships report their routes.

- Receiving information of who is the distress vessel owner, through boat register for example, proved to be not at ideal level with the Operative, even though it was in rather good level. Having the owner information helps contacting the necessary sectors and receive the passenger lists for example. Few services exist, such as the Vesselfinder, but gathering the necessary links to one place for conducting the search more easily would be advisable. The information is also under request from different places, such as AECO, but this fact is possibly not known to all members.

- Receiving information/details of the SAR plan of the vessel in distress is not at optimal level with Operatives. The vessels have the SAR plan created to make cooperation with SAR authorities less complicated and the SAR plans include details of vessel owners etc. It would be recommended that the plans could be delivered through email or other means to the RCCs along the voyage or other relevant place. These are not relevant plans for all the partners, mainly to the operative ones.

- Receiving information of the health status of the rescued people that need transferring (Triage classification for example) usually comes through the RCC or from the site, but it was not at optimal level with Operatives. Problem was that not always triage skilled personnel at scene, but general knowledge of how many critical patients or non-critical patients will help in planning the next steps of the operation. Training in this area would be useful for all authorities in the Arctic.

- Operatives are not receiving all necessary information of objects related to the accident (floating containers etc.). These could also pose threat to others in the area, not only rescue operation participants, so this information would be very beneficial to many partners. Navigational warnings are used sometimes in these situations, but that needs for the information to get to RCC from the accident site in the first place.

For the other information sharing gaps that were in orange, in most cases just the simple fact of collecting the data or links that lead to the data in one place would help partners to receive it. In multiple cases the information of where to find some information was lacking, so the ARCSAR platform could use these findings as guidance of what to include in there. Cooperation with land-based troops and other Institutes came up in the findings as well, and as they could be considered as potential ARCSAR partners or supportive partners that provide information.

4.3   Summary of the gap analysis

The gap analysis reflected the critical points where the information sharing is not currently manifesting. As the hypothesis was that there are some gaps, it was proven to be right. The main theme of the thesis was focus at the operative side, and the current situation is mainly in acceptable level. However, some gaps were detected in the operative side information sharing. Concerning the other partners, gaps were detected in majority of the questions. As these gaps were detected, they should be acknowledged in the future.

5   Main recommendations

The results will be used in the process of creating a communication platform where data may be shared effortlessly between international parties. The gap analysis provided insight to the sections which are lacking proper information exchange. These results will give the platform developers guidelines of what to focus to. Few main recommendations with more details are given in this chapter, based to the results.

5.1   Regular communication checks

As the results suggested, a regular contact with others is creating sustainable way for staying up to date and conducting cooperation. Recommendation is that a regular check-ups will be conducted in the future. A plan for doing the contact checks and prioritization of the most likely partners that would be necessary in case of larger accident, is the start for this recommendation. After each partner has for example their nearest partners at their check-up list, it will be effortless to continue the circle wider, in case the situation requires more resources. These schedules could be placed in ARCSAR platform.

5.2   Contact details sharing

As the gap analysis showed, the contact detail sharing of others than SAR authorities is not at optimal level. A recommendation therefore is that establishing contact persons in the relevant NGOs, other authorities that don't have already a contact person or they are not part of ARCSAR, shipping companies etc. The communication should not be tied to a person, but rather for example to a position. In case the person changes, the contact responsibility would move on to the new person as part of the position. This requires cooperation with the other parties, and clear definition of the responsibilities. In case the ARCSAR platform will collect a contact detail list, the updating of the list must be accredited clearly, and preferably done in a scheduled way.

5.3   Resource knowledge sharing

Special rescue equipment is often rare, and in the Arctic not easily accessible. Recommendation would be to compile a listing of available resources of neighbouring countries. Even as it would not be live status feed, a rough knowledge of the possibly available units could prove useful in case of emergency. The RCCs have contact details of other RCCs, so knowing what to ask would be beneficial, even if the resources naturally might not be always available.

5.4   Link gathering in the ARCSAR platform

Multiple answers mentioned links, that they use even in daily operations. As the purpose of the ARCSAR platform is not to duplicate some other service, the recommendation would be to collect either the feed, or the links to the platform for purposeful use. When having the necessary links gathered, the partners would know where to search for information. Links could be divided in categories or other purposeful way.

Named sources that came up in the research are following:

- **Receiving traffic data**: AIS (open services), Directorate of fisheries, EMSA SEG satellite for AIS, ISPS reports, Long Range Identification Tracking, SafeSeaNet, VMS for fishing ships.

- **Receiving ship information**: AECO, International or domestic ship registries. IMO (Most likely refers to: Global Integrated Shipping Information System).

- **Contact details sharing**: sarcontacts.info

- **Other relevant information**: Meteorological Institutes for weather information. Canadian Ice Service website (ice formation).

5.5   Joint exercises with NGOs and land-based authorities

As the resources of authorities will be limited during a larger disaster, the NGO resources might prove valuable. Recommendation is that the most relevant NGOs would be included in exercises and that small scale and approachable exercises could be conducted at least yearly. As the resources and people are more familiar with each other, the cooperation should be more effortless. One critical part of this is the fact that with regular joint exercises, the contact details of the NGOs would also be available, as that was one of the detected gaps.

Recommendation is also to include the land units into exercises, if they are willing to participate. Even as the responsibility areas might not directly meet in everyday business, they might become overlapped in large enough event.

5.6   Arctic CISE

During the process of writing the thesis, the possibility of creating a "Arctic CISE" came up. Maritime CISE (Common Information Sharing Environment) is an EU funded project, called EU-CISE2020, and it will be finalized to full use at year 2020 (European Commission 2019). The need for shared information has been recognized at EU level, as majority of information is inside national or sectorial systems and often neighboring states are producing duplicate data (EUCISE2020 2015). Recommendation would be for the ARCSAR partners to get familiar with the CISE results to find out if it could be implemented in the Arctic operating environment. One recognized problem is at the information sharing between non-EU partners, as the existing CISE is between EU-partners. But the cooperation willingness in the Arctic is recognized, and similar solution could still prove to be useful if the obstacles are crossed in name of mutual interest.

5.7   Mandatory sailing plans

As it rose up in answers, the sailing plans are not mandatory, but often they would be helpful for the authorities when planning operations and keeping up the situational picture. At the Barents Sea, the Barents SRS (ship reporting system) became into force at 2013 (Pettersen 2012). There might be some data available already, that could be used for doing research about if that system would be beneficial in the Arctic Region.

6   Conclusion

In the exercise reports and questionnaire answers it rose up that difficulties in communication during operations in the ANA (Arctic and North- Atlantic) region are caused by the fact that there is not one clear place or platform where the operators and other stakeholders could share all the necessary information. Often the information is behind different services or authorities or organizations and the partners must have the knowledge beforehand of where to ask for certain piece of information. Partners search information from multiple different

services and sometimes they do not even find what they would need. These finding in the thesis should be taken into consideration at the development of the ARCSAR project platform.

The Arctic is difficult environment not only caused by the nature, but due to the multiple actors on the area, as they must find a way to collaborate with each other. The international relations have effect and sometimes they complicate matters, but the will to find mutual ground is seen in the already strong cooperation and in the objective to improve it. Changing circumstances will have effect in the Arctic region, global warming being one of the biggest ones, but the resilience will be stronger if the foundation for working together is solid. The ARCSAR project is aiming to that, and it will possibly result in some cooperation agreements or other means to reach the objectives.

There are multiple gaps existing currently in the information sharing, and they should be taken into account. The operative side has different requirements for the information and this viewpoint should not be forgotten. Operative side need the information at that moment, and the other partners might need it varyingly. But the innovations for the future use might come from the other partners, so the need of sharing information with them should not be understated. The value of cooperation should be cherished between partners, and ARCSAR is one powerful step towards functional information sharing that benefits all.

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Figures

Tables

Appendices

Appendix 1: Questionnaire layout

ARCSAR questionnaire

The aim of this questionnaire is to collect and deliver material for the ARCSAR project and more specifically to the Work Package 1 (WP1) "Project Management and Network Support", Task 1.3 (T1.3) "Project Website, Network Platform and Stakeholder database ". Results are also used as material at a Bachelor's Thesis, that will be published in Finland and the Thesis will be publicly available online/as paper copy to everyone. Anonymity of answers will be maintained.

The goal of the ARCSAR project is to establish and support a new Arctic and North Atlantic Security and Emergency Preparedness Network. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 786571.

The ARCSAR project's WP1, Task 1.3 "Project Website, Network Platform and Stakeholder database" will:

1) Design, develop, and maintain the ARCSAR website that includes the ARCSAR network platform, containing the innovation arena
2) Establish and maintain the stakeholder database to create an extended network of practitioners and stakeholders, for invitation to events, awareness raising, dissemination and communication activities, innovation and knowledge exchange activities, and surveys.
3) Database to include additional members of ARCSAR beneficiary organisations, practitioners, other relevant networks or associations, researchers in academic and non-academic organisations, companies, innovators, and technology providers, as well as those involved in governance and policy making. Stakeholders will be able to join the network through a formal (but free) membership process.

With reference to the WP1, T1.3 platform content, this questionnaire is sent to the ARCSAR partners in order to gain
the necessary, above presented, information for the ARCSAR project and to develop criteria for the ARCSAR
platform.

Questionnaire is divided in three sections, A "general questions", B "situation picture", C "Emergency phase situation picture". Section A has 3 questions, Section B 10, and Section C 10 + 1 (free word). Sections B and C has sub-questions based to your answer, so please answer shortly to the corresponding place.

*Required

1. **A1. I have understood that the results will be used in the ARCSAR project and as a part of openly published Thesis** *
   Tick all that apply.

   ☐ Yes, I have understood

2. **A2. Which ARCSAR partner type do you represent?** *
   Tick all that apply.

   ☐ Academia

   ☐ Industry

   ☐ Organization

   ☐ Practicioner, operational level

   ☐ Practicioner, management level

   ☐ Other: _____

3. **A3. Which country do you represent? (Optional)**
Tick all that apply.

☐ Canada

☐ Finland

☐ Iceland

☐ Ireland

☐ Italy

☐ New Zealand

☐ Norway

☐ UK

☐ USA

☐ Russia

☐ Sweden

☐ Other: _____

Situation picture, section B

Number 1 means there is no information received
Number 2 means there is some information received but not enough
Number 3 means that all necessary information is received
Number 4 means that you do not need that information to perform your tasks

Please specify shortly after the answer, where do you get the information from (this information will be used for designing the data collection sources)? Or why you do not receive it (it is not relevant, the equipment for receiving the information is missing etc.)

4. **B1. Do you have up to date contact details of other SAR (Search and Rescue) authorities in ANA (Arctic and North Atlantic) region? ***
Mark only one oval.

◯ 1. No

◯ 2. Some, but not all

◯ 3. Yes

◯ 4. I don´t need this information

5. **B1.1. If you answered 3, please specify where do you receive that information from?**

_____

_____

_____

_____

_____

6. **B1.2. If you answered 1 or 2, please specify why you do not receive the information?**

_____

_____

_____

_____

_____

7. **B1.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**

Tick all that apply.

☐ Yes

☐ No

8. **B2. Do you have up to date contact details of SAR related relevant NGOs (Non-Governmental Organizations) in the ANA region (such as Red Cross etc.)?** *

Mark only one oval.

◯ 1. No

◯ 2. Some, but not all

◯ 3. Yes

◯ 4. I don´t need this information

9. **B2.1. If you answered 3, please specify where do you receive that information from?**

_____

_____

_____

_____

_____

10. **B2.2. If you answered 1 or 2, please specify why you do not receive the information?**

_____

_____

_____

_____

_____

11. **B2.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**

Tick all that apply.

☐ Yes

☐ No

12. **B3. Do you receive information of other Arctic countries' search and rescue unit positions in your operational region?** *

Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

13. B3.1. If you answered 3, please specify where do you receive that information from?

_____

_____

_____

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14. B3.2. If you answered 1 or 2, please specify why you do not receive the information?

_____

_____

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_____

_____

15. B3.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

Tick all that apply.

☐ Yes

☐ No

16. B4. Do you receive information of other Arctic countries' search and rescue unit preparedness state (active/under maintenance etc.) in your operational area? *

Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

17. B4.1. If you answered 3, please specify where do you receive that information from?

_____

_____

_____

_____

_____

18. B4.2. If you answered 1 or 2, please specify why you do not receive the information?

_____

_____

_____

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_____

19. **B4.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**
Tick all that apply.

☐ Yes

☐ No

20. **B5. Do you receive information of other Arctic countries' search and rescue units in your operational area that have special rescue equipment on board? ***
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

21. **B5.1. If you answered 3, please specify where do you receive that information from?**

_____

_____

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_____

22. **B5.2. If you answered 1 or 2, please specify why you do not receive the information?**

_____

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23. **B5.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**
Tick all that apply.

☐ Yes

☐ No

24. **B6. Do you receive regular traffic data (routes, schedules etc. of cruise ships)? ***
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

25. B6.1. If you answered 3, please specify where do you receive that information from?

_____

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26. B6.2. If you answered 1 or 2, please specify why you do not receive the information?

_____

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27. B6.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

Tick all that apply.

☐ Yes

☐ No

28. B7. Do you receive other traffic data? *

Tick all that apply.

☐ Fishing boats in fishing areas based on the time of the year (regular fishing points)

☐ Tankers/cargo-ships

☐ Vessels with hazardous cargo

☐ Leisure vessels, small

☐ Leisure vessels, cruise ships (non-regular traffic)

☐ I do not need this information

☐ I do not receive any

☐ Other: _____

29. B7.1. If you receive information of vessels, please specify where do you receive that information from?

_____

_____

_____

_____

_____

30. B7.2. If you do not receive information, please specify why you do not receive it?

_____

_____

_____

_____

_____

31. B7.3. If you do not receive information, would you need it to perform your tasks more efficiently?
Tick all that apply.

☐ Yes

☐ No

32. B8. Do you receive relevant weather broadcast data in your operational area? *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

33. B8.1. If you answered 3, please specify where do you receive that information from?

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34. B8.2. If you answered 1 or 2, please specify why you do not receive the information?

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_____

35. B8.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
Tick all that apply.

☐ Yes

☐ No

36. B9. Do you receive avalanche warning data for your operational area? *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

37. B9.1. If you answered 3, please specify where do you receive that information from?

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_____

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_____

38. B9.2. If you answered 1 or 2, please specify why you do not receive the information?

_____

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39. B9.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
Tick all that apply.

☐ Yes

☐ No

40. B10. Do you receive current ice formation data of your operational area? *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

41. B10.1. If you answered 3, please specify where do you receive that information from?

_____

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_____

_____

42. B10.2. If you answered 1 or 2, please specify why you do not receive the information?

_____

_____

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43. B10.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
Tick all that apply.

☐ Yes

☐ No

Emergency phase situation picture, section C

Number 1 means there is no information received
Number 2 means there is some information received but not enough
Number 3 means that all necessary information is received
Number 4 means that you do not need the information to perform your tasks

Please specify shortly after the answer, where do you get the information from (this information will be used for designing the data collection sources)? Or why you do not receive it (it is not relevant, the equipment for receiving the information is missing etc.)

ANA (Arctic and North Atlantic region)

44. C1. Do you receive information of preliminary situation assessment (what type of emergency etc.)? *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

45. C.1.1. If you answered 3, please specify where do you receive that information from?

_____

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46. C1.2. If you answered 1 or 2, please specify why you do not receive the information?

_____

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47. **C1.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**

Tick all that apply.

☐ Yes

☐ No

48. **C2. Do you receive information about the developments in the distress situation (changes in distress vessel condition etc.)? ***

Mark only one oval.

○ 1. No information is received

○ 2. Some information is received but not enough

○ 3. All necessary information is received

○ 4. I don´t need this information

49. **C.2.1. If you answered 3, please specify where do you receive that information from?**

_____

_____

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_____

_____

50. **C2.2. If you answered 1 or 2, please specify why you do not receive the information?**

_____

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51. **C2.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**

Tick all that apply.

☐ Yes

☐ No

52. **C3. Do you receive information of who is the distress vessel owner? (through boat register for example) ***

Mark only one oval.

○ 1. No information is received

○ 2. Some information is received but not enough

○ 3. All necessary information is received

○ 4. I don´t need this information

53. C.3.1. If you answered 3, please specify where do you receive that information from?

_____

_____

_____

_____

_____

54. C3.2. If you answered 1 or 2, please specify why you do not receive the information?

_____

_____

_____

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55. C3.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
Tick all that apply.

☐ Yes

☐ No

56. C4. Do you receive information/details of the SAR plan of the vessel in distress? *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

57. C.4.1. If you answered 3, please specify where do you receive that information from?

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58. C4.2. If you answered 1 or 2, please specify why you do not receive the information?

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59. **C4.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**
Tick all that apply.

☐ Yes

☐ No

60. **C5. Do you receive information of the rescue operation coordination structure (what countries/vessels are participating, changes in operating units etc.)?** *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

61. **C.5.1. If you answered 3, please specify where do you receive that information from?**

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62. **C5.2. If you answered 1 or 2, please specify why you do not receive the information?**

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63. **C5.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?**
Tick all that apply.

☐ Yes

☐ No

64. **C6. Do you receive information of the already assigned rescue measures to the site?** *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

65. C.6.1. If you answered 3, please specify where do you receive that information from?

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66. C6.2. If you answered 1 or 2, please specify why you do not receive the information?

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67. C6.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
Tick all that apply.

☐ Yes

☐ No

68. C7. Do you receive information of the amount of rescued people and where they are being evacuated?
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

69. C.7.1. If you answered 3, please specify where do you receive that information from?

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70. C7.2. If you answered 1 or 2, please specify why you do not receive the information?

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71. C7.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

Tick all that apply.

☐ Yes

☐ No

72. C8. Do you receive information of the health status of the rescued people that need transferring? (Triage classification for example) *

Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

73. C.8.1. If you answered 3, please specify where do you receive that information from?

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74. C8.2. If you answered 1 or 2, please specify why you do not receive the information?

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75. C8.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

Tick all that apply.

☐ Yes

☐ No

76. C9. Do you receive information of the amount of people searched for (in case there is people in the water for example)? *

Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

77. C.9.1. If you answered 3, please specify where do you receive that information from?

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78. C9.2. If you answered 1 or 2, please specify why you do not receive the information?

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79. C9.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?
Tick all that apply.

☐ Yes

☐ No

80. C10. Do you receive information of objects related to the accident (floating containers etc.)? *
Mark only one oval.

◯ 1. No information is received

◯ 2. Some information is received but not enough

◯ 3. All necessary information is received

◯ 4. I don´t need this information

81. C.10.1. If you answered 3, please specify where do you receive that information from?

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82. C10.2. If you answered 1 or 2, please specify why you do not receive the information?

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83. C10.3. If you answered 1 or 2, would you need that information to perform your tasks more efficiently?

Tick all that apply.

- [ ] Yes
- [ ] No

84. C11. Do you have anything to add, that would be beneficial to the questionnaire related research?

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