European Union's Seventh Framework Programme

Grant Agreement **Nº: 603521**

Project Acronym: **PREFACE**

Project full title: **Enhancing prediction of tropical Atlantic climate and its impacts**

Instrument: Collaborative Project

Theme: ENV.2013.6.1-1 – *Climate-related ocean processes and combined impacts of multiple stressors on the marine environment*

Start date of project: 1 November 2013 Duration: 48 Months

Deliverable reference number and full title: *D13.2 "Report of survey results"*

Lead beneficiary for this deliverable: CAU

Due date of deliverable: 30.04.2017

Actual submission date: 29.04.2017

Project co-funded by the European Commission within the Seven Framework Programme (2007-2013)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

If this report is not to be made public, please state here why:

Contribution to project objectives – with this deliverable, the project has contributed to the achievement of the following objectives (from Annex I / DOW, Section B1.1.):

N.º	Objective	Yes	No
1	Reduce uncertainties in our knowledge of the functioning of Tropical Atlantic (TA) climate, particularly climate-related ocean processes (including stratification) and dynamics, coupled ocean, atmosphere, and land interactions; and internal and externally forced climate variability.		X
2	Better understand the impact of model systematic error and its reduction on seasonal-to-decadal climate predictions and on climate change projections.		X
3	Improve the simulation and prediction TA climate on seasonal and longer time scales, and contribute to better quantification of climate change impacts in the region.		X
4	Improve understanding of the cumulative effects of the multiple stressors of climate variability, greenhouse-gas induced climate change (including warming and deoxygenation), and fisheries on marine ecosystems, functional diversity, and ecosystem services (e.g., fisheries) in the TA.		X
5	Assess the socio-economic vulnerabilities and evaluate the resilience of the welfare of West African fishing communities to climate-driven ecosystem shifts and global markets.	X	

Author(s) of this deliverable: Kira Lancker, Dr. Jörn Schmidt, CAU, Germany

Deviation from planned efforts for this deliverable: none.

Deliverable 13.2: Report of survey results on surveys in Senegal and Cabo Verde

(April 2017, CAU with CRODT-ISRA, INDP, IRD)

Kira Lancker, Dr. Jörn Schmidt

Content

1 Survey report

1.1 Introduction

Task 13.2 of the PREFACE project aimed to use survey data in order to assist the attainment of WP 13 aims, namely to understand the positive and negative effects of climate change on small-scale coastal fishing communities, to analyze additional uncertainties such as on input prices, understand current responses and potential implications for management.

The framework applied by most publications that analyze the impact of climate change on fishing aims to identify vulnerability, defined as the expected damage from climate change after counter-measures taken by the actors. It is determined by three factors: Extrinsic exposure to climate change, intrinsic sensitivity and adaptive capacity, i.e. their capacity to absorb change and modify their position (e.g. Allison et al 2009, Tuler et al. 2008, Brugère et al 2015, Belhabib et.al 2016). Within this framework, our WP shall draw on available data from other WP to understand the exposure. However, we also aim to use the survey to possibly identify climate change impacts on resource and catch that have not yet been recognized as important. Survey data provides a unique opportunity for an in-depth qualitative assessment of the situation in general, of fisher folk's sensitivity and adaptive capacity and to integrate the management perceptions of the participants. In the next step, comparability between our in-depth data for Cabo Verde and Senegal will help us to identify effects from interrelations between factors and between factors and the general environment, which will be continued using the data from Nigeria once the latter is available.

Senegal ranked high with regard to disaster exposure, both concerning frequency of occurrence and mortality, giving rise to the discussion how artisanal fishermen are affected compared to industrial vessels in the same region (Badjeck et al 2013). In Cabo Verde, one of the main aspects of exposure is possibly the focus on tuna (roughly one third of total artisanal catch and one fifth of total industrial catches in Cabo Verde). Tunas are highly migratory species and their migration routines depend on the physical environment, such as sea surface temperature (e.g. Maury et al 2001). Belhabib et al (2016) predict a rising catch potential (18%) for Senegal due to invasion of warm-water species, while they predict a decrease in catch potential by 6% for Cabo Verde. However, there is substantial uncertainty: Using a different oceanography model, Barange et al (2014) for example predict a decline in catch potential of 14.6% for the entire Canary Current Large Marine Ecosystem,

West African fishing communities were identified as vulnerable to climate change, especially due to a high sensitivity and low adaptive capacity (Allison et al 2009). With regard to sensitivity, both Senegal (29th) and Cabo Verde (8th) ranked within the top quartile of countries that are highly dependent on fisheries as a source of employment (index of percentage of fisher folk in the economically active population (EAP), n=143) in an FAO report on disaster vulnerability of fisheries (Badjeck et al 2013). One focal point of fisher's individual sensitivity is the fisher folk's degree of specialization on target species, fishing ground and gear (Belhabib et al 2016). A lower specialization would limit vulnerability, since climate change will likely not affect species homogenously. Another aspect here is the management of a fishery prior to climate change impacts: Overfishing reduces the ability of the fish resource itself for adaptation, and declining CPUE's for West African fisheries point towards major problems in this respect (Belhabib et al 2016).

Several factors on country as well as individual level impact the fisherman's adaptive capacity (e.g. Tuler et al 2008, Cinner et al 2015, Allison et al 2009, Brugère et al 2015). The survey specifically provides

insights on the following aspects: Education, financial assets/ credit markets, outside options, social capital (participation in decision-making, community organization, migration…), and human agency. This part is where we suspect to find the largest differences between Senegal and Cabo Verde. We expect those to be interrelated, for example a negative relationship between social capital and access to credit, or a positive relationship between education and human agency.

The data collected for both countries is ready for use and includes (non-exhaustive list):

- Socioeconomic data
- Enterprise data (cost, investment, revenues)
- Perceptions of climate change
- Perceptions of fishing regulation in the area
- Credit market data
- Investment experiment data

In the following, after a short chapter on survey setup, stratification and weighting, we will provide insights into four important parts of our results, namely, the general situation, climate change perceptions, and two coping mechanisms: Diversification and community strength. A comprehensive overview containing graphs is provided in the Annex.

1.2 Survey setup

1.2.1 Senegal

For Senegal, we have collected data from 691 participants, of which 485 (70.19%) are artisanal captains, vessel owners or both, 98 (14.18%) are processors and 108 are retailers (15.63%). In total, participants provided information on 623 artisanal fishing vessel which we collated separately in the vessel data base. The graph below shows the distribution of our vessel sample over gear types. Please note that the Senegalese survey was stratified both according to landing sites and gear types.

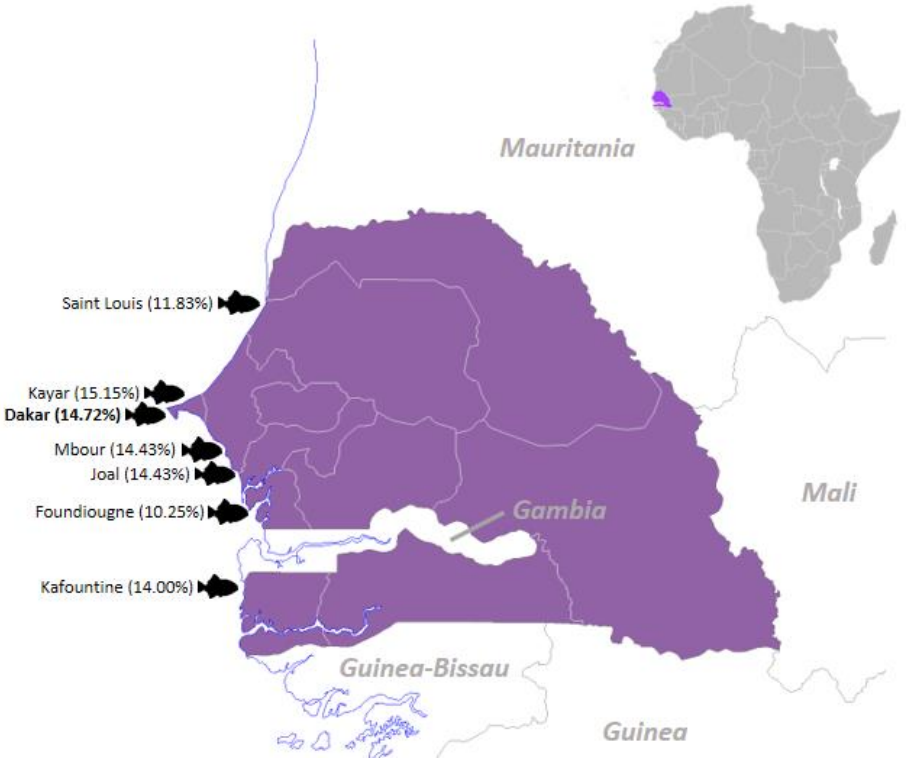
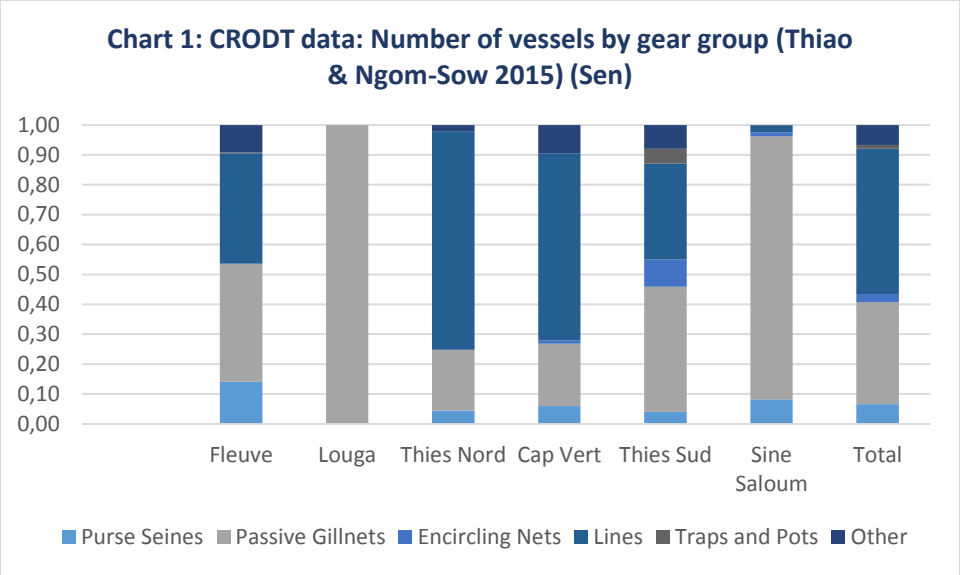


Figure 1-1: Map of Senegal survey



Stratified sampling commands the use of weights in order to use the data on aggregate levels. In Senegal the weighting adjustment is based on two auxiliary variables: 1) the landing site and 2) the gear category. Population data on each of these variables is available in the official report of the Senegalese research facility "Centre de Recherches Océanographiques de Dakar-Thiaroye" (CRODT) (Thiao & Ngom-Sow 2015). The results of their 2014 vessel census are shown in the graph above.

The auxiliary variables used from the survey data set are the location and the gear type of vessels 1-5 of each participants. Location strata are (with major fishing centers in brackets): Fleuve (St. Louis), Thiès Nord (Kayar), Thiès Sud (Mbour, Joal), Cap Vert (several in Dakar) and Sine Saloum (Foundiougne). Unfortunately, for a small part of observations south of Gambia in the region called Casamançe (Kafountine), no population data (neither reported nor expert knowledge) is available, such that we have to restrict the weighted analysis to observations to the North of Gambia. For analysis on location level, we can use the full dataset as we did not stratify for gear in Casamançe. Gear-strata in all other locations include: Purse seines, passive gillnets, encircling nets, lines, traps/ pots and other. We use the multilevel svyset command to apply weights in Stata. The corresponding Master-do-file provides the user with a choice between running summary statistics on the following datasets, which are available upon request:

Dataset	#Obs	Comment	Weighting Process
Overall (Northern) Dataset	383	If location south of Gambia or "None", observation was dropped	1st Weight: Landing Sites 2nd Weight: Gear Type
Overall Dataset, gear only	449	Landing sites are not taken into account (no location based observations dropped)	1 Weighting process only, based on Gear
Vessel Dataset	535	Each vessel is treated as a seperate observation. Vessels where the f. If location == "Kafoutine" or "None" observation was dropped	1st Weight: Landing Sites 2nd Weight: Gear Type
Vessel Dataset, gear only	623	Landing sites are not taken into account (no location based observations dropped)	1 Weighting process only, based on Gear

Table 1: Datasets available on Senegal

1.2.2 Cabo Verde

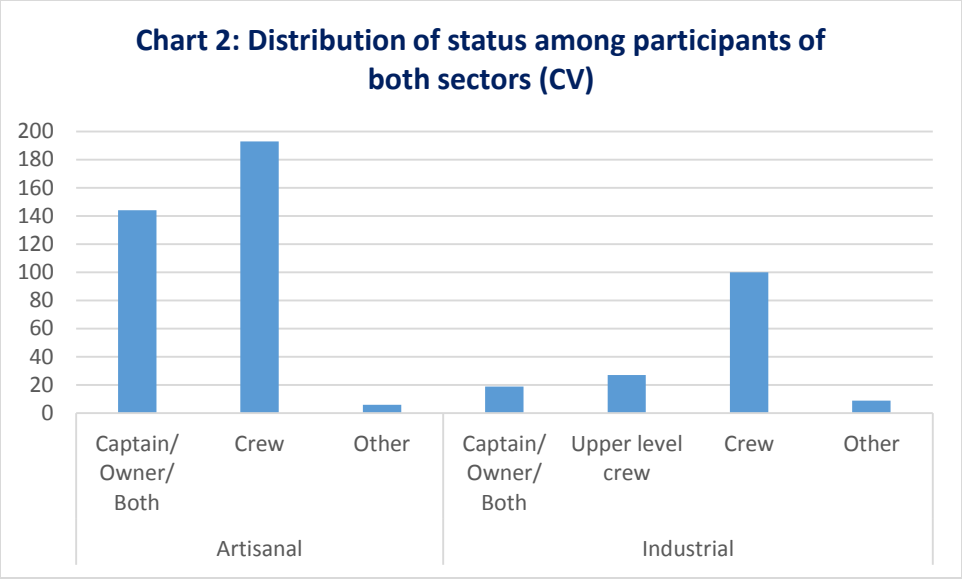
For Cabo Verde, we collected a total sample of 670 participants comprising both artisanal and industrial fishing and retailing, but no processors. This was decided due to the different realizations of the wider-fishing-industry in the two countries: While the processing sector is small and dominated by only two large firms in Cabo Verde (personal source INDP), it is a diverse sector dominated by numerous small processers in Senegal. On the other hand, the industrial and artisanal fishing sector in Cabo Verde are equally significant with regard to landings (42% artisanal and 58% industrial[1]), while the dominant sector in Senegal is the artisanal one and the number of Senegalese industrial vessels has decreased continuously (81% artisanal and 19% industrial[2]).The table below shows the distribution of participants across sectors and the three islands targeted (Sal, Santiago and Sao Vicente were chosen because of their importance for the fishing industry, because they adequately represent the two geographical regions Sotavento and Barlavento):

Frequencies	Sal	Santiago	Sao Vicente	Unknown	Total
Artisanal	79	178	85	1	343
Industrial	26	40	79	1	146
Retailer	13	132	36	0	181
Total	118	350	200	2	670

Table 2: Cabo Verde survey participants

We decided to include crew members in addition to captains and vessel owners. This decision was based both on the idea that there may be substantial differences in viewpoints on regulation and climate change effects, as well as a practical consideration that this simplifies the carry-out of the survey, as crew members are often more approachable for the survey due to both their number and their occupation (especially concerning the industrial sector). The drawback of this decision is in the reduced number of participants commenting on cost and investment, thus data that crew members do not have. However, the diversity of gears used is a lot smaller than in Senegal, such that we neither had to stratify according to gear, nor collect as large a total sample concerning captains. We sampled data on 148 vessels (random with respect to gear), of which 125 operate with hand lines and 15 with gillnets (with 8 "purse seines", "snorkeling" or "others"). The following table shows the distribution across vocational status of our fisher folk participants (excluding retailers):

[1] INDP 2012, Boletím estatistico No. 21, Mindelo.
[2] DPM (2014), Résultats géneraux des pêches maritimes, Dakar 2014.



The weight adjustment process for Cabo Verde is relatively simple compared to that of Senegal because, due to limited variation in gear use, we only consider one auxiliary variable: island groups. The population data and distribution across the islands of Santiago, Sal and Sao Vicente is based on expert knowledge on the number of fishermen supplied by the INDP (Instituto Nacional de Desenvolvimento das Pescas). The location variable from the survey data is summarized to represent each of these islands. This gives rise to one overall dataset and one vessel dataset, both location-weighted.

1.3 Results

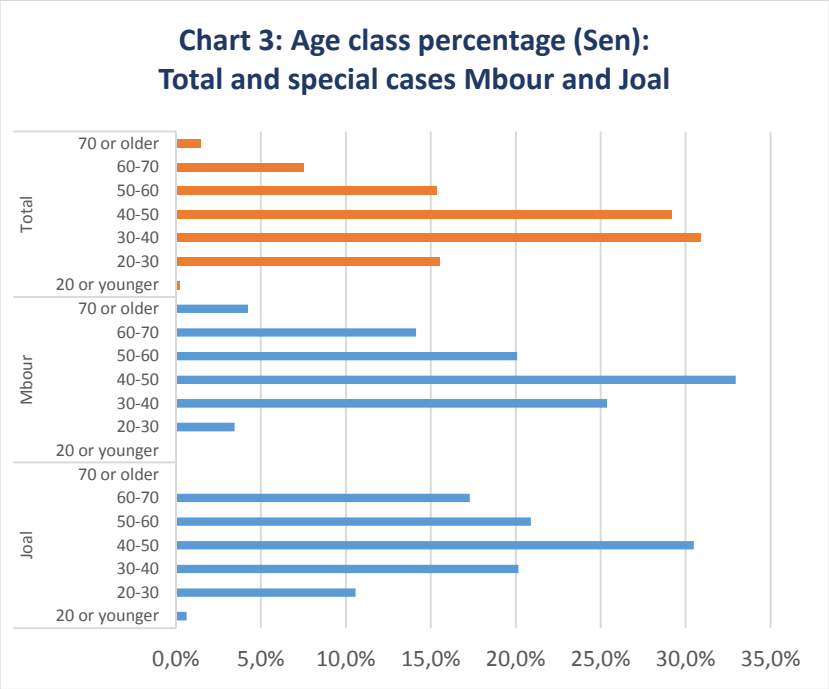
1.3.1 General

1.3.1.1 Senegal:

Total artisanal landings in Senegal were estimated to be 574 137 tons in 2014 by CRODT, and the artisanal sector thus accounts for roughly 75% of total (official) catches. Effort was at 899 485 fishing trips for the artisanal fleet (Thiao & Ngom-Sow 2015).

We identify three large ethnic groups within the Senegalese fisher folk: The Lébou are the largest group (41.03%) and live mostly in Dakar and Kayar, followed by the Guet-ndarien in Dakar and St. Louis (38.50%) and the Foundiougne-based Sérère niomka (12.08%). The "petite coast", Mbour and Joal, are inhabited by a vast mix of ethnic groups according to our survey results. Senegalese fisher folk are near-exclusively Muslim and male (>99% for both). A vast majority is married (92.68%), and the average household size (defined as the number of people eating together from one pot) is 14.4 people (weighted standard error: 0.59).

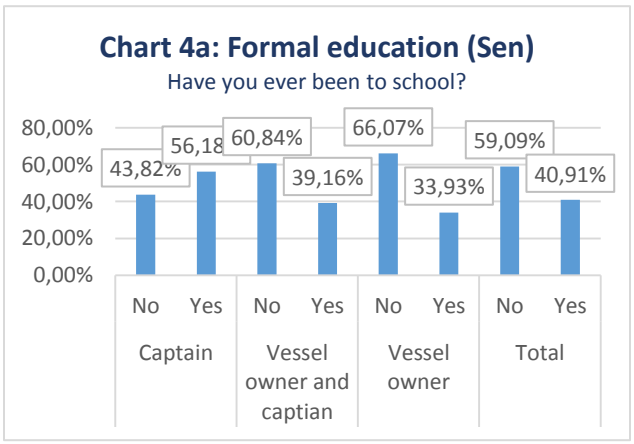
Most Senegalese fisher folk are between 30 and 50 years old, but there is a substantial amount of younger people in the sector (16%). This is true for most fishing locations (distribution is adequately represented for those in the "Total" part), but interestingly, the petite coast with the villages Mbour and Joal (mostly encircling gillnets) seems to experience a drain of young fishermen more pronounced than the other locations, as shown by the graph below.

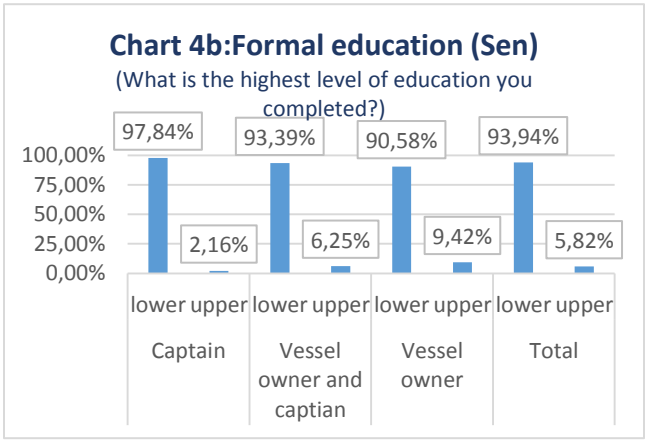


A bit more than half (54.81%) of the participants described the standard of living they achieved working in the fishing industry as “Unacceptable” and only 13.66% find it "Good" or "Very good". Notably, the self-assessment results are a lot better for fishing villages along the northern coastline, in Kayar and St. Louis. We are currently developing an income index for our data, which will provide a more objective measure.

However, nearly all have access to running water and electricity (94% for both), and live in houses built from slate, zinc or cement (89.02%). While three quarters own mobile phones, roughly one quarter has internet access. Over half of all participants (56.36%) reported to have some amount saved. Another 39.65% said they could not afford to have savings. Of those with savings, 91.14% had a specific purpose in mind for the fund.

Within the target group, 15.2% of respondents are captains, 68.64% are both captains and owners and 16.15% are owners only, indicating a strong duality of ownership and vessel responsibility. Our data shows a relationship with education: Captains are less often literate than vessel owners, even though they more often attended formal education. The percentage with high school, college or university education (see "upper") is higher for owners. Overall weighted literacy is at 37.31% (read and write) and another 21.44% are able to read.





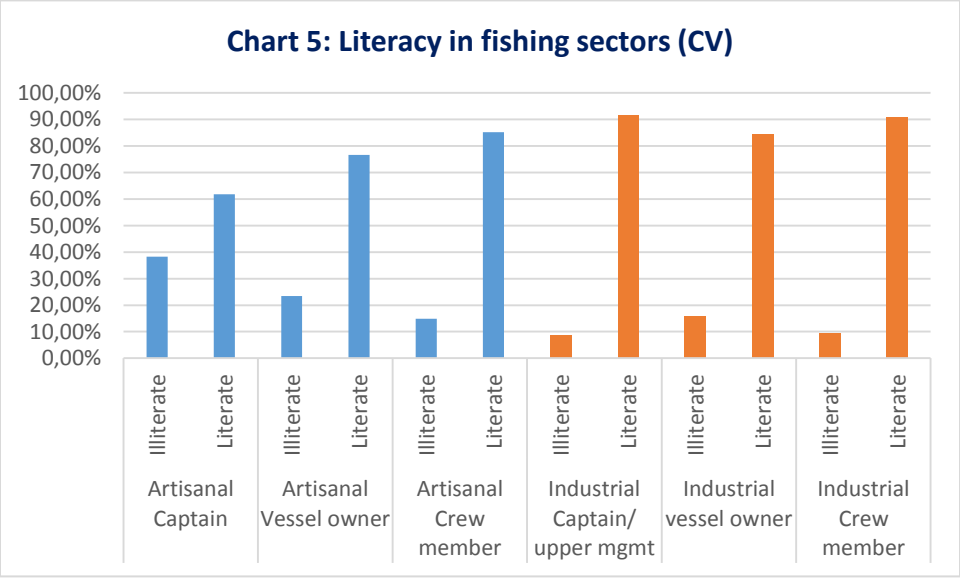
More than half of all variable fishing costs in Senegal costs are fuel costs (54%) followed by costs on wages (35%)[3].

1.3.1.2 Cabo Verde:

Total artisanal landings in Cabo Verde were estimated to be 4.31 tons in 2012 by INDP, and the artisanal sector thus accounts for roughly 42% of total (official) catches. Industrial total catch was at 5.95 tons. Effort was measured to be 146 373 fishing trips for the artisanal fleet, and 6264 days at sea for the industrial fleet (INDP 2013). This considered, Cabo Verde is a comparably small fishing nation. A large part of the catch in Cabo Verde is in relatively valuable tuna species (37.4% for the artisanal catch and 28.7% for the industrial catch).

While in artisanal and industrial fishing, 99% of fisher folk are male, the women's share in retail amounts to 95%. Of the total population in fishing and retail, 86.32% declare themselves Christian, 9.74 as not belonging to a religion, with the rest belonging to various smaller religious groups. Ethnicity was not part of the questionnaire, since it is reportedly not of importance in the Cabo Verde population. 8.59% are married, 65.58% single, divorced or widowed, and 25.82% cohabit. The large party of those who live alone is dominated by artisanal fishermen (68.04%), against retailers (63.88%) and industrial fishermen (61.37%).

The average household size measures 6.21 persons (weighted standard error: 0.18), with on average 1.92 persons contributing to household income (weighted standard error: 0.06). 21.67% are illiterate across all sectors (artisanal: 22.70%, industrial: 9.80%, retail: 26.88%), but only 5.33% have had no education (artisanal: 5.15%, industrial: 5.81%, retail: 5.32%), three quarters attended school up to primary level, the rest mostly up to secondary level. The Cabo Verde illiteracy rate in the artisanal sector is only half the rate in Senegal, indicating an overall better educational standard, even though the survey in Cabo Verde includes crew members in addition to vessel responsible participants and owners. .



With respect to age classes, a lot more people in Cabo Verde's fishing sectors are between 20 and 40 than in Senegal. This could indicate either a weak adaptive capacity regarding outside opportunities, or

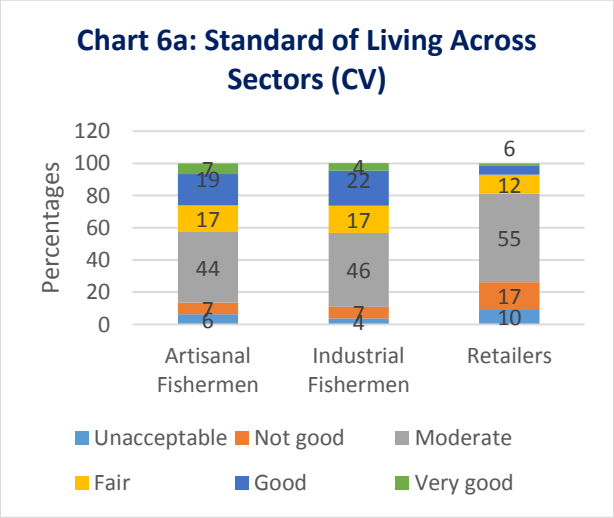
[3] However, since most practice a sharing system, some of the profit may still be accountable as labor income.

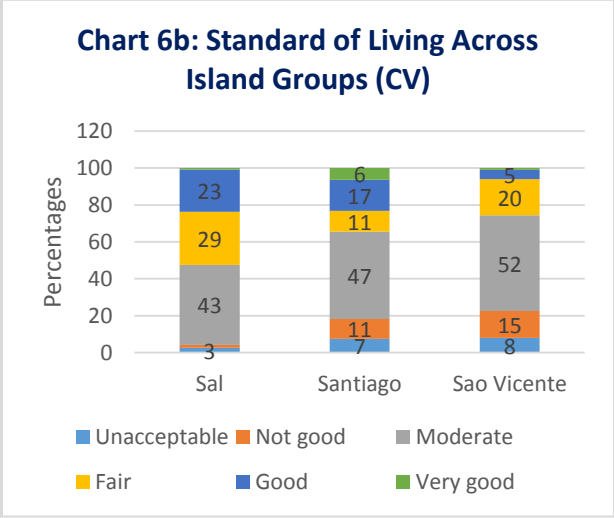
it could be a sign that the Cabo Verde fish sector sustains participants better than the Senegalese one and therefore Cabo Verde youth have a greater incentive to stay in the sector. Across islands, the only particularity is the relatively lower share of young fishermen in Sao Vicente, similar to Mbour and Joal in Senegal.

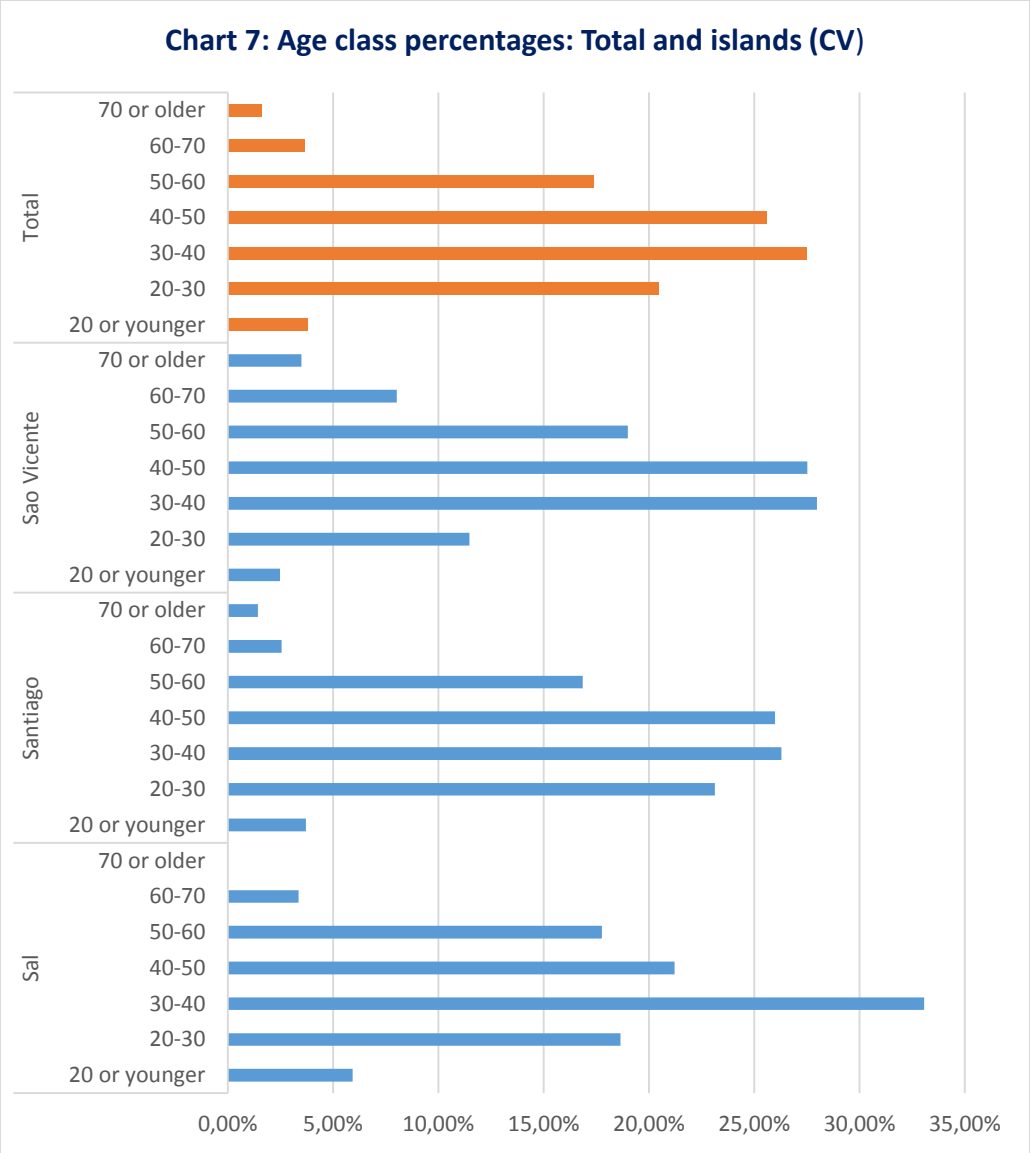
With regard to stated standard of living, this assumption seems to be supported, as across all sectors, participants are unhappier with their standard of living in Sao Vicente than in Santiago or Sal. The worst standard of living result has the retail sector, whereas industrial and artisanal sector show similar results. Overall, the results are enormously better than for Senegal, where more than a weighted half of the participants described their standard as "unacceptable". This result holds despite the fact that the Cabo Verde survey includes crew members, i.e. lower paid positions, whereas the Senegal survey includes only captains and vessel owners. An objective asset income index is being constructed, that will allow us to compare subjective statements to objective measurement.

More than 82.13% have access to electricity, but access to piped water (public or private) is only available to 76%. Access to a phone (77.64) is lower, but access to internet (48.38%) is higher than in Senegal. majority of the participants hold savings (60.09%) with (38.57%) not having enough money to do so. Particularly the women dominated retail sector has a slightly higher percentage of participants who do not have enough money to own savings (51.88% vs 47.46%).

However, nearly all have access to running water and electricity (94% for both), and live in houses built from slate, zinc or cement (89.02%). While three quarters own mobile phones, roughly one quarter has internet access. Over half of all participants (56.36%) reported to have some amount saved. Another 39.65% said they could not afford to have savings. Of those with savings, 91.14% had a specific purpose in mind for the fund.







1.3.2 Climate change perceptions

A first qualitative insight into where physical weather change, fish resource wealth rank compared with other worries in participants live is shown in the graph below. Fish resource wealth is the top worry in the lives of all participants across countries and sectors, the second is financial poverty. Afterwards, worries in Senegal and Cabo Verde diverge: Problems with land ownership are a major concern in Senegal, but apparently not in Cabo Verde. On the other hand, diseases and alcoholism are a dominant worry for Cabo Verde fisher folk. With regard to climate change, rainfall issues rank in the upper quartile as well.

Chart 8a: Top 5 worries as weighted %age of participants (CV)

(Do the following issues according to your worries exist in your life?)

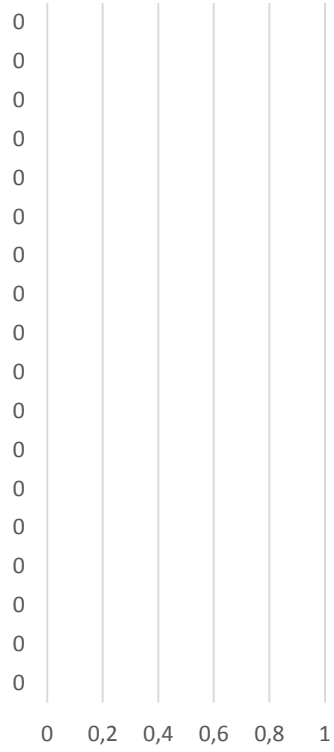
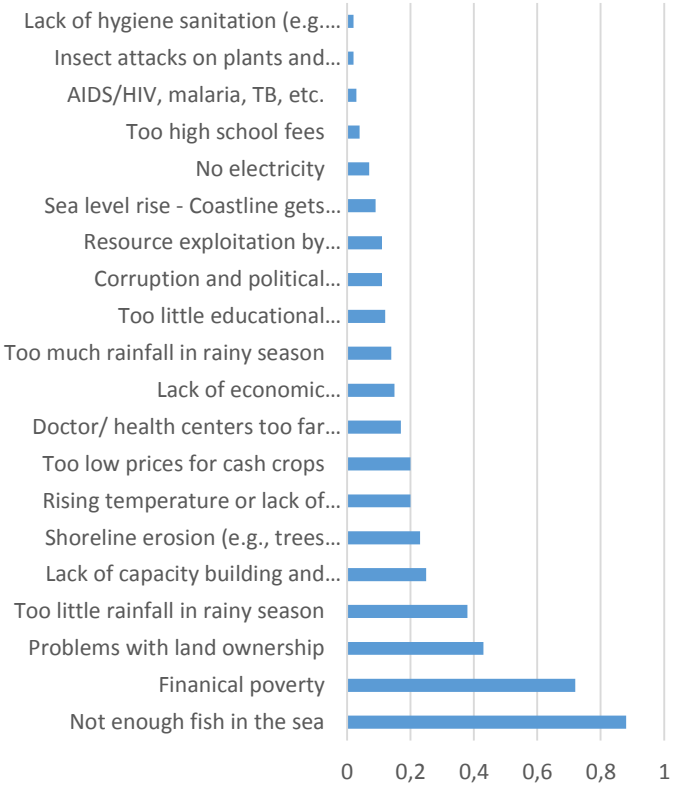


Chart 8b: Top 5 worries as weighted %age of participants (Sen)

(Do the following issues according to your worries exist in your life?)

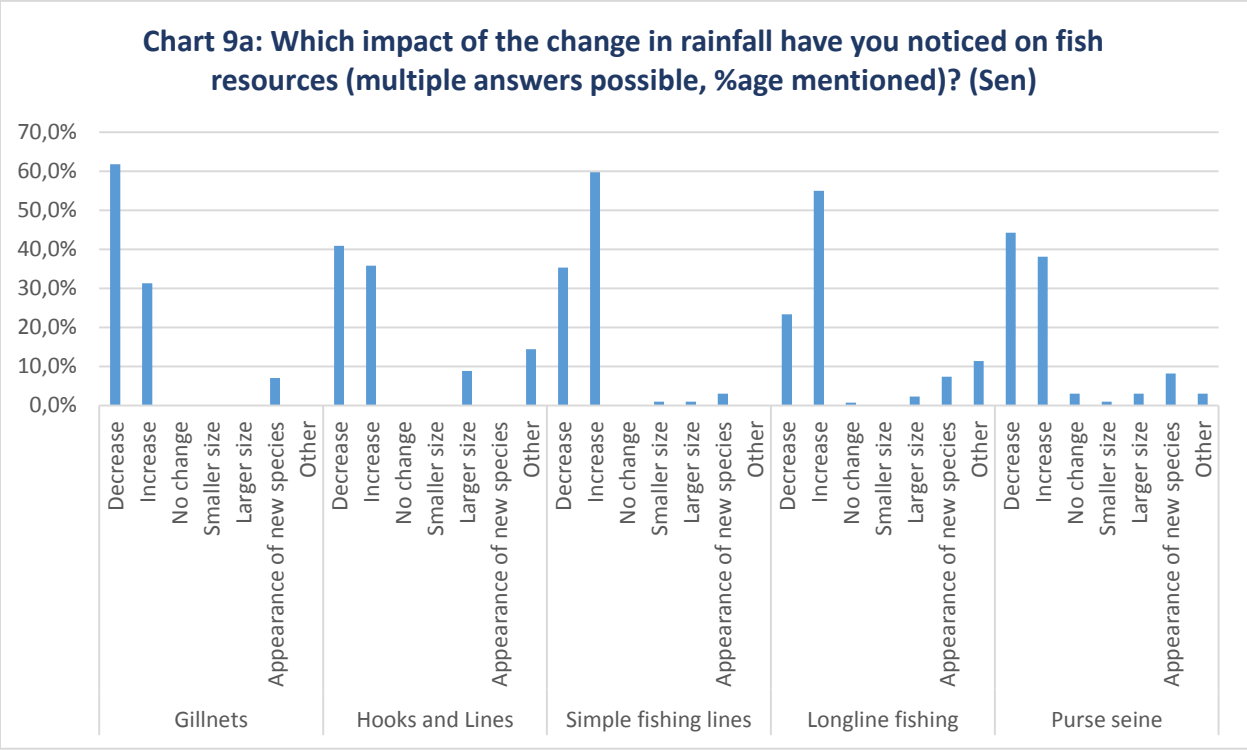


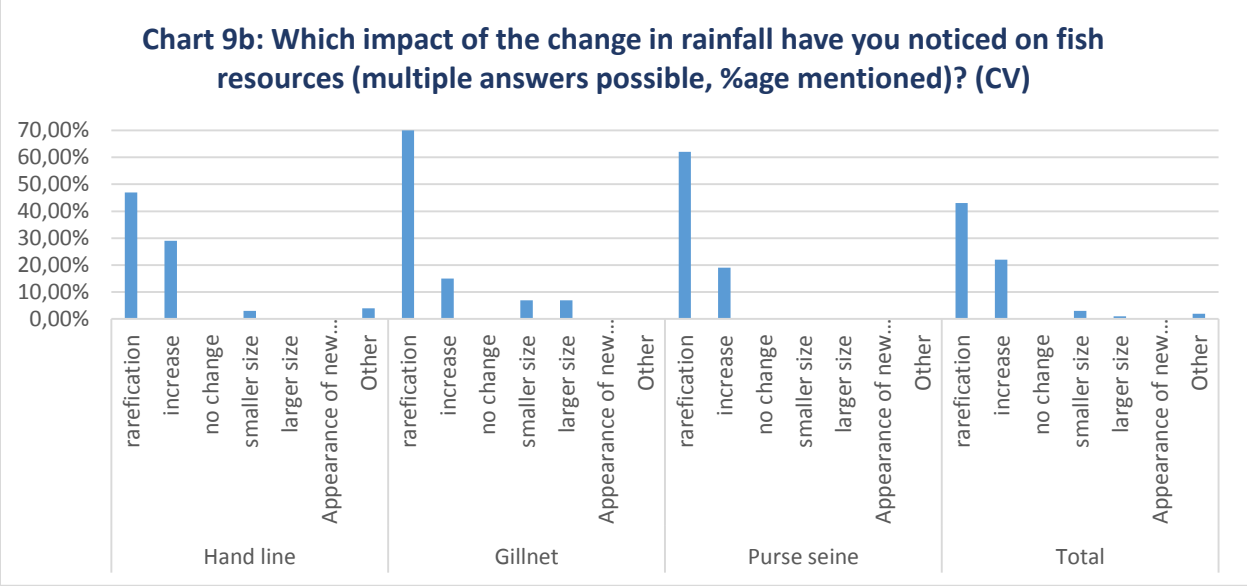
In the literature, one of the determinants of adaptive capacity used is understanding of environmental changes, human agency, i.e. to recognize humans as agents that cause certain environmental changes, and the recognition of a need to adapt. Our data provides two sources of information on this: We asked for climate change signs and causes as well as for resource abundance change signs and causes.

In Senegal, across all surveyed sectors, the link between environmental physical factors and the fish resource was clear to most participants: Existence of an impact of rainfall pattern changes on fish resources reported 95.46% of participants, of temperature – 87.92% and of wind – 92.97% (all weighted percentages). The direction of stated impacts diverge, but the open answers indicate a clear positive relationship between rain and fish resource. Divergence with regard to rainfall may be related to the fishing location (for example, it seems that the southern Sine Saloum fishers more often experience an increase in the resource) or to target species (see graph below with an analysis by gear used, including the five most important gear types).

For Cabo Verde, across all surveyed sectors, an impact of changed rainfall patterns was reported by 78.72%, and impact of temperature by 77.23% and by wind of 82.95%. The percentages are slightly lower for all three categories than in Senegal. The direction of stated impacts diverge again. Open

answers indicate a negative relationship of the wealth in resource with wind intensity, and even more pronounced and unsurprisingly, a negative relationship between the number of fishing trips and wind intensity. This indicates a threat, as respondents agreed mostly on an increase in the number of windy days (81.05%) and in the wind intensity (75.46%). The impact of rainfall on the resource is not as clear and again seems partly driven by specialization, as shows the graph below.





While this impact was considered existent, other causes seem to be more important. When asking participants in Senegal for the main reasons for a change in the number of fish, they recognized the impact of overfishing (36.83%), foreign fleets (28.61%) and the large scale fleet (10.34) as important. 13.99% stated other causes, such as the use of certain gear (monofilaments, encircling gillnets) and the

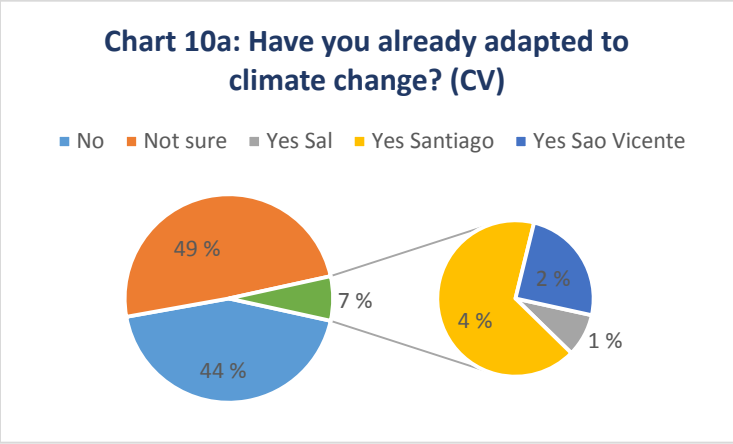
fishing of juveniles, or God's will. In Cabo Verde, the dominant reasons given were foreign fleets for the tuna fishery, and foreign fleets, large-scale fishing and overfishing for small pelagics and demersals, though the variation across islands is striking (see Appendix for graphs).

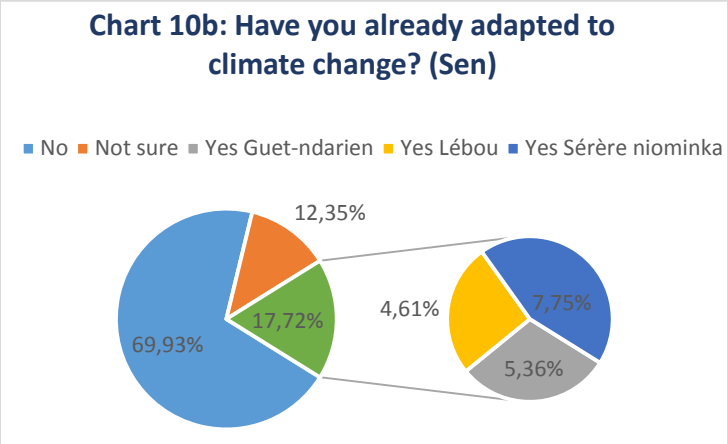
All in all, it seems that the state of and reasons behind overfishing are well recognized in the fishing communities, but it is unclear how well they can disentangle effects from overfishing and climate change effects.

While 77.48% of Senegalese fishing sector participants state that they had heard of climate change, nearly 100% of Senegalese fishing sector participants believe that climate change exists, and 20.47% linked the existence to human causes (be they scientifically sound or not), most thought it to be caused by "God's will". In Cabo Verde, only 63.83% had heard about climate change before, 32.91% said they weren't sure whether climate change exists, and 62.86% believe in climate change. Of those who do, human causes were given by 23.77%, whereas most attribute it to "natural processes" (other than anthropogenic pollution caused) (56.22%). We conclude that while knowledge about climate change is in both countries already rather common, in-depth knowledge of cause and effect is limited.

In Senegal, 19.08% stated that they already took measures to adapt to what they perceived as climate change influences on their fishing business, 69.06% stated they did not do so and 11.86% were unsure. Interestingly, there is a strong divergence across ethnic groups: 58.58% of the more southern based Sérère niomka stated they already adapted, but only 12.83% of Guet-ndarien and of 10.25% Lébou fishermen. In Cabo Verde, the overall adaptation percentage was way lower. While at least part of the literature predicts positive effects of climate change on fishing for the Canary current Large Marine Ecosystem (e.g. Belhabib et al 2016), climate change is not viewed as opportunity by the Senegalese fisher folk: 73.34% (71.31% for CV) of participants reported an impact on revenues, and in 98.71% (89.01% for CV) of these cases the impact was negative. We conclude that either, there is indeed a negative dominant impact, or more likely, the effects of overfishing and climate change impacts are not disentangled in the perceptions of participants.

For those who already heard about climate change, knowledge about climate change stems mostly from television (49.89% Sen, 69% CV) or radio (31.14% Sen, 34% CV).





1.3.3 Diversification

Apart from *noble fish*, a composite of scarce but very valuable (export-) species, the most important target species include during the hot season *Octopus* and *Bluespotted Seabass* while during the cold season, they fish mostly *Bluespotted Seabass* and *False Scad*. *Round sardinella* and *Madeiran sardinella*, as well as *Ethmalosa fimbriata*, are most important for the purse seines and encircling gillnets, which together constitute the two major sectors and together accounted for 83% of total production in 2014 (Thiao & Ngom-Sow 2015). Among the three most important target species, 12 are mentioned by more than 5% in both the hot and the cold season, and a lot more use the option "other" to name a fish not in the already long list of 26 options. This shows that the overall sector diversification is high, not surprising considering the number of different gears used.

Target species specialization is very common in Senegal: Only 7% do not specialize in any specific type of fish. When asked for the reason of specialization, most participants are specializing either because this type of fish is more available (16.51%) or because it is most profitable, sells better etc. (29.47%) (free answer). Fewer answers give rise to the assumption that another important reason is knowledge or the possession of the relevant gear (5.26%) (graph see Annex). If demand specifics or knowledge constraints are indeed the dominant force behind target species selection, fishermen are more constrained and adaptive than if it is a question of availability, especially considering the possibility that catch potential rises but species composition changes, as is for example being forecasted by Belhabib et al (2016).

Apart from fishing, 14% of all households have income contributions from agriculture, 13% from other employee-positions and 9% from other sources. For a large part (67%) of household's, the number of income contributing households is smaller or equal to the number of those who work in fishing (note that family members who work in fishing do not account as income contributing if another member is head of household), thus a large share of households relies only on fishing income. Per household, 0.24 persons work in employee positions and 0.13 persons in agriculture. This is a stark contrast to 4.28 persons per household who on average work in fishing. 17% of participants individually gain income in sectors apart from fishing.

In Cabo Verde, *tuna* and *mackere*l species head the list of target species. On each of the island groups, *Yellow fin tuna* is a very popular target groups, and the overall most important target for the artisanal sector. On Sal, the *Black mackerel* comes in second with 21%, on Sal this is the case for the White mackerel (9.6%) and on Sao Vicente the *Grouper* and *Bullet tuna* are just as popular as the *Yellow fin tuna*. Another interesting result is that the island group of Sal is the least diverse island group when it comes to target species (7 species) whereas Sao Vicente is the most diverse group (16 species).

Table 3: 1st Most Important Target Species

Artisanal Sector CV	Industrial Sector CV	Artisanal Sector Sen, hot season	Artisanal Sector Sen, cold season
Yellow fin Tuna	*Bigeye scad*	*Noble fish*	*Noble fish*
Grouper	*Black Mackerel*	*Octopus*	*Bluespotted Seabass*
Blackspot Picarel	*White Mackerel*	*Bluespotted Seabass*	*False Scad*

Even though the survey encompasses industrial as well as artisanal fishing, the target species range is very narrow. The six species that occur the most as primary target species (Yellow fin tuna, Black and white mackerel, Blackspot picarel and Grouper, Bullet tuna) together account for the primary species of

72% of participants. In addition, 44% of industrial and artisanal participants state that they have only 2 or less important target species. Apparently, there is a high concentration within gear groups, but also within and across sectors, which is likely driven by a little diversified resource around the archipelago.

In contrast to the Senegalese fishing industry that is to a large degree artisanal, Cabo Verde hosts both industrial and artisanal relevant sectors, which gives participants the opportunity to diversify using both. We find that in the household of an artisanal fisher, 1.34 people work in artisanal fishing, 0.48 people work in industrial fishing and 0.65 people in retail on average, indicating a strong diversification of households across all three sectors. This is especially true keeping in mind the small size of Cabo Verde households (2.93 members contributing to income on average). In the household of an industrial participant, 1.16 people work in industrial fishing, 0.07 in artisanal fishing and 0.11 in retail. This fits with the previous finding that mobility into the industrial sector is high, but not vice versa. The results show that the industrial sector is an important income diversification alternative for fisher folk in Cabo Verde. We formulate two hypothesis from this: For once, it might be a good strategy for the Cape Verde government to focus on the industrial sector and possibly to not prolong foreign fishing contracts in favor of further developing the national fleet (in conjunction with the vertical product line components, like processing). Secondly, the hypothesis that artisanal fishing folk is prone to climate change due to too little possibilities to diversify (Belhabib et al (2016)) may be right but not relevant in the Cape Verde case, if the ties with industrial fishing itself are as tight.

On the other hand, there are also substantial links to non-fishing-sectors. Participants were asked whether they had household members working in various other sectors. While 42% (38%) stated that no further sectors were covered by household members, 20% (24%) had ties to services and 11% (9%) to the publics services sector, 6% (6%) to agriculture, 3% (1%) to mining and only 2% (2%) to tourism (numbers in brackets refer to values for artisanal captains and vessel responsible persons only, to compare to our Senegal data). This was a multiple answer question. There might be an opportunity to strengthen the link between tourism and fishing further. In general, Cabo Verde fishermen seem a lot better provided with outside opportunities than Senegalese fishermen.

1.3.4 Community strength

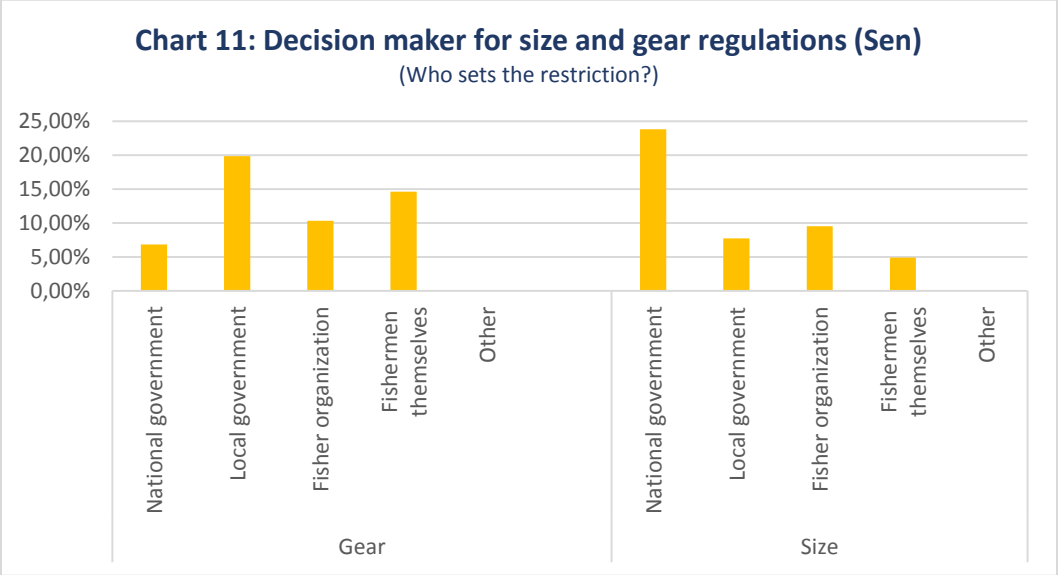
Three quarters of the respondents (73.61%) were born to parents who also worked in the fishing industry. Fishing as a family business strongly persists for both vessel owners and captains. In 66.79% of all cases, the parents worked at the same location (whether they were fishermen or not), which indicates a substantial part of migration along the coastline, and possibly a lower community strength. This is supported by the large majority of 91.84% that attest a large number of migrants in their own fishing locality. However, in addition to organization in ethnic groups and large households, 82.9% of fishermen in Senegal are a member of a fishing association in Senegal. All of these results indicate a high degree of social organization.

In Cabo Verde, migration is not as common or traditional as in Senegal, due to the archipelago structure. However, there is strong inter-sector mobility: A share of 59.86% of fishing sector participants have parents who were fisher folk. 57.00% of industrials have parents who worked in the artisanal fishing sector, 17.64% worked already in the industrial sector. Reverse mobility is uncommon: Only 2.42% of artisanal fishermen were born to parents in the industrial sector, most had parents in the artisanal sector (64.87%). Of the fishermen (no retail) survey participants themselves, 15.81% switched between artisanal and industrial fishing sectors themselves, mostly from artisanal to industrial sectors. 70.87% of

the artisanal fisher population and 72.86% of the industrial fisher population is organized in fishing associations. Altogether, the degree of organization is lower in Cabo Verde than in Senegal, on household and community level. However, a lower overall population and a lower migration routine may render a strong community organization less relevant here.

When asked about their perception of the necessity of (more) fishing regulation, most artisanal Senegalese fisher folk see the need for management (93.46% Sen, 86.57% CV). Notably, with 77.93%, agreement in the industrial sector is much lower in Cabo Verde.

Fish size (31.06%) and gear (35.48%) regulations were known to exist in Senegal, although this does not correspond to national level official data. These two were also seen to be most effective and best for both fish resource and fishermen, with roughly one quarter agreement for each. Especially concerning gear, decision-making seems to be done on local level and within the fishing communities themselves, as shown by the following graph:



In Cabo Verde, 63.23% stated that size regulations exist and 51.68% stated that regulations on target species exist. The rate of "Don't know/ Not sure" answers was particularly high, between 12.91% and 22.56% for various regulations. Cabo Verde fishermen consider and to be the most effective forms of regulation for the resource. No cases of local government or self-regulation were found for Cabo Verde.

All in all, while artisanal fisher folk in Senegal seem well organized, and exhibit a surprisingly high level of self-regulation, fisher folk in Cabo Verde is less organized and also less informed about regulations on fishing.

1.4 Conclusion

For Senegal and Cabo Verde, WP 13 has finished surveys on fishing and fishing-related sectors including socioeconomic and business data and data on perceptions of climate change impacts as well as fishing regulation. The data provides a detailed insight into exposure and sensitivity to climate change, as well as the overall situation of artisanal fishing in Senegal and artisanal as well as industrial fishing in Cabo Verde.

Our Senegal data shows an artisanal fisher folk that is largely dissatisfied with their standard of living, but benefits from sound basic infrastructural services and lives in large households. In Cabo Verde,

standard of living satisfaction is way higher, even though infrastructural services are often lacking and we survey also crew members here.

The exposure of our participants cannot be sufficiently analyzed using the survey alone, but the survey assists in finding relevant aspects for modelling. Impacts of weather changes on the resource seem evident. For Senegal, this is dominantly visible in the perceptions on rainfall pattern effects, while for Cabo Verde, wind changes may prove more important, on the resource as well as on fishing effort in the artisanal sector.

We highlighted how our data can shed light on sensitivity and adaptive capacity in two chapters. While in the Senegalese sector, we find specialization on individual level but rather diverse range of target species and gears used, the Cabo Verde fisheries depend to a dangerous degree on only six species, and most importantly tunas. This is true on individual, fishing sector and total-fishery level. In that regard, while only individual sensitivity is high in Senegal and the artisanal sector itself is likely too diverse to be hit by singular species changes, the Cabo Verde fishery is very sensitive to certain species changes. Intersectoral diversification is strong in Cabo Verde, both between artisanal and industrial fishing and between fisheries and other economic sectors, such as services. The former may only function as outside option in case of climate change threats though, if either the impact is via storms on fishing effort, or if the larger steaming range of industrials can remedy the threat. The target species seem to overlap to a large degree.

Community strength, according to our data, is stronger in Senegal and also translates into better community regulation. This is not negated by the strong migration character of the Senegalese fishing population. In Cabo Verde, it seems that organization is lower, and that the artisanal sector might be declining slowly. There is a strong movement of artisanal fishermen into the industrial sector. The status of regulation is not well known.

The data is ready for use and already assists the team in modelling decisions. Planned analysis includes an income index, a full vulnerability assessment and additional uses, for example in conjunction with the AWA project on risk and investment behavior, credit market issues and in conjunction with further time series data from CRODT on nutritional aspects.

1.5 References

Allison, E. H., Perry, A. L., Badjeck, M.-C., Adger, W. N., Brown, K., Conway, D., Ashley S. Halls, A. S., Pilling, G. M., Reynolds, J. D., Andrew, N. L. & Dulvy, N. K. (2009): Vulnerability of national economies to the impacts of climate change on fisheries*, Fish and Fisheries*, 10(2), pp. 173-196. DOI: 10.1111/j.1467-2979.2008.00310.

Badjeck, M.-C., Allison, P., Renn, S., Brown, D., Poulain, F. (2013): The vulnerability of fishing-dependent economies to disasters, *FAO Fisheries and Aquaculture Circular* No. 1081, Rome (FAO).

Barange, M, Merino, G., Blanchard, J. L., Scholtens, J., Harle, J., Allison, E. H., Allen, J. I., Holt, J., Jennings, S. (2014): Impacts of climate change on marine ecosystem production in societies dependent on fisheries, *Nature Climate Change*, 5, pp. 211-216. doi:10.1038/nclimate2119.

Belhabib, D., Lam, V. W.Y., Cheung, W. W.L. (2016): Overview of West African fisheries under climate change: Impacts, vulnerabilities and adaptive responses of the artisanal and industrial sectors, *Marine Policy*, 71, pp. 15-28.

Brugère, C., De Young, C. (2015): Assessing climate change vulnerability in fisheries and aquaculture. Available methodologies and their relevance for the sector, *FAO Fisheries and Aquaculture Technical report*, Rome (FAO).

Cinner, J. E., Huchery, C., Hicks, C. C., Daw, T. M., Marshall, N, Wamukota, A., Allison, E. H. (2015): Changes in adaptive capacity of Kenyan fishing communities, *Nature Climate Change*, 5, pp. 872-876. Doi:10.1038/nclimate2690.

Instituto Nacional de desenvolvimento das pescas (INDP) (2013), Boletim Estatístico No 21, Dados sobre Presca Artesanal, Pesca Industrial, Conservas e Exportacoes, Mindelo.

Maury, O., Gascuel, D., Marsac, F., Fonteneau, A., De Rosa, A.-L. (2001): Hierarchical interpretation of nonlinear relationships linking yellowfin tuna (Thunnus albacares) distribution to the environment in the Atlantic Ocean, *Canadian Journal of Fisheries and Aquatic Sciences*, 58, pp. 458-469.

Thiao, D. & Ngom-Sow, F. (2015): Statistiques de la pêche maritime sénégalaise en 2014: Pêche artisanale et Pêche thonière, Archives Scientifiques du Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT), Dakar.

Tuler, S., Agyeman, J., Pinto da Silva, P., Roth LoRusso, K. , Kay, R. (2008): Assessing Vulnerabilities: Integrating Information about Driving Forces that Affect Risks and Resilience in Fishing Communities, *Human Ecology Review*, 15(2), pp.171-184.

2 ANNEX 1: Descriptive summary: Artisanal fishing sector survey in Cabo Verde in the framework of PREFACE WP 13

2.1 Profile of respondents

A total of 670 people were interviewed on the islands belonging to the nation of Cape Verde. Figure 1 below gives an overview of the **unweighted and weighted** distribution of the location where the participants were interviewed on Cape Verde. The islands have been grouped into 3 main island groups: 1) Sao Vicente 2) Sal and 3) Santiago. According to the distribution of the participants across these island groups, the complete Cape Verde Dataset was weighted against official data on the overall populations' distribution across these island groups. Unless specified otherwise, the descriptive statistics in this report are based on the **weighted** results.

2.2 Sectors in Fishing and Working Status

When it comes to the gender of the participants (70.44%) is male while (29.56%) is female. The average age of all particapants is 54 years old. The sector in which these participants work in is distributed as follows.

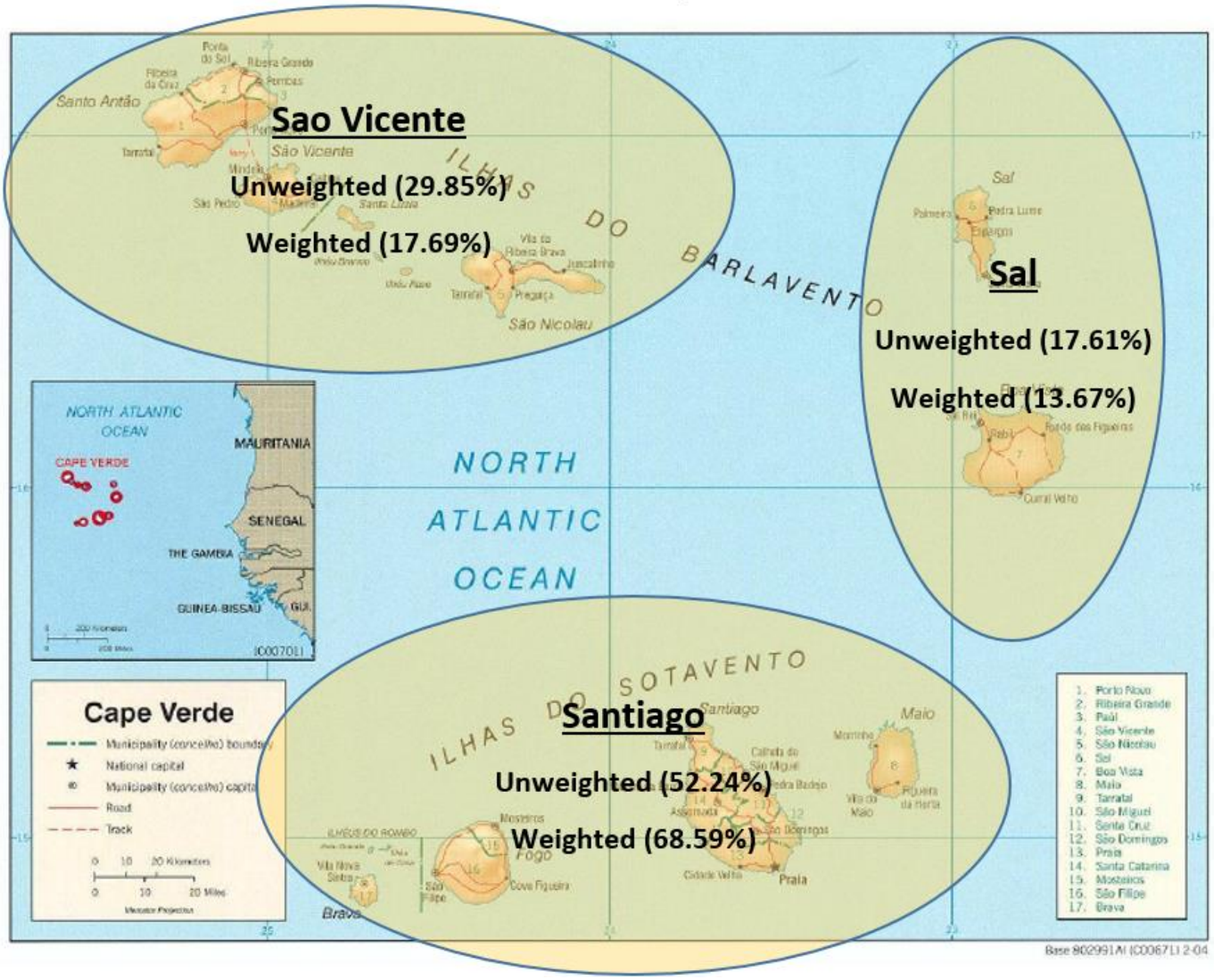
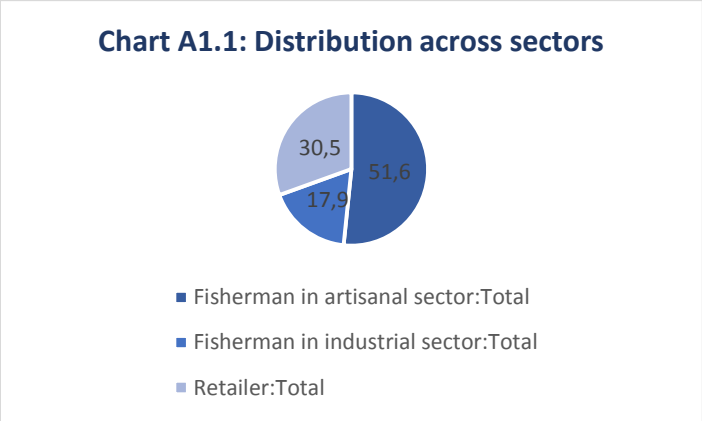


Figure A1.1. Distribution of participans across Cabo Verde Islands



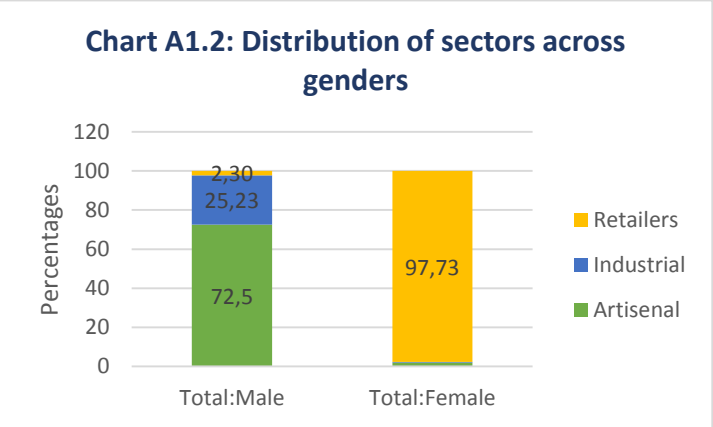
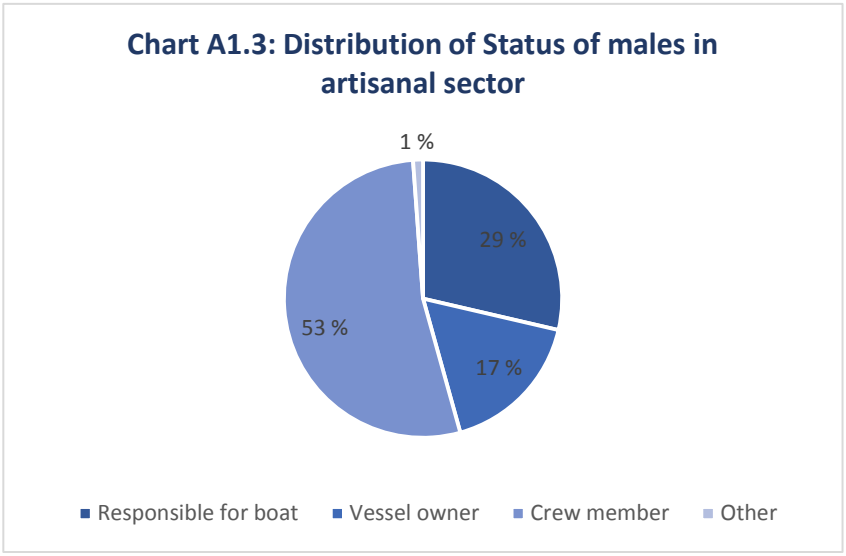
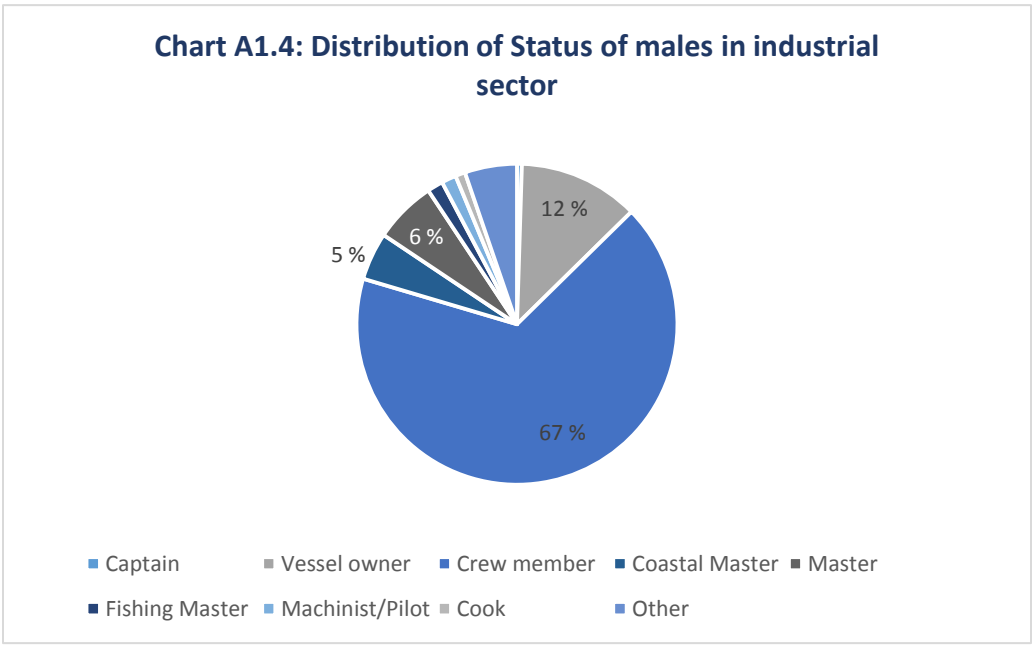


Chart 1 shows that the biggest sector the participants belonged to is the Artisanal Fishery Sector (51.63%). Chart 2 shows that in sorting the distribution among the sectors across genders one can also see that female participants are highly underrepresented as fishermen but overrepresented as retailers (97.7%). The male participants are mostly active in the artisanla fishing sector (72.5%).

Gender and marriage

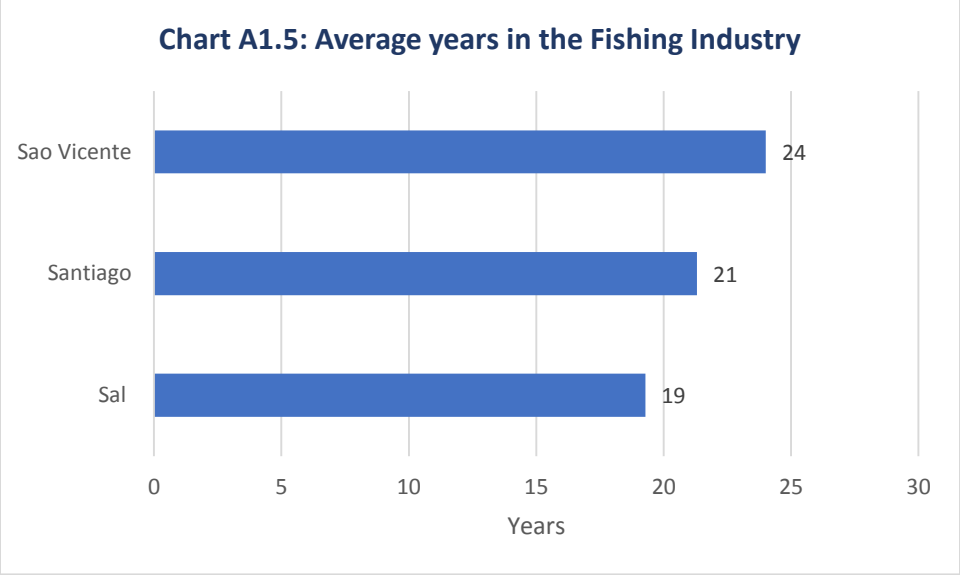
Charts 3 and 4 shows how the status of males in both artisanal fisheries and industrial fisheries is distributed. The major status in both fishery types is being a crew member (53% in artisanal fisheries and 67% in industrial fisheries). Of the males participating in artisanal fisheries 17% is a vessel owner and 29% is responsible for the boat. The average amount of years male participants remained with the same status is 14.31 years, for female participants this is 17.40 years. 85.89% of all participants started in the artisanal fishery when they first entered the fishing industry as a whole, furthermore most of the participants are single (63.44%) and very few are married (8.59%).





2.3 Economic, Livelihood and Educational Characteristics

In describing the economic, livelihood and educational conditions of the participants, the relevant variables have been analysed accross the different summarized island groups. This in order to get a grasp of the different circumstances on each of the island groups. The average amount of years in the Fishing industry is highest in Sao Vicente (24 years) and lowest in Sal (19 years). For the island groups as a whole the average amount of household members is 5 while the average amount of contributing household members is 2.



From Charts 6 below one can easily read that the most important household activity across all of the islands is Fishing, other relatively relevant activities are farming, wage labor and services most of which occur mostly in the island group of Santiago (2.58%, 4.03% and 3.45% respectively). Sal is the island group where the most fishing activity in households occurs (97.46%)

Chart A1.6.1. Most important HH Activity in Sal (%)

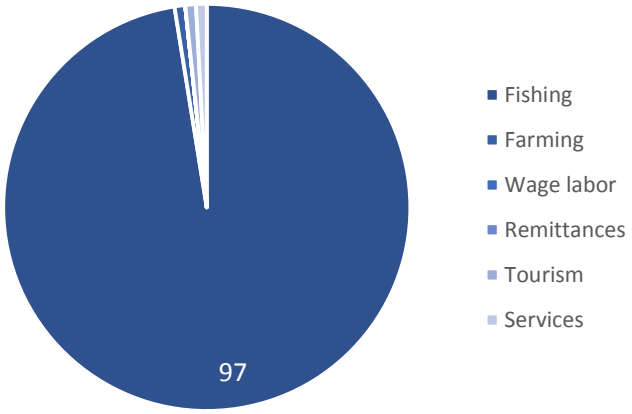


Chart A1.6.2. Most important HH Activity in Santiago (%)

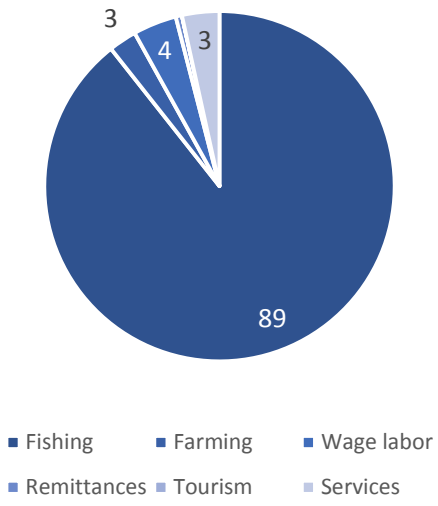
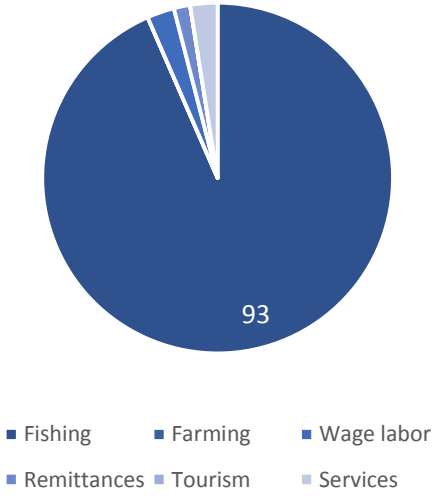
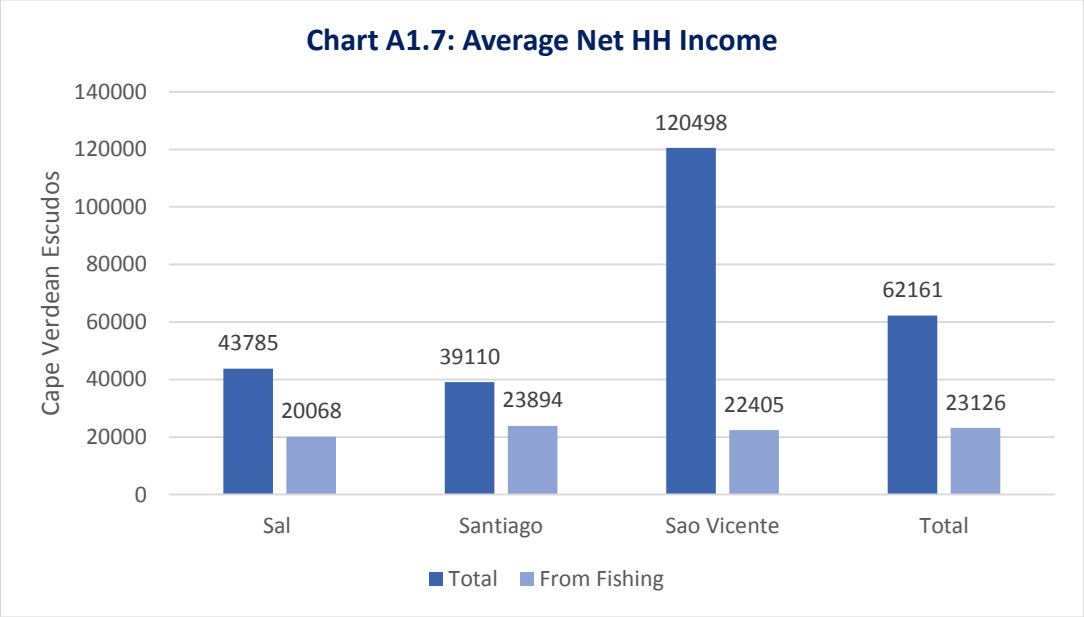


Chart A1.6.3. Most important HH Activity in Sao Vicente (%)



In Chart 7 one can easily discern the total amount of HH income on each of the island groups as well as the overall averages. The second bar in the chart indicates how much of the total HH income results from fishing activity. The chart implies that fishing is not the *only* source of income for many households. Another relevant aspect seen in this chart is that the average amount of household income in Sao Vicente is above average even though Chart 6 states that fishing is the most important activity for households on *all* of the island groups.



When it comes to the standard of living it is interesting to look how it is distributed across both the island groups and the status of the respective participants. This is indicated in Chart 8 and 9 below. In total 47.61% of all the participants live in circumstances that are moderate, 10.1% of the overall participants live in circumstances that are not good. The island group with noticeable high living standards is Santiago where 16.97% lives in circumstances that are good and 6.32% lives in circumstances that are very good. In Chart 9 we can see that industrial and artisanal fisherman seem to enjoy the highest living standard, with 19.35% and 22.00% living in good circumstances compared to 5.70% for retailers. It is interesting to keep in mind that most of the retailers are female.

Chart A1.8: Standard of Living Across Island Groups

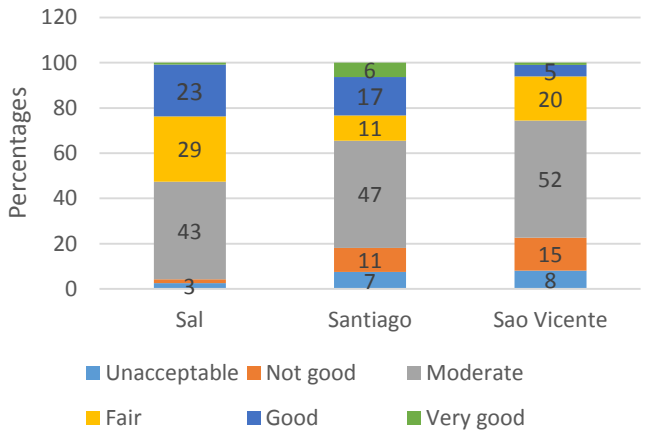
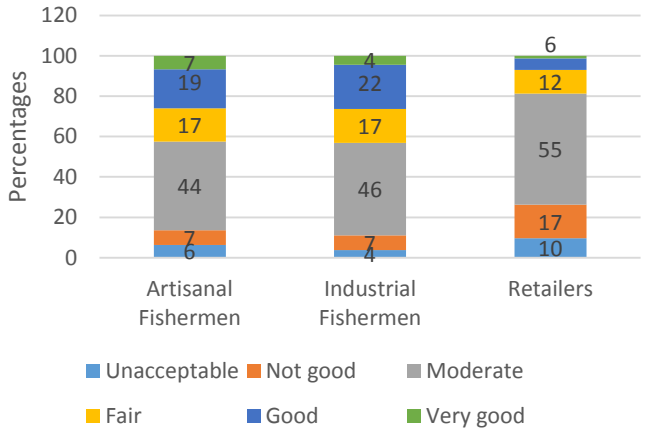
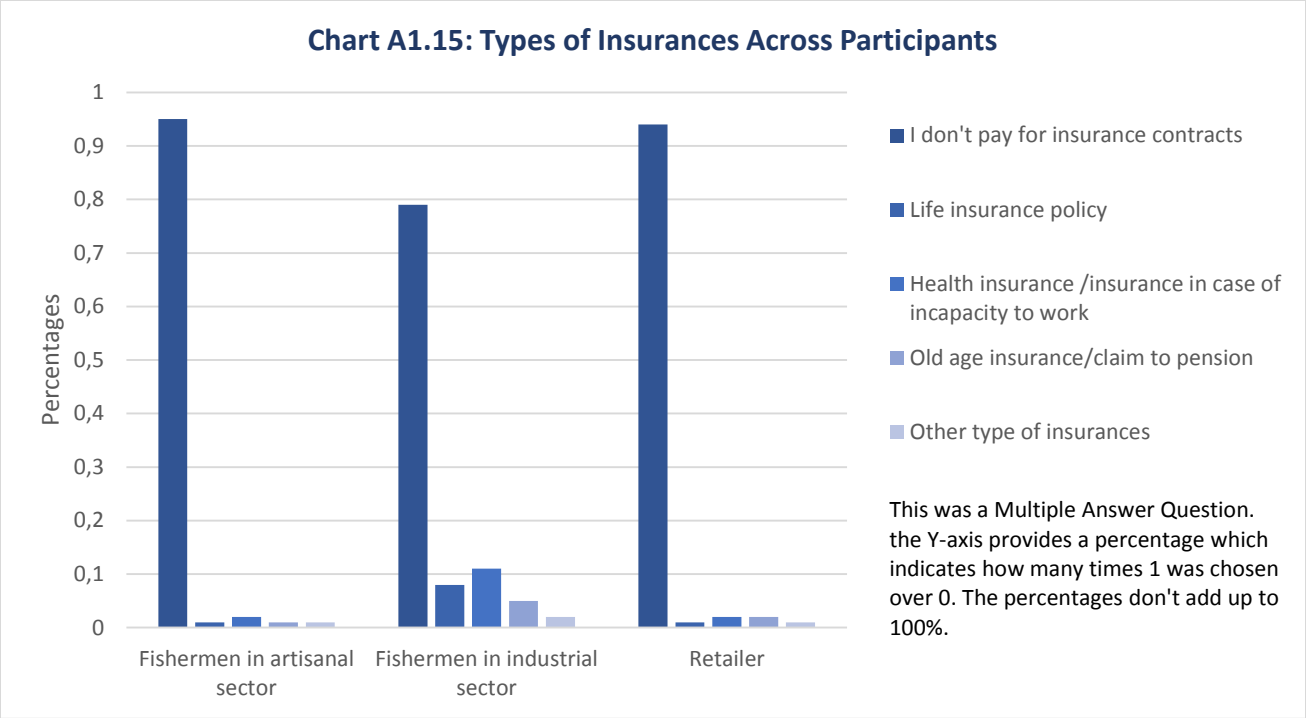


Chart A1.9: Standard of Living Across Sectors



2.4 Insurance, Loans and Saving

The following section will discuss the distribution on insurances, loans and savings among the participants of the survey. It was chosen to reflect the presence and type of insurances and loans across the different sectors and status within particularly the artisanal sector.



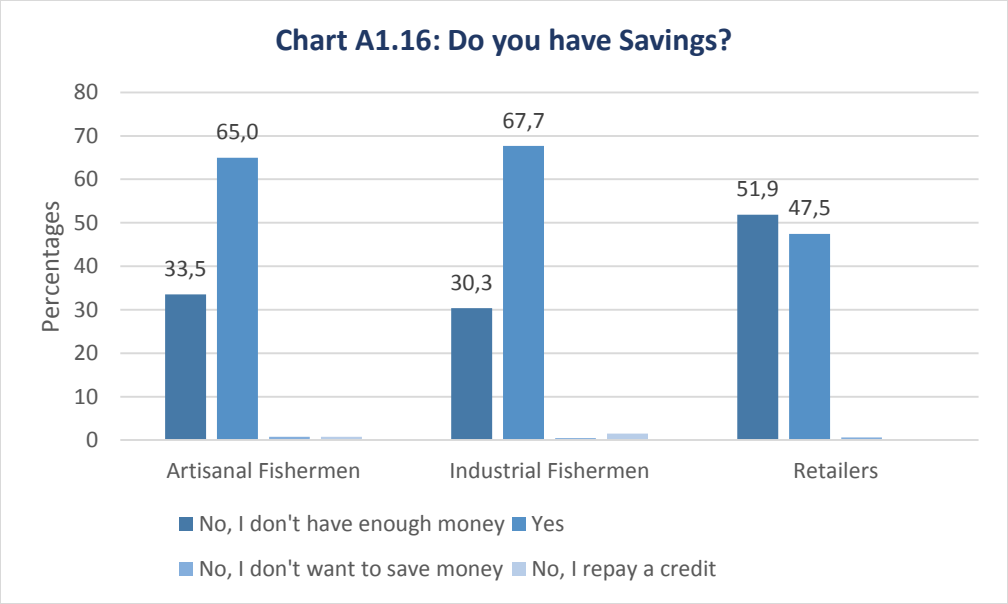
It seems that 91.98% of the participants don't pay for insurance contracts and when they do, the most popoplar one among each of the sectors is a health insurance contract (3.7%). The average amount paid for insurance is 36943 CVE, when analysed across the sectors Artisanal Fishermen and Industrial Fishermen pay bove average while Retailers pay below average. But since the majority of participants don't pay for an insurance contract anyways, not much attention is paid to this descriptive.

Loans

Concerning to loans, approximately 48% of the participants hold 1 or more loans, this is approximately 7% of the sample size. The two main sources of the loans are Micro Finance Organizations (24.97%) and Banks (55.78%). The main reasons for undertaking the loans are Vessel and Gear Purchase (33.30%) and Education (20.47%). The average value of the loans is 1305892 CVE, the average duration of the loans is 30 months with a monthly payback frequency.

Savings

When it comes to savings, Chart 16 illustrates how it is distributed accross the 3 different sectors. It turns out that a majority of the participants hold savings (60.09%) with (38.57%) not having enough money to do so. Particularly the retail sector has a slightly higher percentage of participants who do not have enough money to own savings (51.88% vs 47.46%)



In describing the purpose of these savings we'll adhere to Charts 17 and 18. The main saving purpose seems to be as a buffer for hard times. When looking at the distribution across the different statusses in the artisanal fisheries we can see that those who are responsible for the boat save way more for their kid's education than those who have another status. Crew members mostly set aside money as a buffer for hard times and for family support.

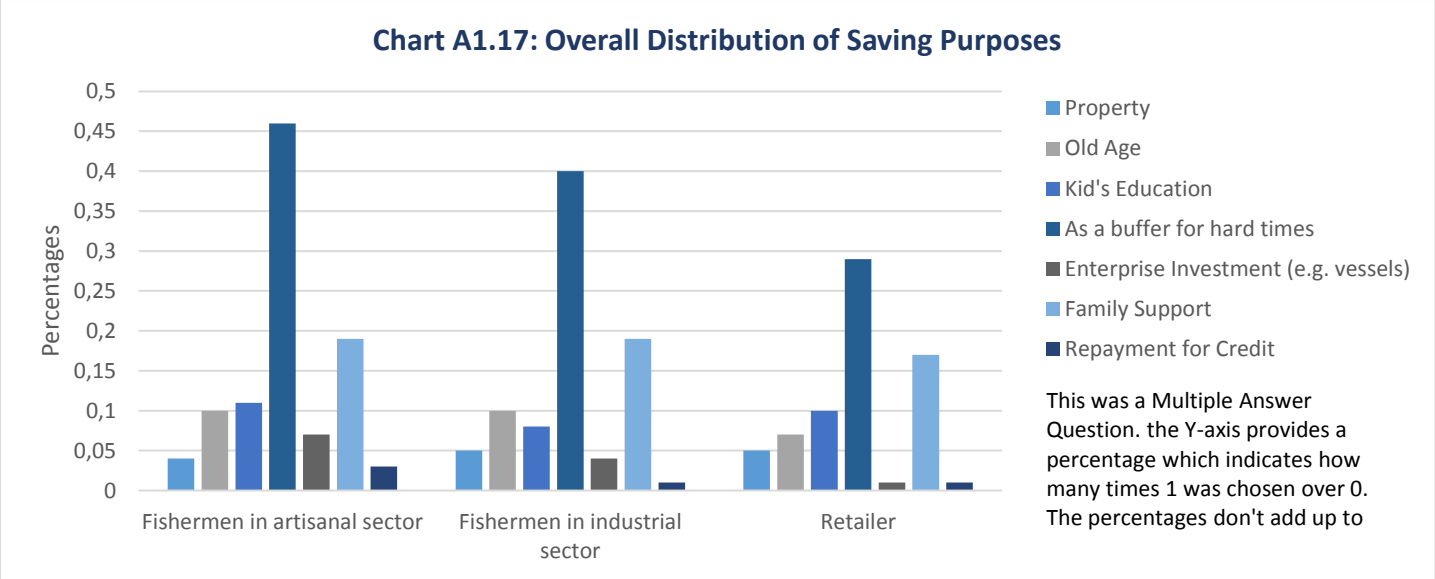
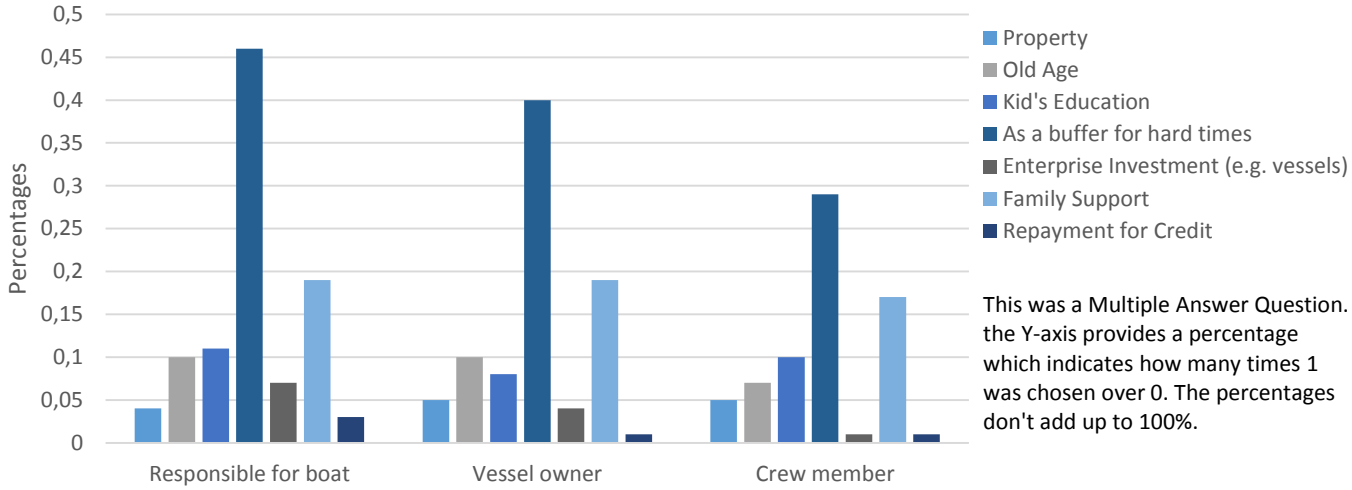


Chart A1.18: Distribution of Saving Purposes across Status in Artisanal Fisheries



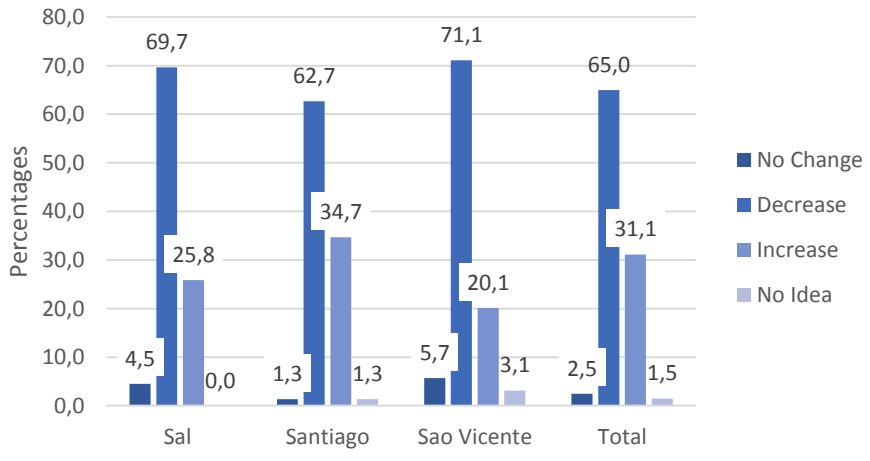
This was a Multiple Answer Question. the Y-axis provides a percentage which indicates how many times 1 was chosen over 0. The percentages don't add up to 100%.

2.5 Climate Change and Regulations

Rainfall

The following section will discuss some of the aspects of the survey which touched upon climate change and government regulations. The answers were analyzed as a whole, across the 3 island groups or across the fishing sector. Chart 19 shows that 65% of all participants have experiences a decrease in the amount of rainfall. Sal and Sao Vicente are the island groups were this experience is the highest (71.1% and 69.7%).

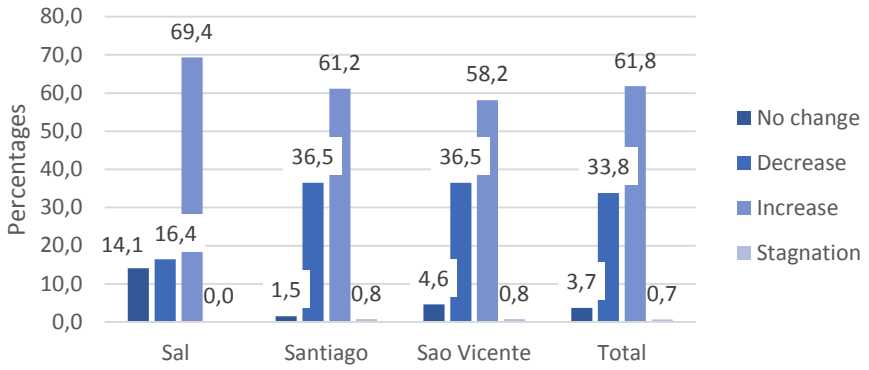
Chart A1.19: Changes in Rainfall Across Island Groups (last 5 years)



Temperature

When it comes to temperature changes, Chart 20 indicates that 61.8% of all participants have experienced an increase in the temperature. A significant amount however, 33.8%, claims the opposite. Sal is the island group where most participants have indicated that they have experienced an increase in the temperature (69.4%).

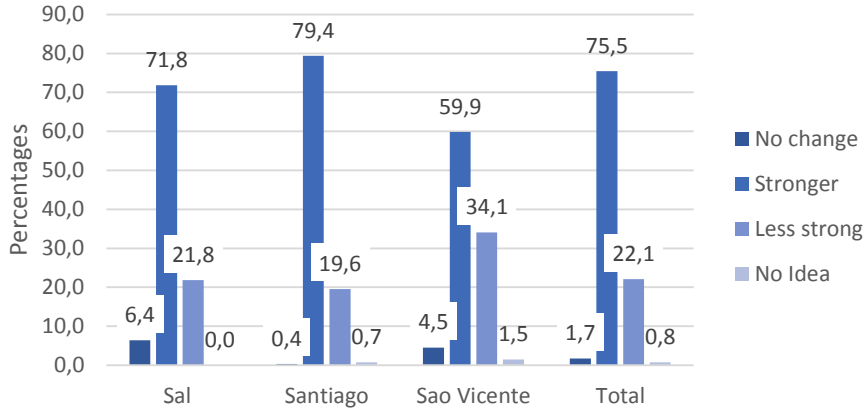
Chart A1.20: Changes in Temperature Across Island Groups (last 5 years)



Wind

Chart 21 shows that when it comes to changes in wind intensity, 75.5% of all participants has indicated that the wind change is stronger. At the same time the island group of Sao Vicente experiences the highest percentage of participants who have stated that the wind intensity is less strong (34.1%).

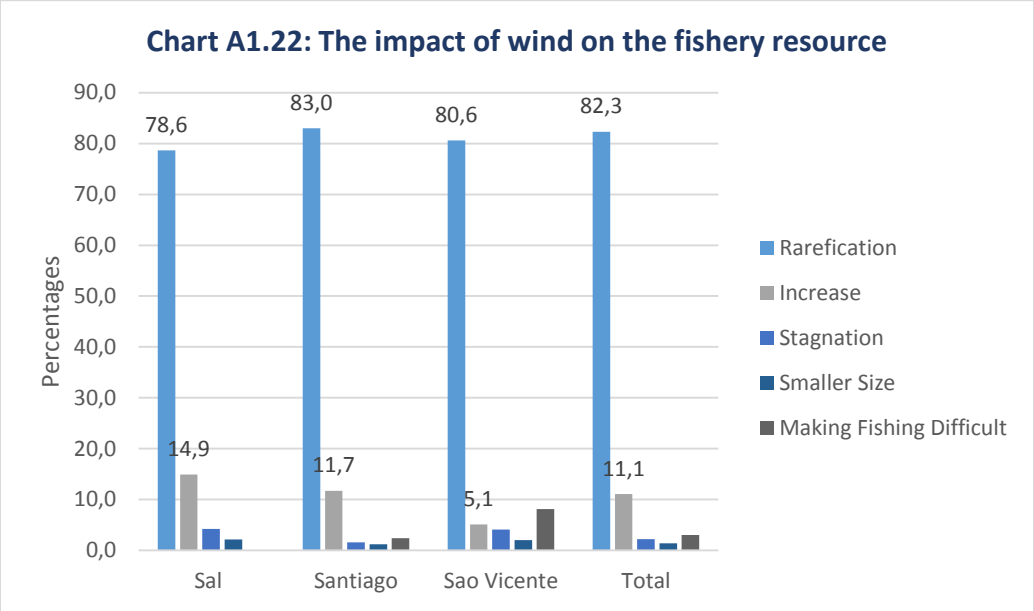
Chart A1.21: Changes in Wind Intensity Across Island Groups (last 5 years)



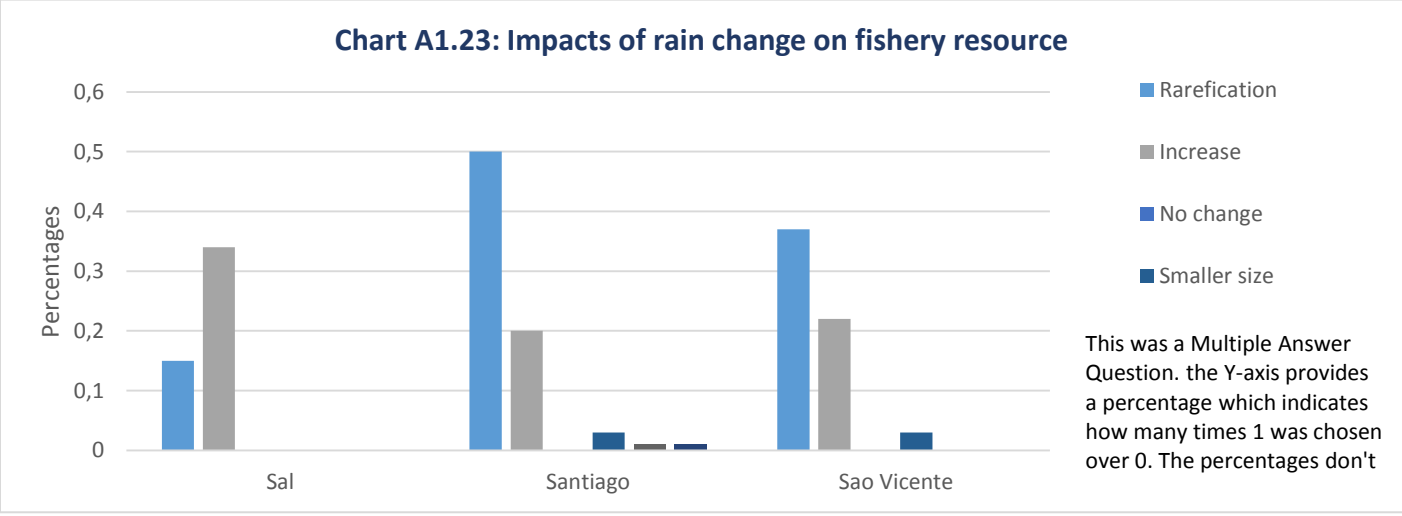
Participants were also asked what their experience was with climatic change and the impact on the fish resource. The result is shown in Charts 22 – 24.

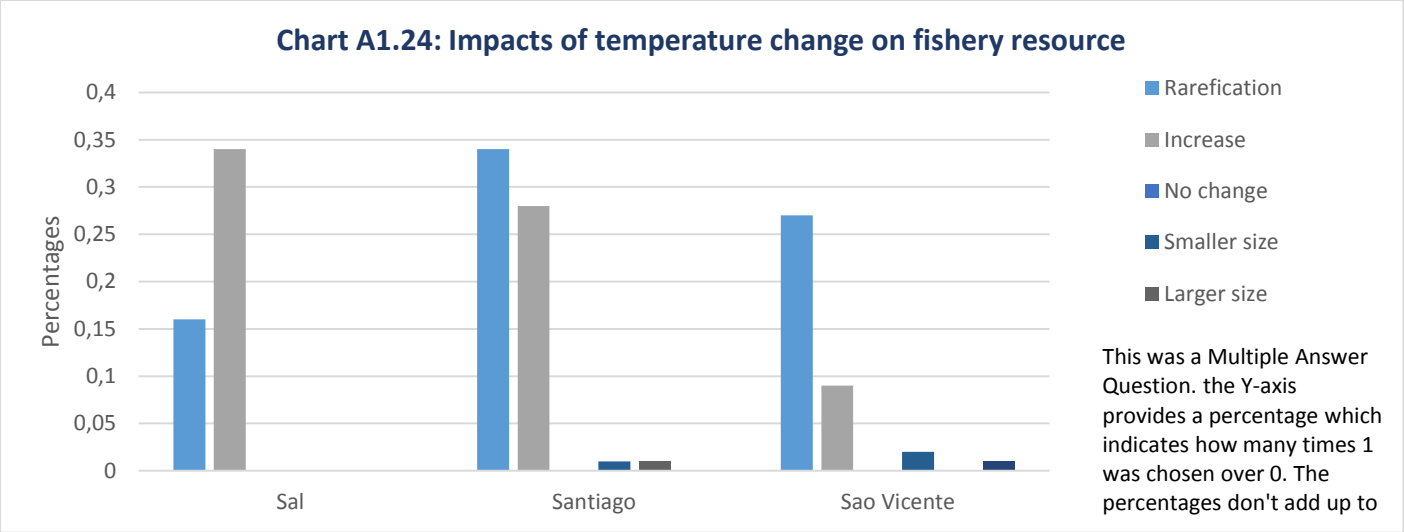
Impacts on the resource

Chart 22 shows that stronger winds, by and large increase the rarification of the fishery resource, though14.9% of participants residing in Sal claim that the wind has increased the fish resource.

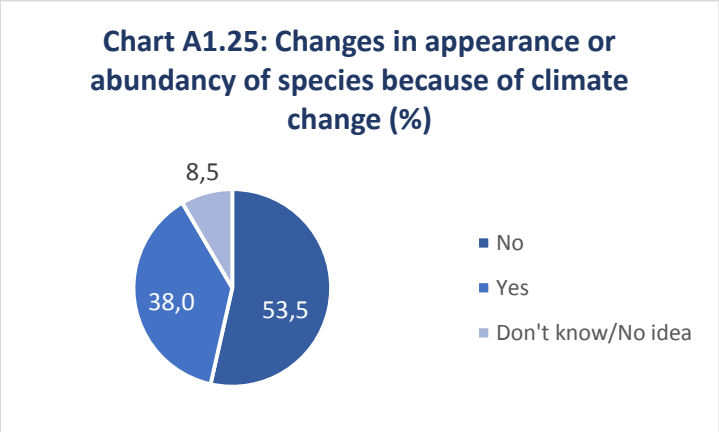


Charts 23 and 24 show that when it comes to rain change and temperature change, the two most named impacts have been both a rarification and an increase of the fishery resource. Where it is clear that, rain change impacts rarification more than it increases the fish resource, the result on the temperature is more ambiguous.





This same result can be framed in a different way according to whether participants believe that climate change has either caused an abundancy or diminishment of overall fish species. The results are shown in charts 25 and 26 below:



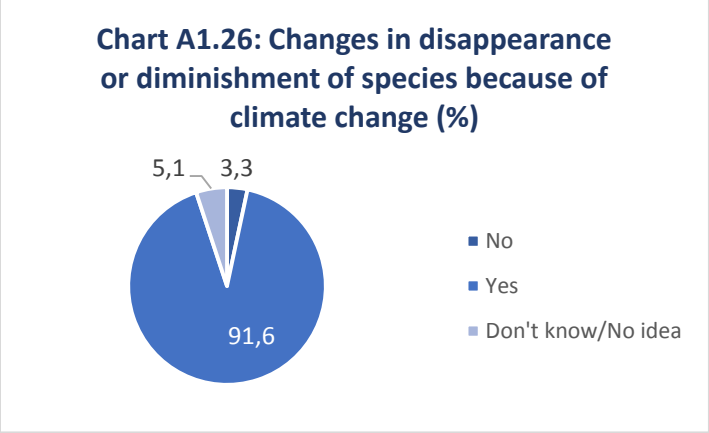
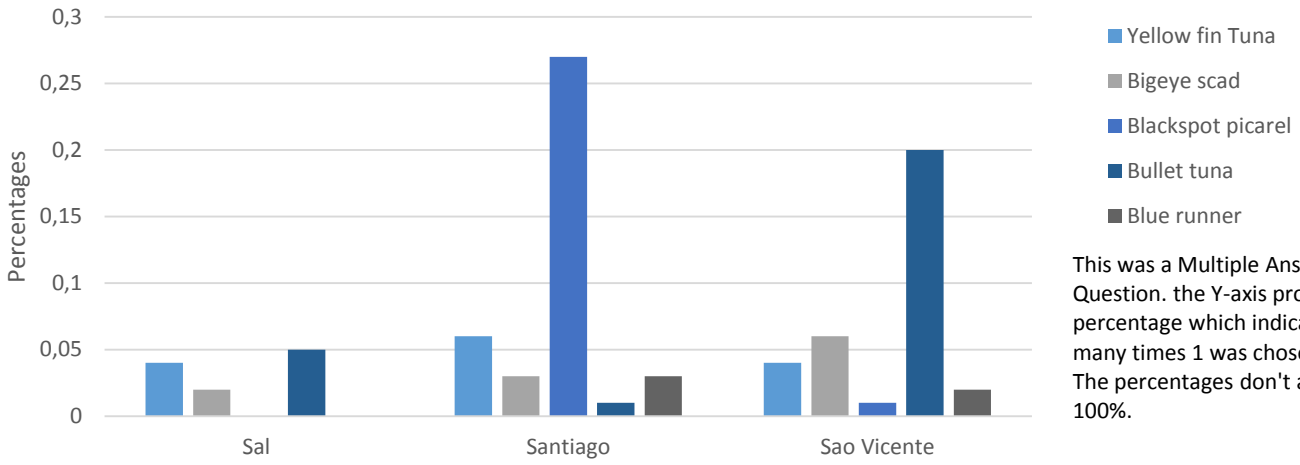


Chart 27 shows the Top 5 species that have appeared or increased in abundancy. What is particularly noteworthy is the increase in abundancy of the Blackspot picarel but mostly on the island group of Santiago. Sao Vicente has experienced an increase of mostly the Bullet tuna.

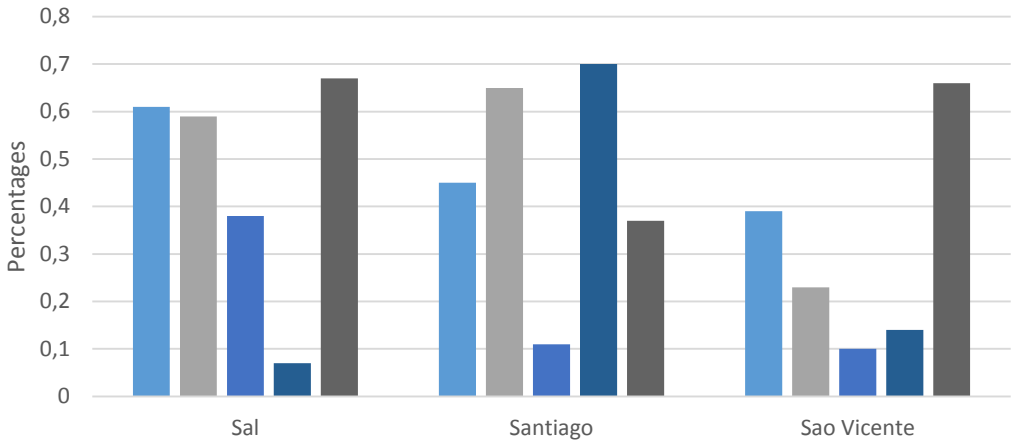
Chart A1.27: Top 5 species which appeared or increased in abundancy



This was a Multiple Answer Question. the Y-axis provides a percentage which indicates how many times 1 was chosen over 0. The percentages don't add up to 100%.

Chart 28 shows the species which have decreased in abundancy. Some of the species that were said to increase in abundancy also appear to dissappear. All of the island groups face a similar experience of the Bigeye scad and White mackerel dimishing, though on the island group of Sal there seems to relatively less White Mackerel dimishing in comparison to the rest of the species.

Chart A1.28: Top 5 species which disappeared or decreased in abundancy

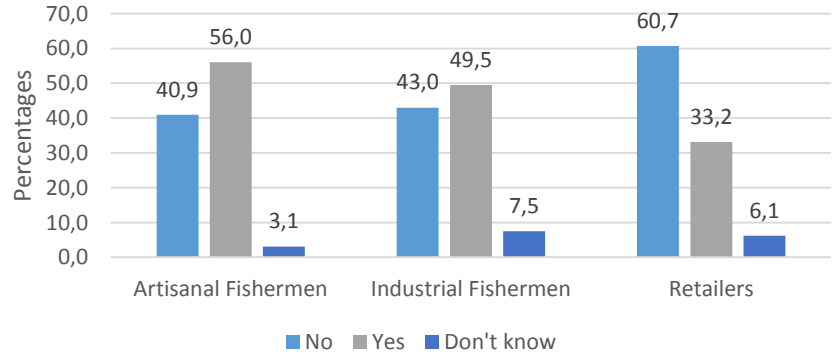


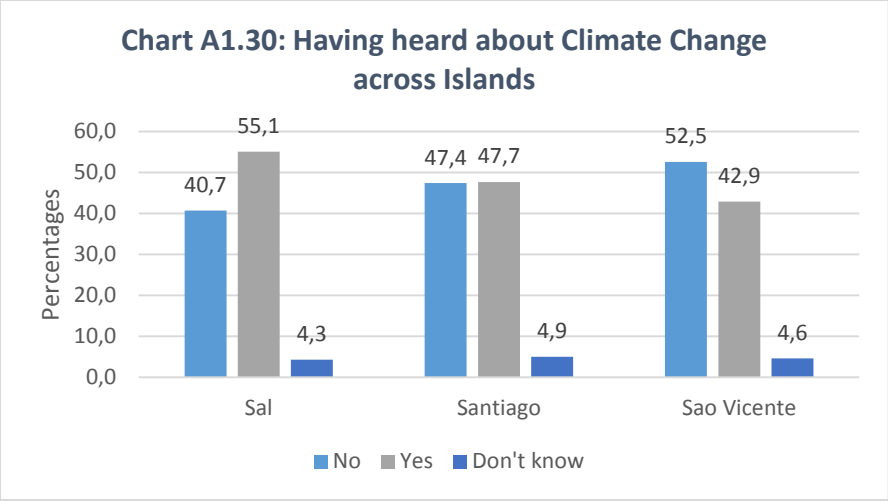
This was a Multiple Answer Question. the Y-axis provides a percentage which indicates how many times 1 was chosen over 0. The percentages don't add up to 100%.

Information on climate change: Roughly 50%, mostly via radio and TV

On the topic of whether the participants have heard about climate change or not, Charts 29 and 30 indicate how this knowledge is scattered across the island groups and and different fishing sectors. Overall, the two main sources for information on climate change were TV (chosen 247 times) and Radio (chosen 227 times). Artisanal fishermen seem to be the most informed group on climate change (56.0% answered yes), whereas Retailers are the least informed (60.7% answered no. When it comes to the islands, Sal seems tob e the most informed island (55.1% answered yes) whereas Sao Vicente is the least informed island group (52.5% answered no).

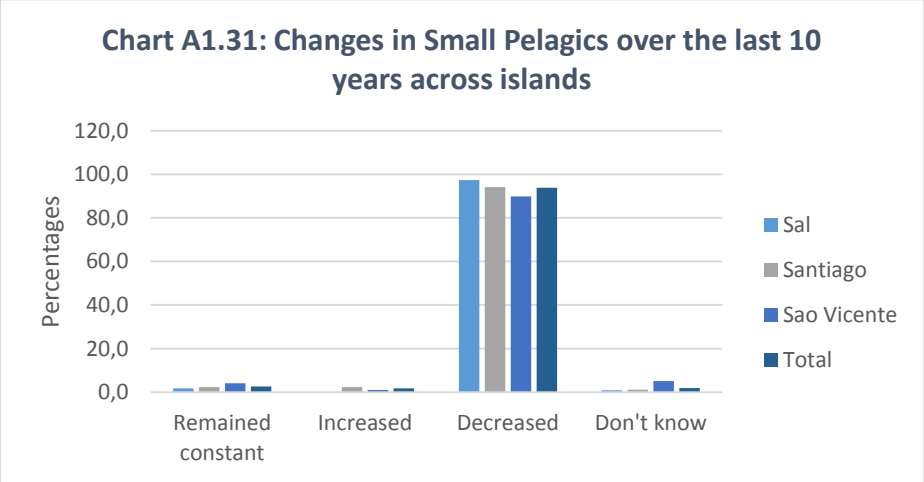
Chart A1.29: Having heard about Climate Change across Sectors

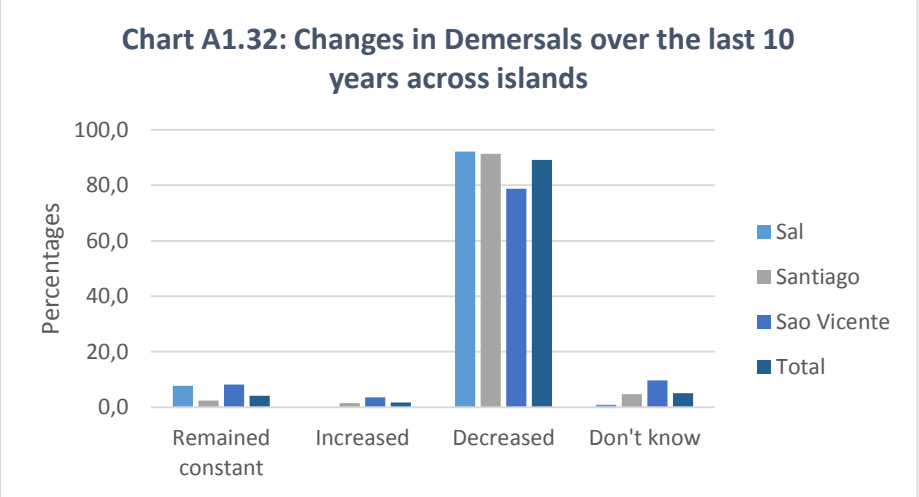


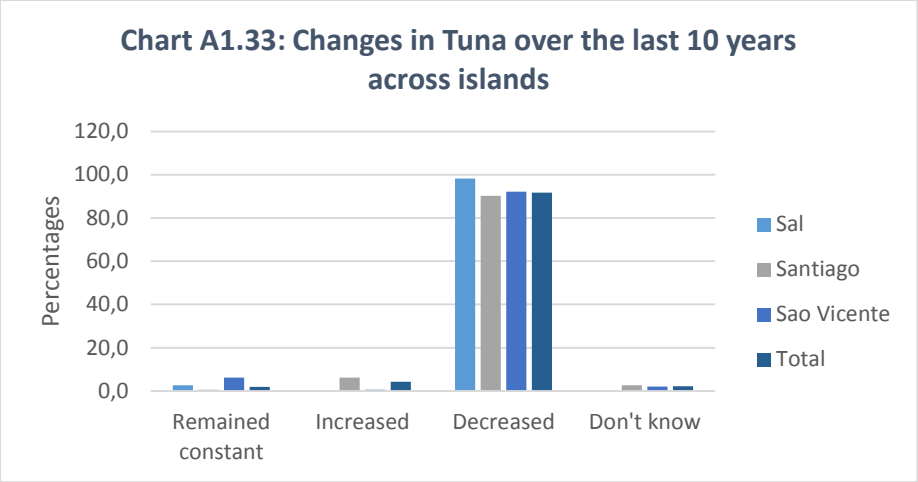


Changes in fish stocks: Decreasing stocks

Participants were also asked whether in particular 1) Small Pelagics, 2) Demersals and 3) Tuna has changed in its fish stock over the last 10 years. The results are shown in Charts 31 – 33. The trend is more than clear, each of these fish types has mostly decreased over the last 10 years.

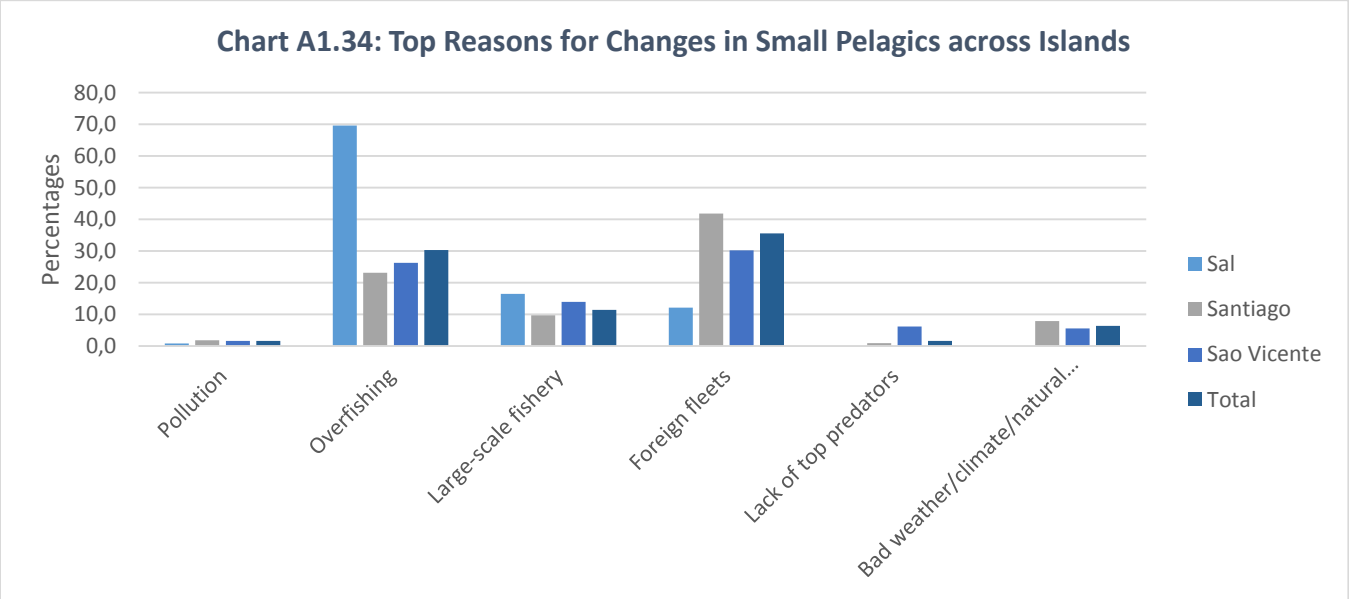


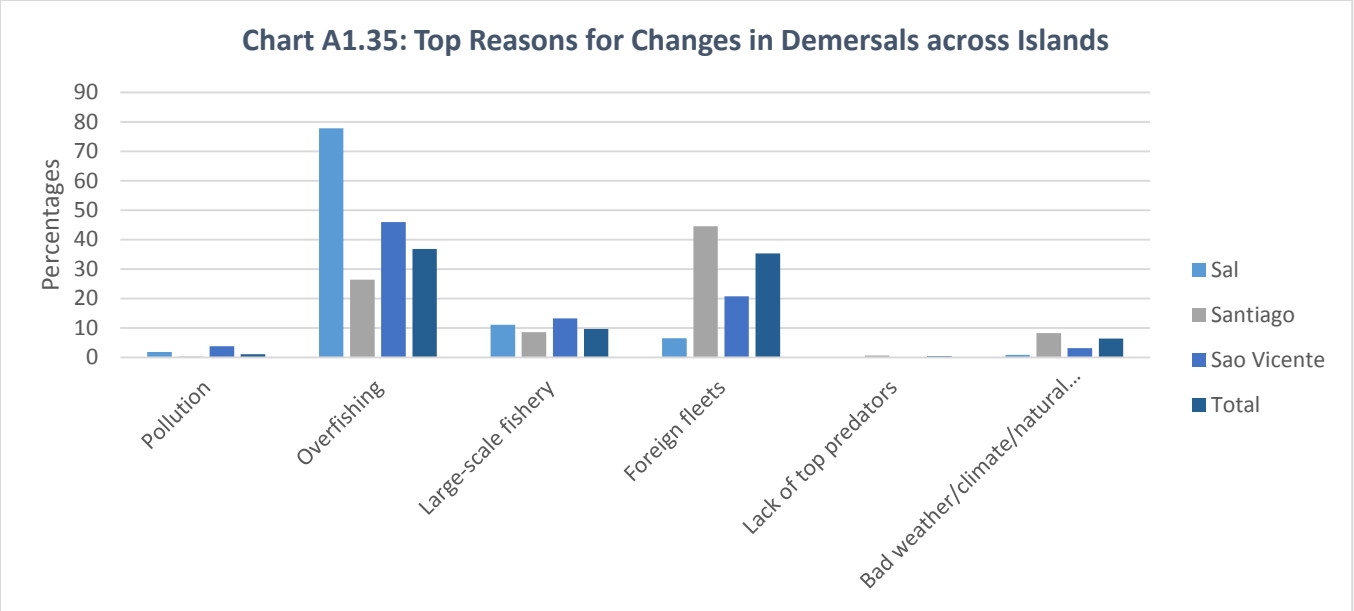


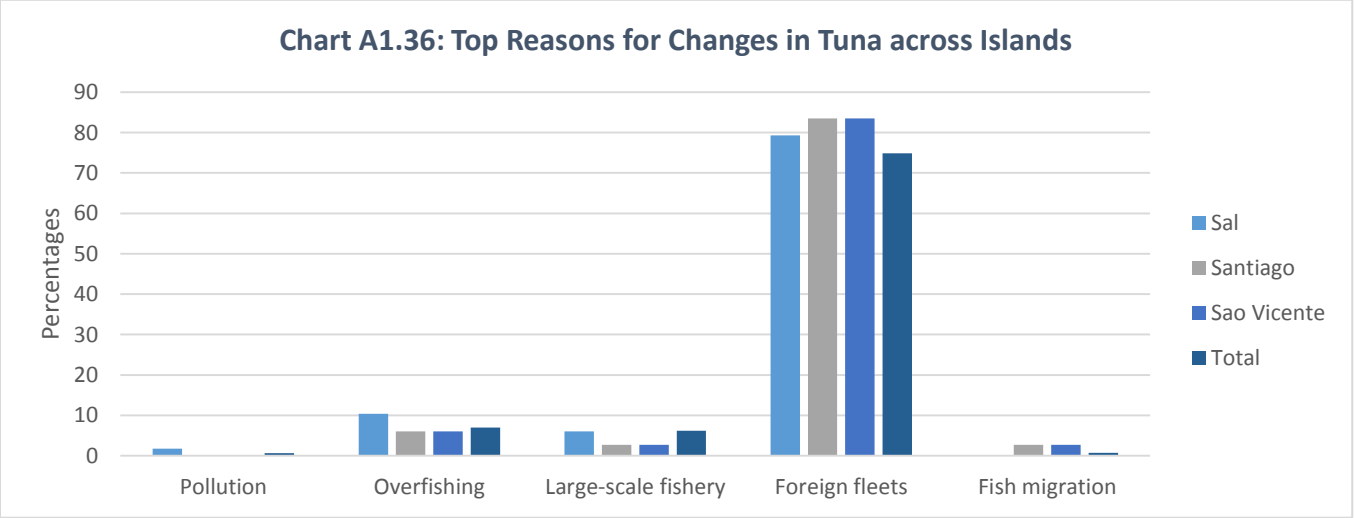


Overfishing, foreign fleets and the large scale fishery impact the resource

As a follow-up question, participants were asked for the reason each of these fish types have changed (and thus mostly decreased. The result is shown in Charts 34-36. For Small Pelagics, the three top reasons are 1) foreign fleets (35.6%) 2) Overfishing (30.3%) and 3) Large-scale fishery (11.4%). Santiago is the island group that over-stated foreign fleets as a reason, whereas Sal is the island group that overstaded overfishing as a reason. It should be mentioned that as a whole, 6.4% of the respondents answered that bad weather/climate/natural conditions were a reason for the decrease in small pelagics. In analysing the result for demersals, the result is similar to that of small pelagics, with different percentages (35.4%; 36.9%;9.7%). Again, 6.4% of all participants answered that bad weather/climate/natural conditions were a reason for the decrease in demersals. For tuna, the result is highly skewed to foreign fleets as a reason for change, indicating that they are seen as the main cause of a decrease in tuna species (74.9%). Here, only 3.67% has indicated that bad weather/climate/natural conditions were a reason for the decrease in tuna.

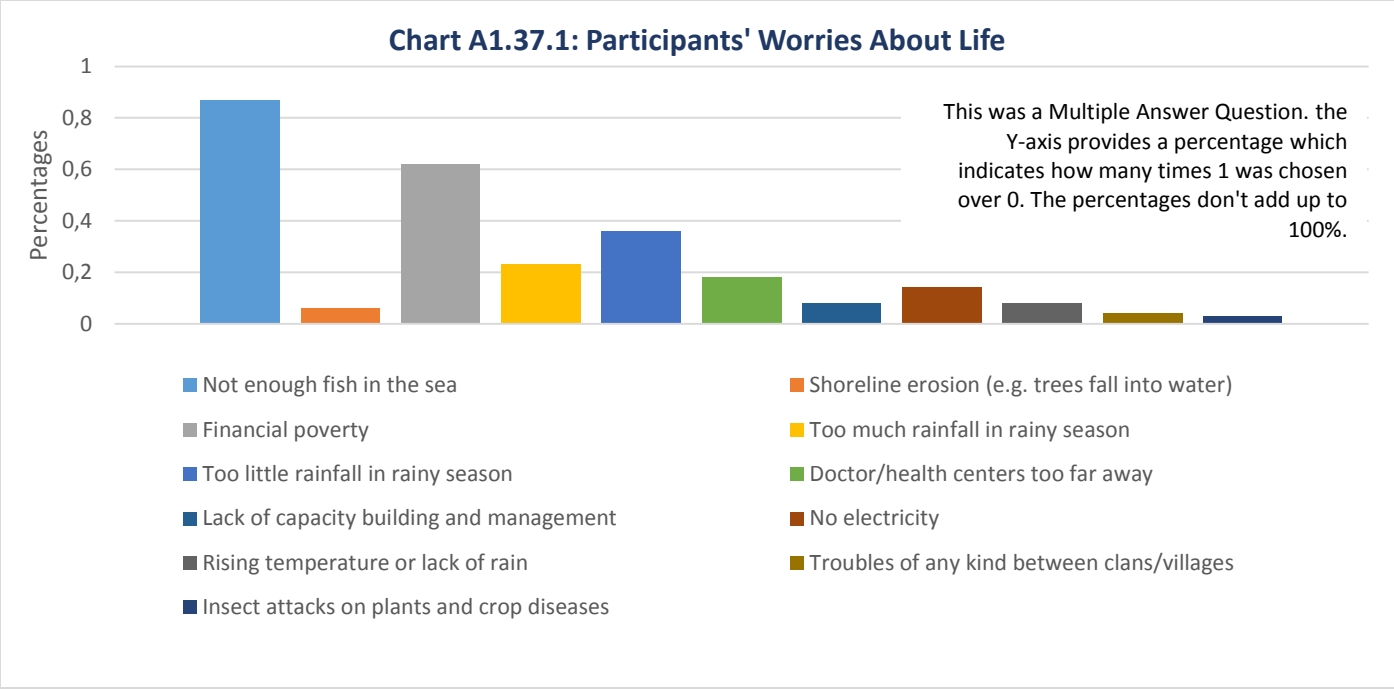


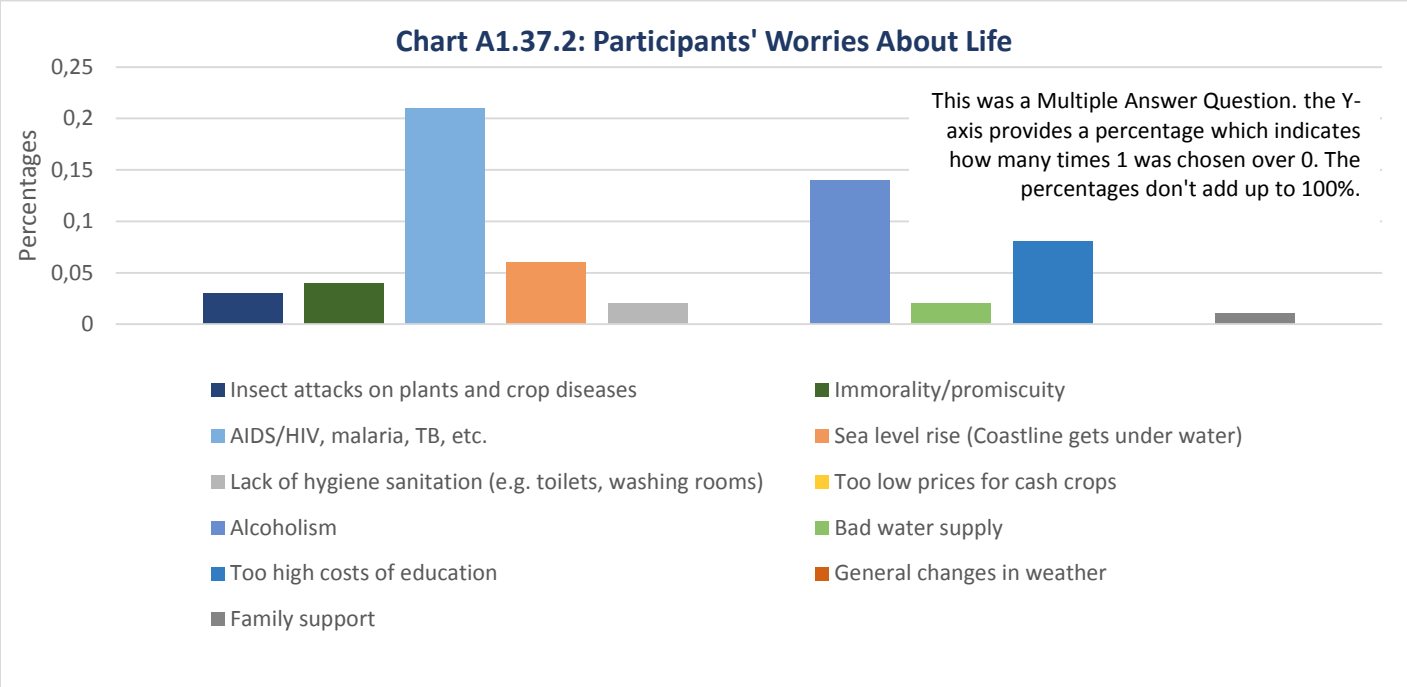




Worries in life

When participants were asked about their life worries, not having enough fish in the sea was the most chosen answer for the group as a whole but also on each of the respective island groups. The second biggest worry was financial poverty. The rest of this distribution is seen in Charts 37.





Off-zone limits to protect artisanal fishing largely supported

One question on regulations concerns the introduction of off-zone limits for industrial fishermen. In the survey this was an open question. 64% of all participants think off-limit zones for industrial fishing is good for artisanal fishermen. 73% of all participants think off-zone limits will not harm industrial fishermen. Chart 38 indicates the reasons participants think off-zone limits for industrial fishermen are good for artisanal fishermen. The two top reasons are 1) there will be more fish for artisanal fishermen and 2) more fish will approach the coast for artisanal fishermen.

Chart A1.38: Reasons all participants think off-zone limits for industrial fishing is good for artisanal fishermen (Open Question, grouped answers)

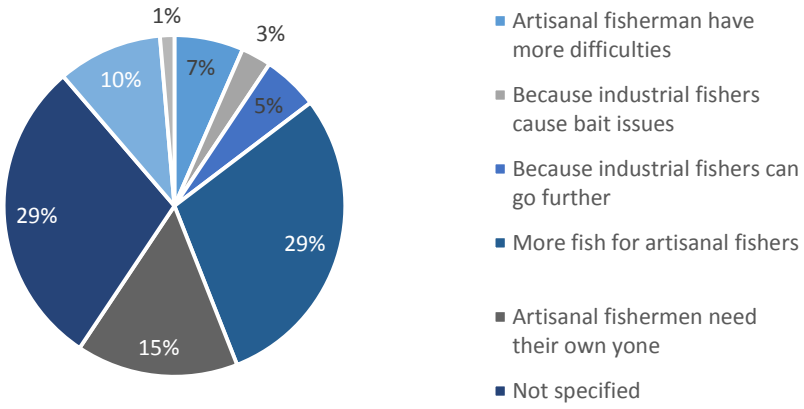


Chart 39 indicates the reasons participants think off-zone limits for industrial fishing is bad for artisanal fishermen. The top answers are 1) that it will decrease fish resources (40%) and 2) it is illegal and unfair (23%). Again, this was an open question in the survey.

Chart A1.39: Reasons participants think off-zone limits for industrial fishing is bad for artisanal fishermen (Open Question, grouped answers)

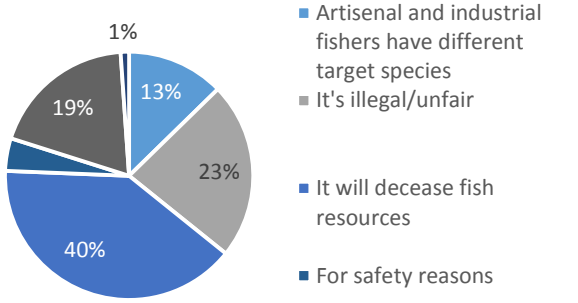


Chart A1.40: Top 5 Reasons all participants think off-zone limits for industrial fishing is bad for industrial

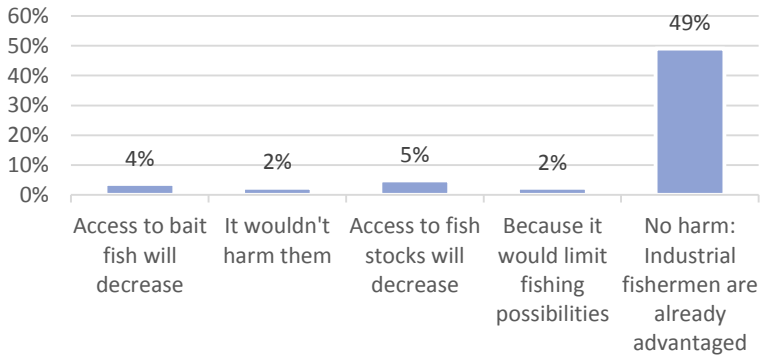


Chart 40 indicates the reasons participants think off-zone limits for industrial fishing is bad for industrial fishermen. The top reason is an indication that there wouldn't be harm in the first place. Because 51.1% of the participants are artisanal fishermen it is interesting to see how this statistic holds if we look at industrial fishermen only. Chart 41 shows that eventhough each reason has slightly increased in percentage, the percentage of participants who chose "No Harm" is higher among the industrial sector participants than it is on average.

Chart A1.41: Top 5 Reasons industrial sector participants think off-zone limits for industrial fishing is bad for industrial

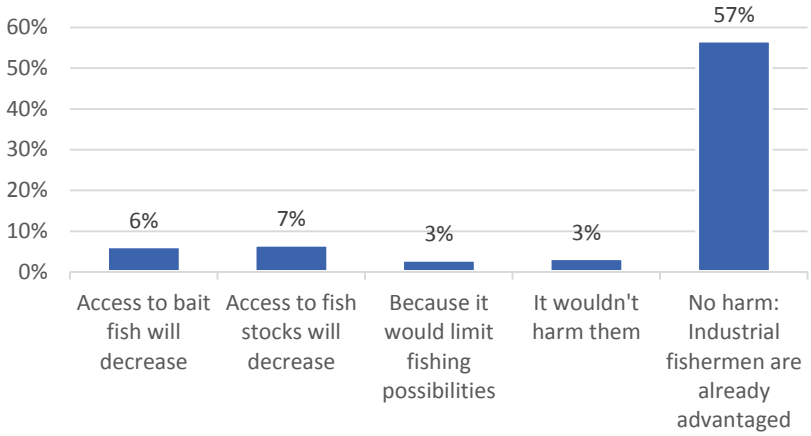
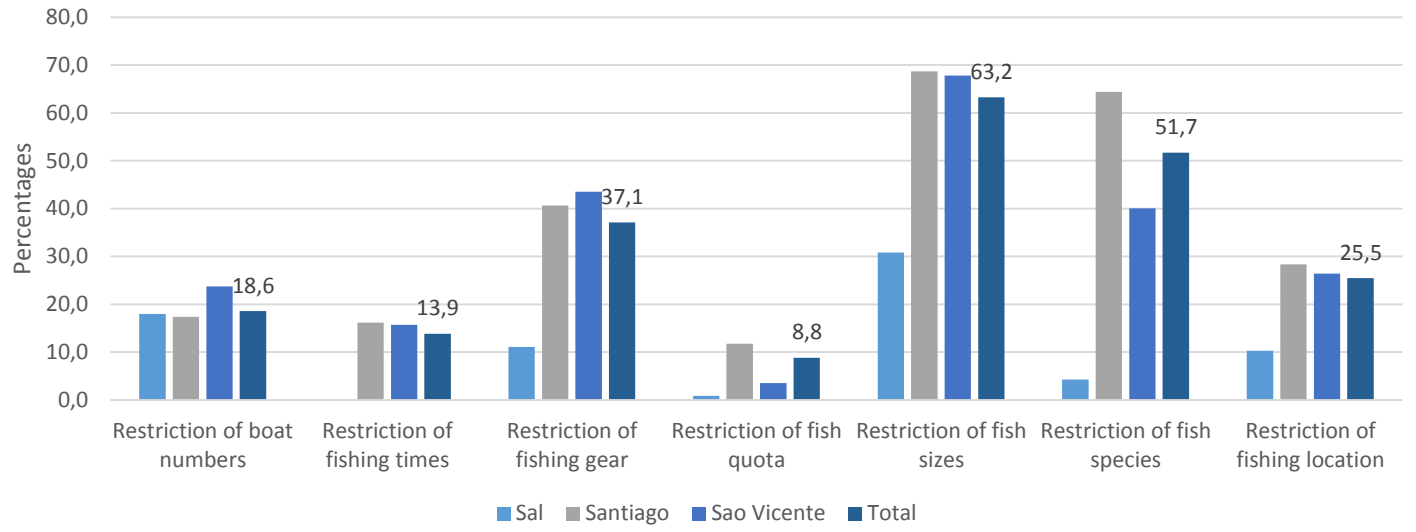


Chart 42 indicates what other regulations are set in place across each of the island groups and as a whole. The two most common regulations set in place are 1) restriction on the fish size and 2) restriction of fish species. Furthermore the island group of Sal has the least amount of regulations set in place

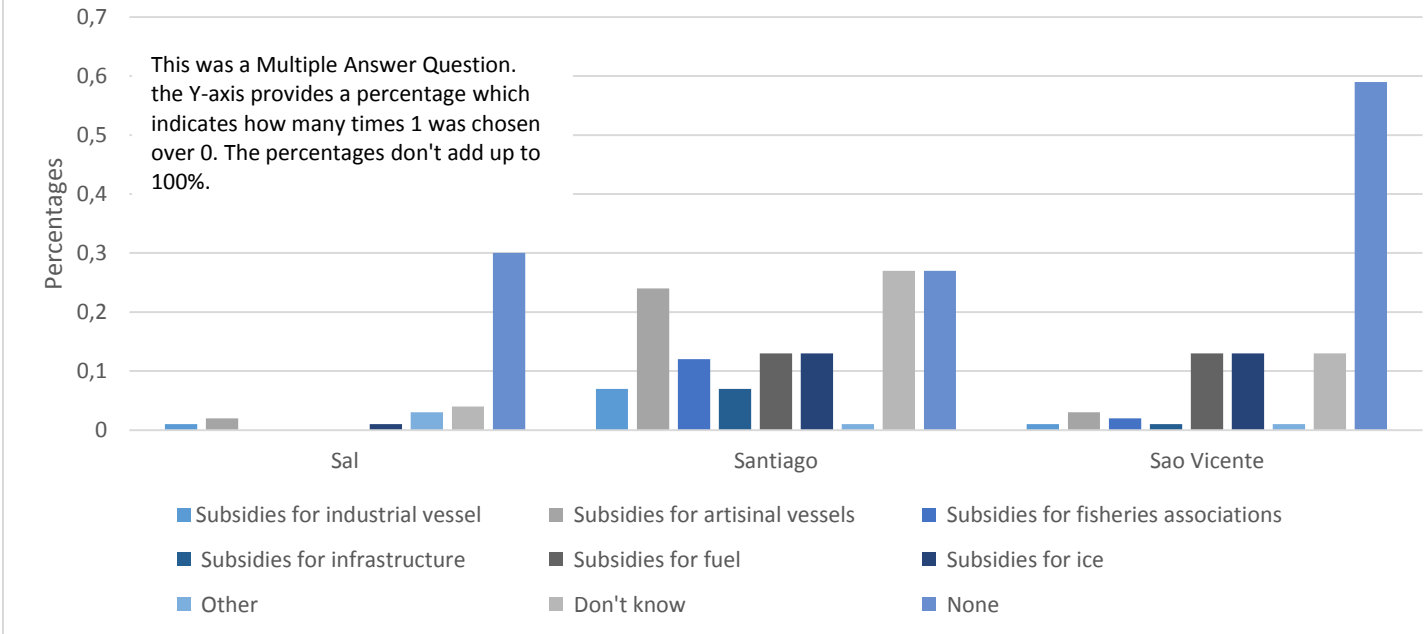
Chart A1.42: Existence of fishing regulations across the island groups



compared to Sao Vicente and Santiago.

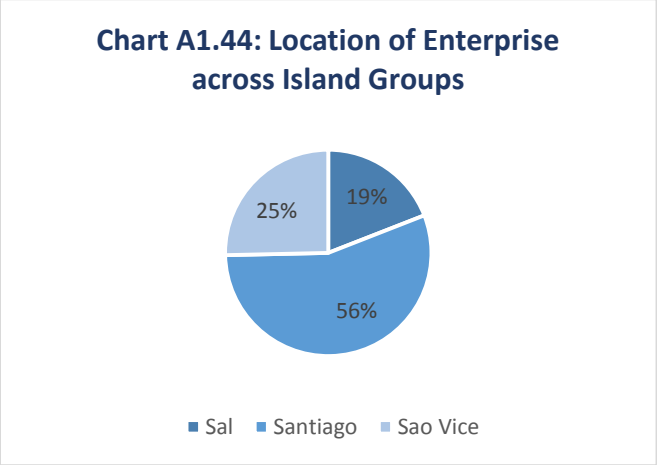
When it comes to government support, the participants were asked to indicate if they receive subsidies for particular equipment. The result is shown in Chart 43. As a whole subsidies for artisanal vessels, fuel and ice seem to be the most common subsidy type provided by the government. Here we can see that Sal and Sao Vicente lack quite some response in this area.

Chart A1.43: Types of Government Support available across Islands

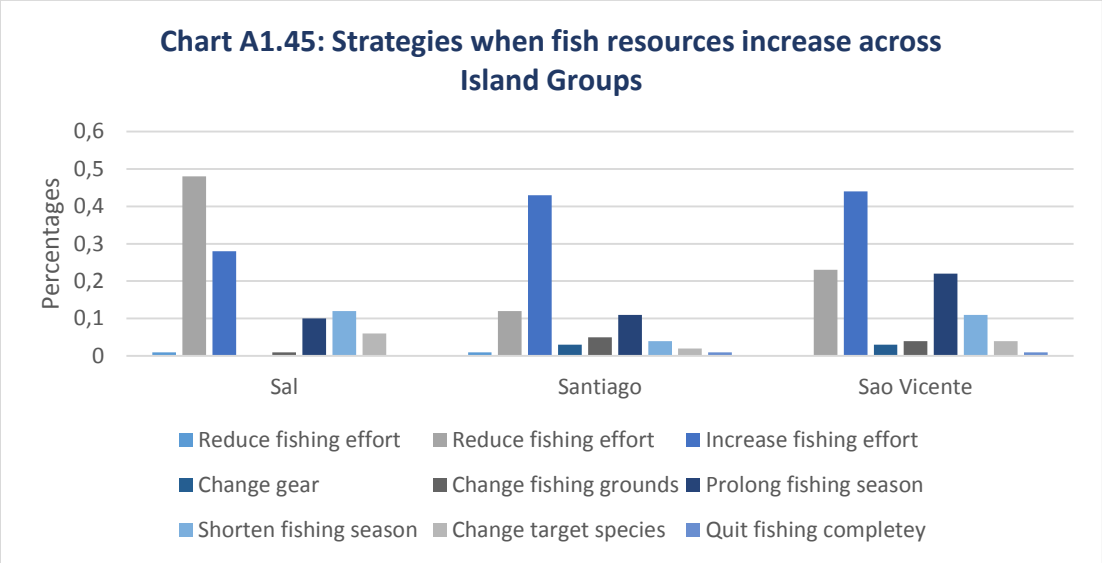


2.6 The Fishing Enterprise and Fishing Activity

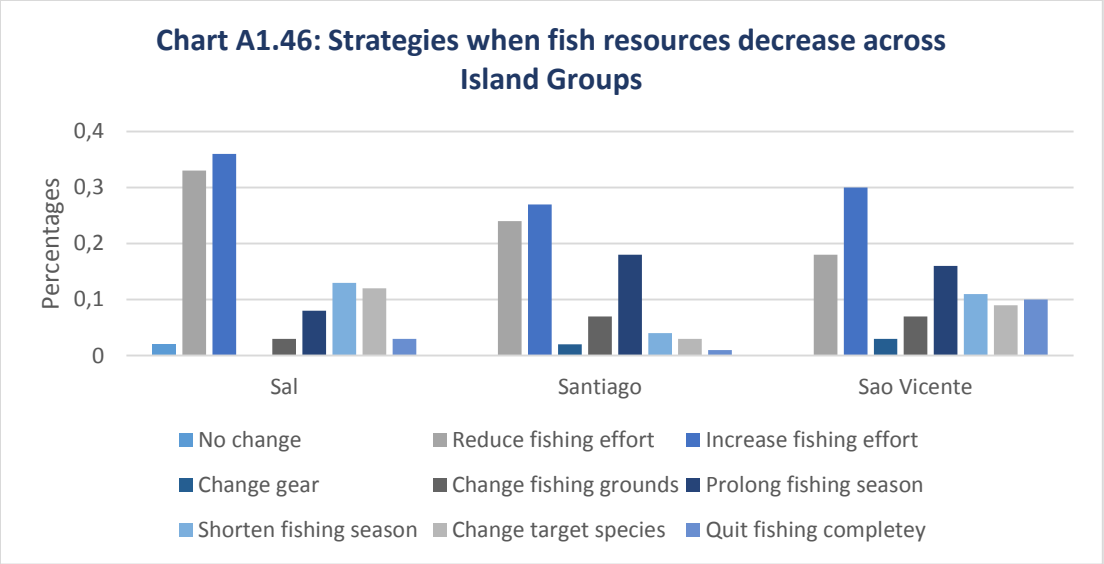
Charts 44 to 47 aim to illustrate the distrubtion of the enterprise locations. 56% of all the enterprises are located on the island group of Santiago. On Sal, 44% of the enterprises are located in Palmeira. On Santiago, 33% of the enterprises are located in Sao Fransisco. On Sao Vicente 39% of the enterprises are located in Mindelo.



Participants were asked to indicate what strategies they use when particular fish resources increase, the results across the island groups is shown in Chart 45. It seems that the three most common strategies are 1) Increase fishing effort 2) Reduce fishing effort and 3) Prolong fishing season. The result indicating which strategy is used in case the fish resource decreases indicated in Chart 46. The top 3 coping strategies do not change in order, however, as the fish resource decreases, they all increase significantly in amplitude.

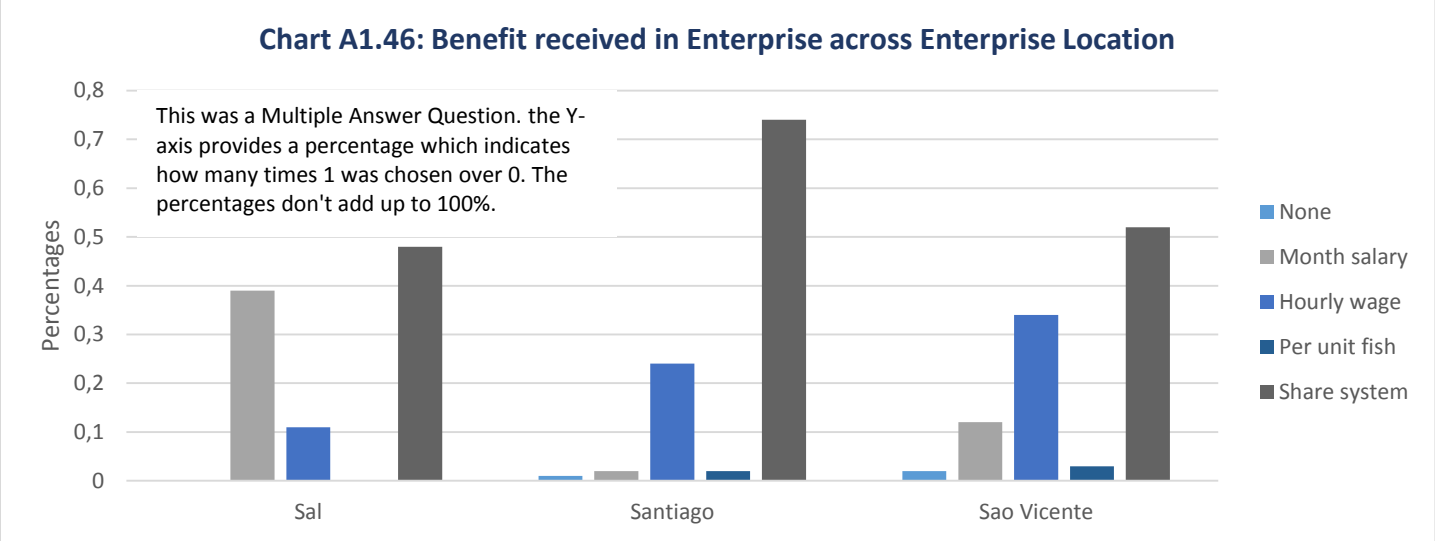


This was a Multiple Answer Question. the Y-axis provides a percentage which indicates how many times 1 was chosen over 0. The percentages don't add up to 100%.



Benefits to participants.

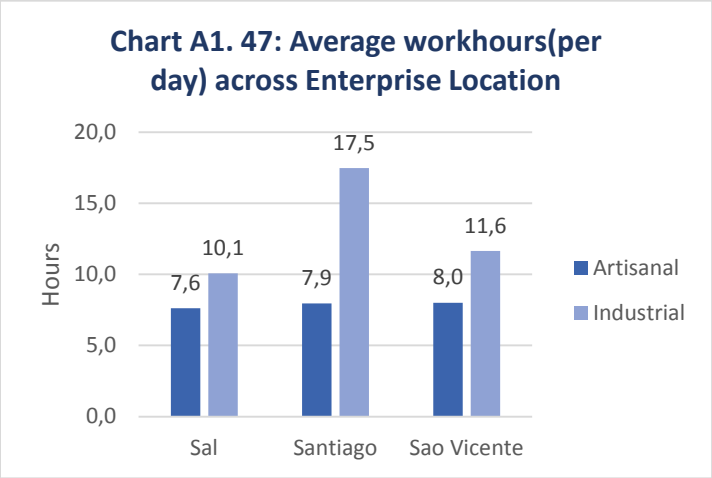
Partipants working in an enterprise were asked to indicate through which channels they receive benefits. The result hereof is shown in Chart 56 and the three most common ways are through 1) Share system 2) Hourly wage and 3) Month Salary. It is important to note that the island groups now represent the enterprise location and not the location of the participant.

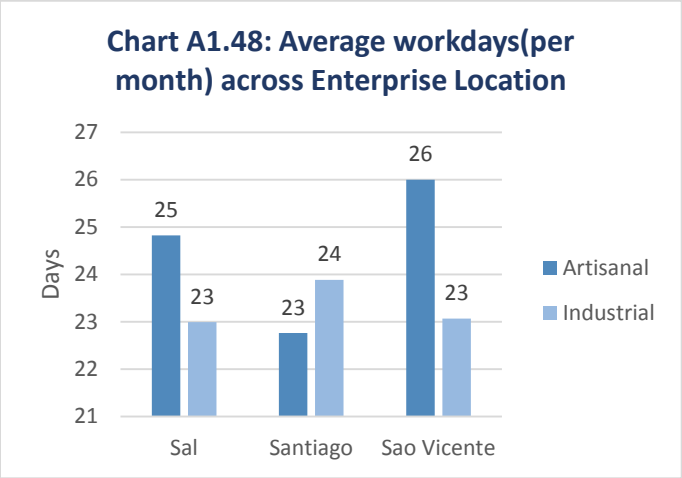


Variable costs are fuel dominated

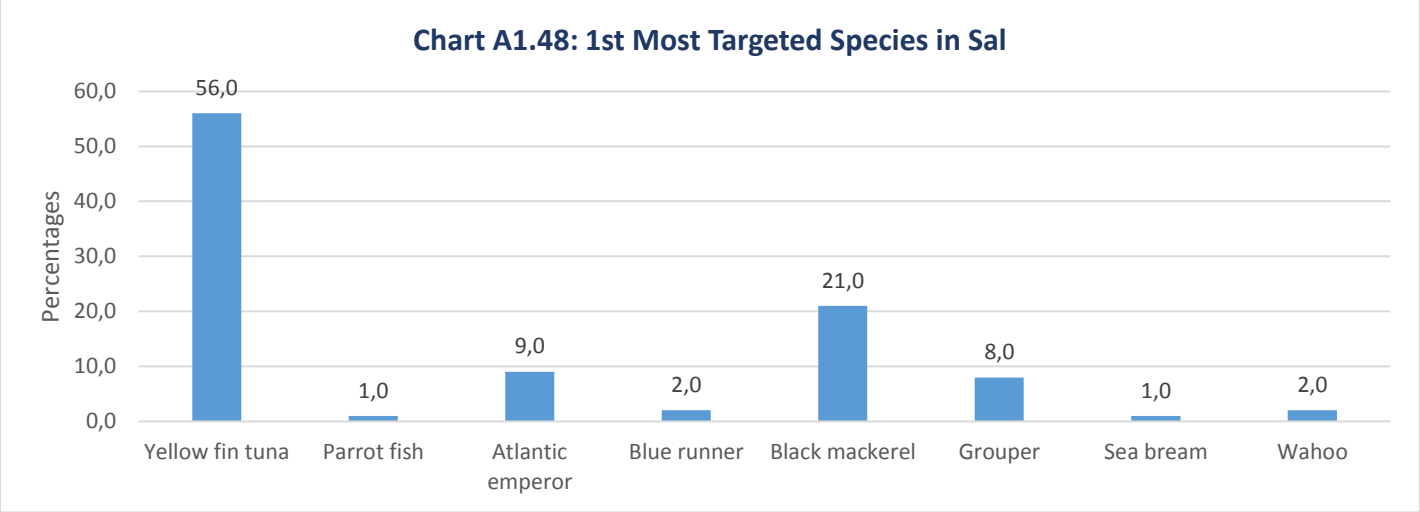
The average workhours per day and workdays per month are shown in Charts 47 and 48. Enterprises in Sao Vicente have the longest workday (9.8 hours/day) and Enterprises in Sal work the most days per month (24). As a whole the average costs within an enterprise are distributed as follows, where the costs are given in Cape Verdean Escudos. The cost for labor again is to be evaluated with care, as sharing systems are common in Cabo Verde artisanal fisheries, same as in Senegal.

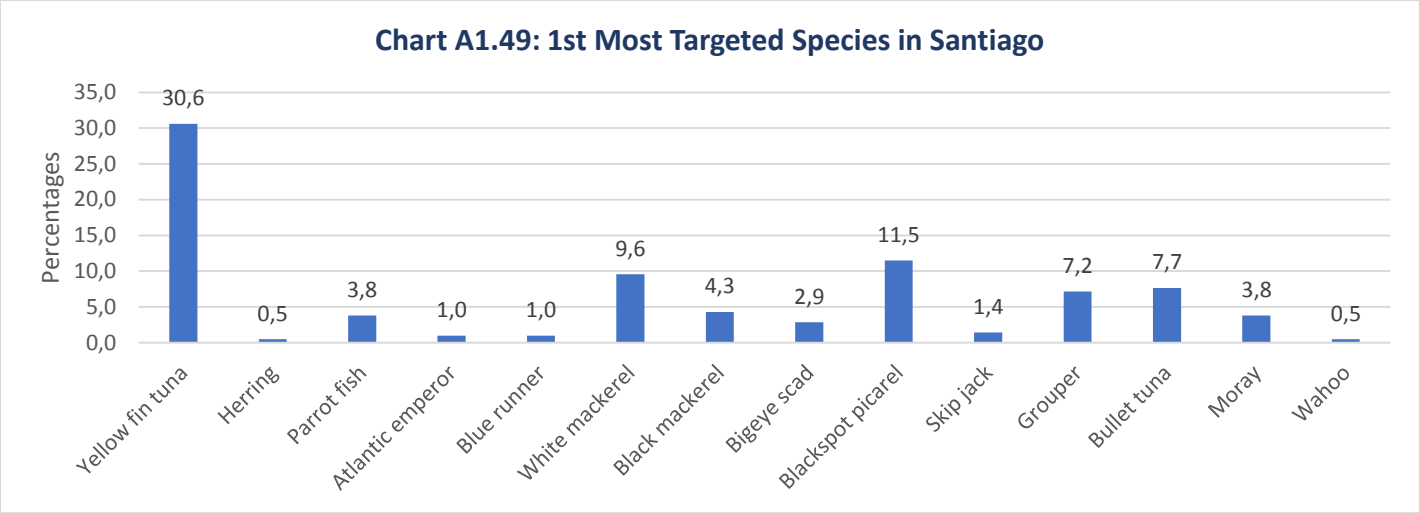
Average costs	43626
fuel	43626
ice	16909
food	9304
lubricant	4220
repairs	27626
labor	23410

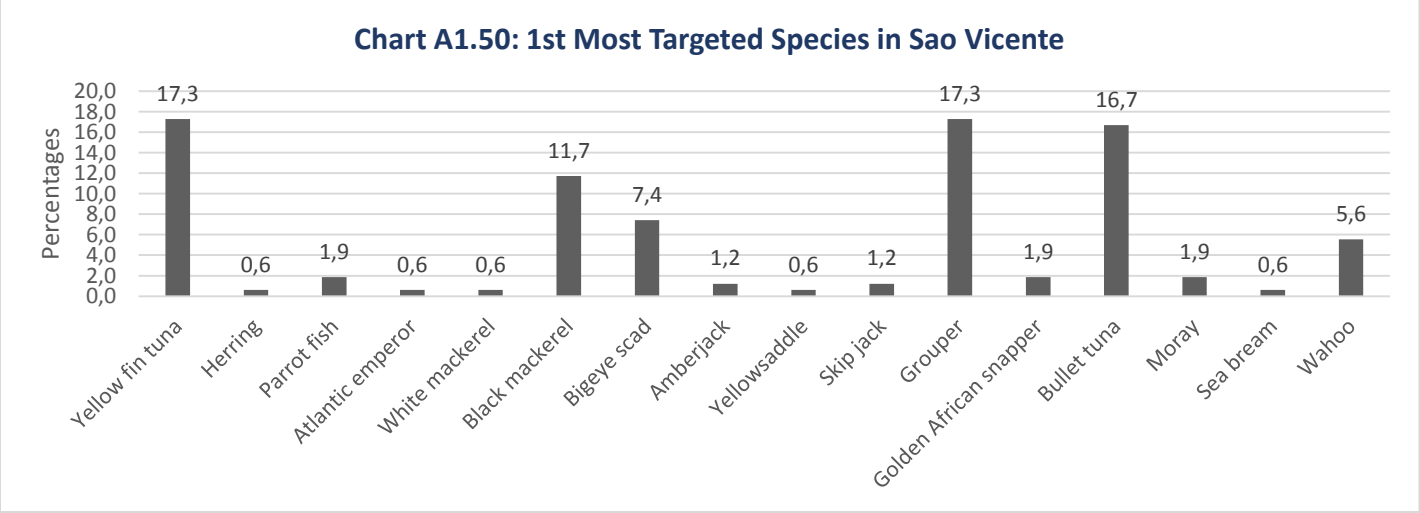




When it comes to the fishing activity, participants were asked what their 1st most important target spcies is. The result is given for each of the (participant) island groups seperately in Charts 48 –50. On each of the island groups, Yellow fin tuna is a very popular target groups. On Sal, the Black mackerel comes in second with 21%, on Sal this is the case for the White mackerel (9.6%) and on Sao Vicente the Grouper and Bullet tuna seems just as popular as the Yellow fin tuna. Another interesting result is that the island group of Sal is the least diverse island group when it comes to target species (7 species) whereas Sao Vicente is the most diverse group (16 species).

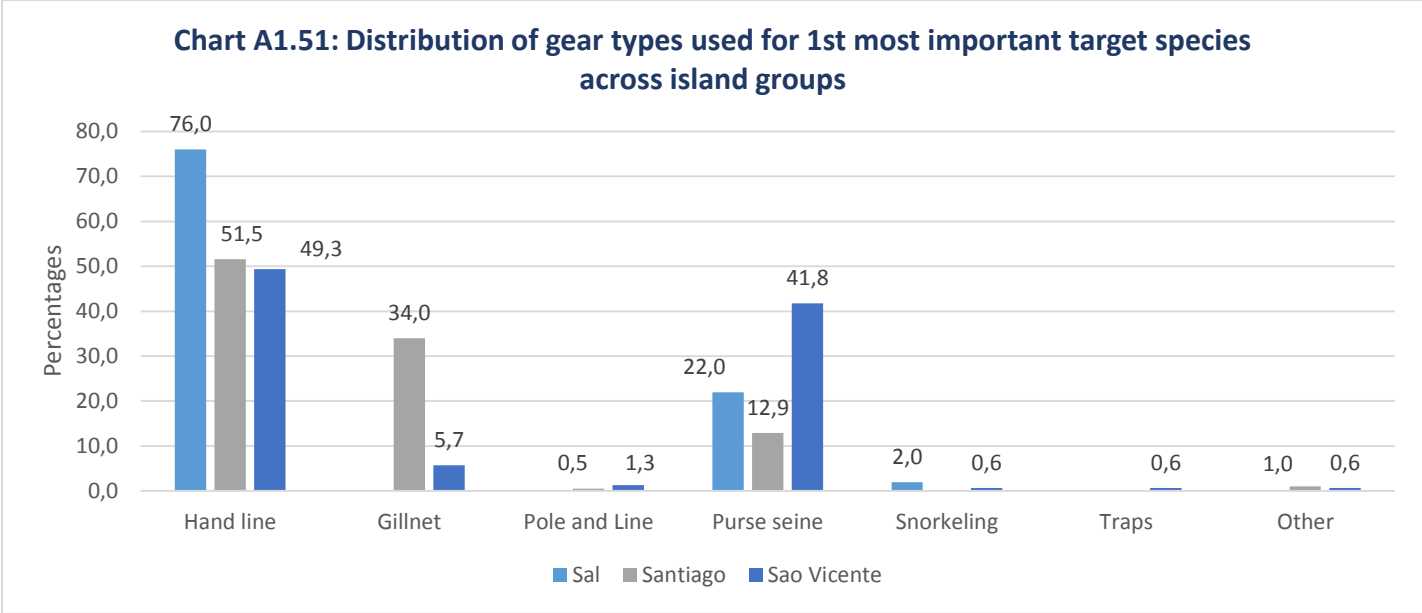




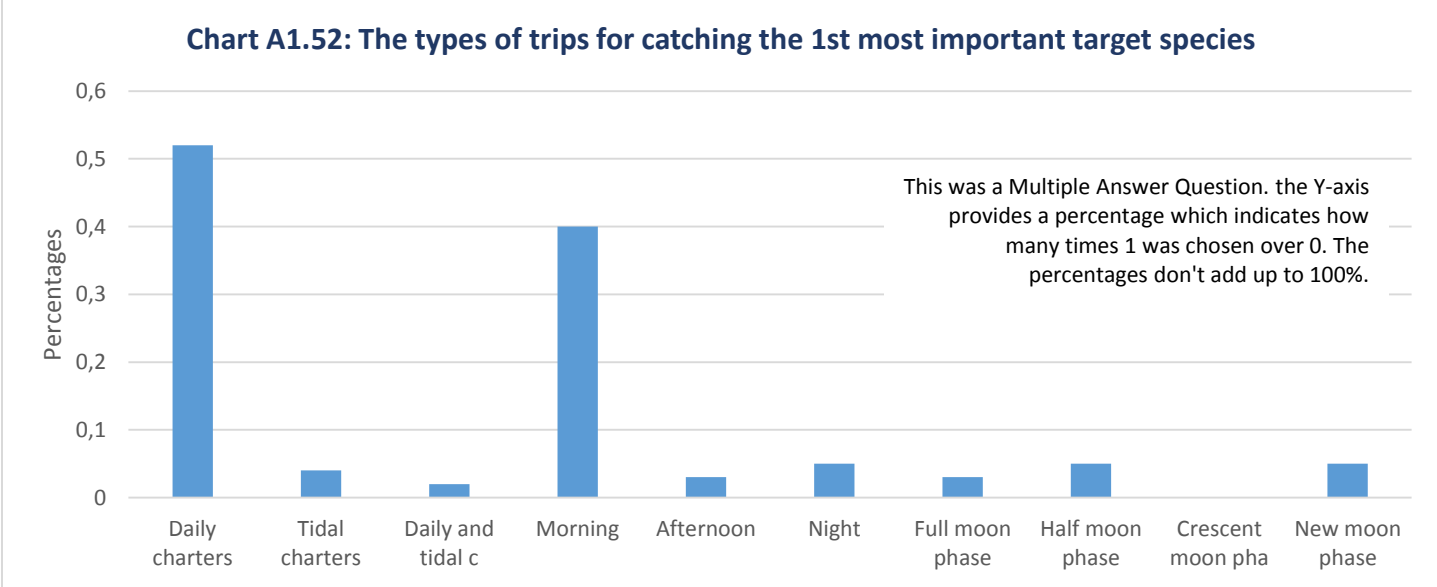


1st Most Important Target Species Artisanal Sector	1st Most Important Target Species Industrial Sector
Yellow fin Tuna	*Bigeye scad*
Grouper	*Black Mackerel*
Blackspot Picarel	*White Mackerel*

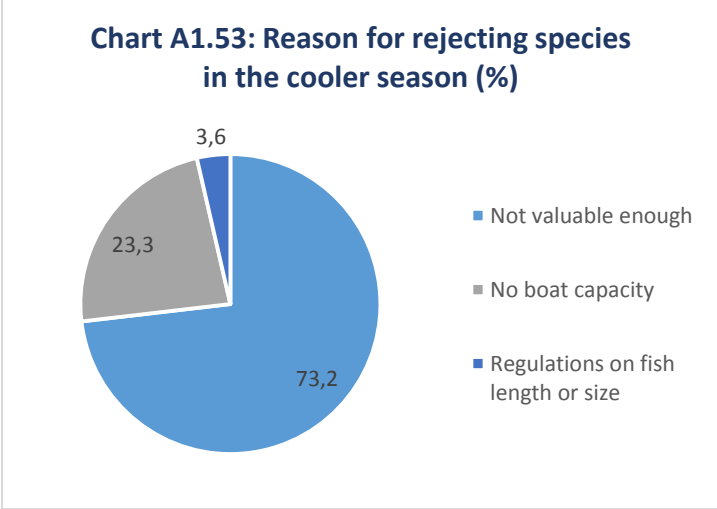
Participants were asked to indicate what type of gear they use for their 1st most important targets. When analysed across the different island groups in Chart 51, we can see that the three most common gear types appear on the island groups os Santiago and Sao Vicente, the island group of Sal does not use Gillnets at all, but does Snorkeling instead.

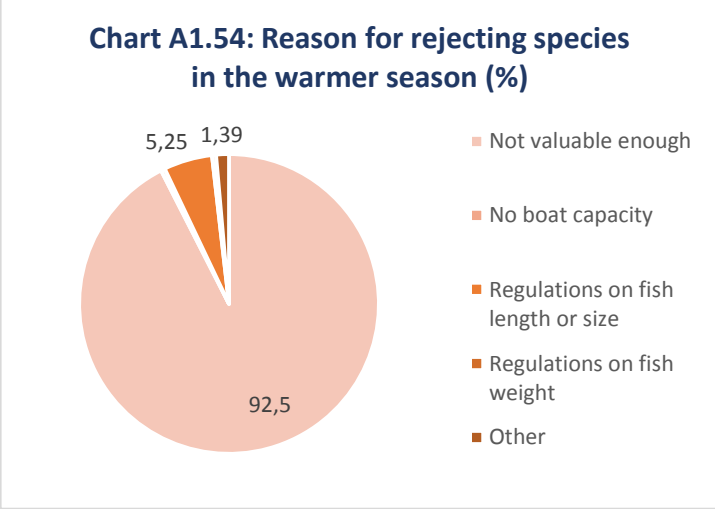


Participants take various trips in order to catch their 1st most important target species, in Chart 52, one can see as a whole, daily charters are the most common type of trip followed by morning and night trips. Some trips are also undertaken according to the moon phase, however this is less common.



In the cooler season, the two species most rejected in the colder season are Herring (2%) and Bulldog





dentex (2%), in this question "None" was chosen 52% of the times indicating that species are not often rejected. In the warmer season, the most rejected species is the Herring (13%), again "None" was chosen 46% of the times, again indicating that species are not often rejected. When rejected though, the reasons for rejection can be seen in Charts 53 and 54 below. In the cooler season, the main reason for rejection is because the species are not valuable enough (73.2%), another significant reason is that there is not enough boat capacity (23.3%). In the warmer season the main reason for rejection is by far because species are not considered to be valuable enough (92.5%).

70.1% of the participants are said to preserve their fish, the overall distribution of fish preservation methods used can be seen in Chart 55. The most used preservation method is Ice (70%) followed by Water with Ice (23.9%). The distribution of fish methods across the island groups is shown in Chart 56. We can see that on the island of Sal, approximately 10.8% uses the Wet Tarp as a preservation method. Furthermore the preservation methods are most diverse on the island groups of Sao Vicente and Sal.

Chart A1.55: Overall distribution of fish preservation methods used (%)

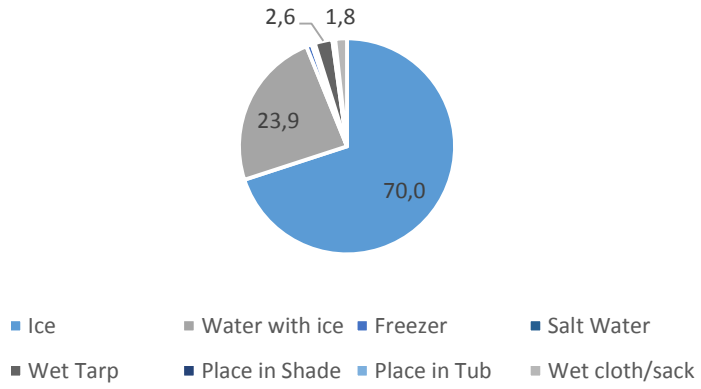
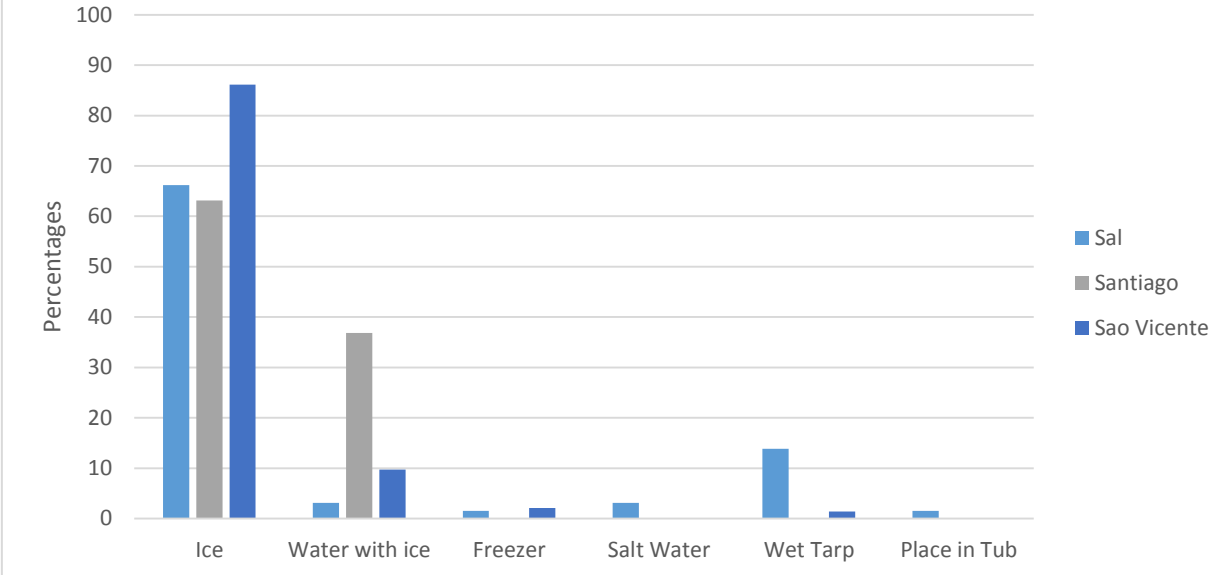


Chart A1.56: Fish preservation methods used across the island groups



2.7 Vessel Specific Descriptives

2.8 Retailing Enterprise

The following section will discuss some of the aspects of the survey which touched upon retailing enterprise. The answers were analyzed as a whole and across the 3 island groups. Out of 670 respondents 72.85% do not sell their own catch of fish. The fish is mostly sold in retail (81.39%) either on the market (46.05%) or by walking (47.60%). Almost none of the participants (only 0.39%) sell fish from home.

Chart A1.57: Types of sale

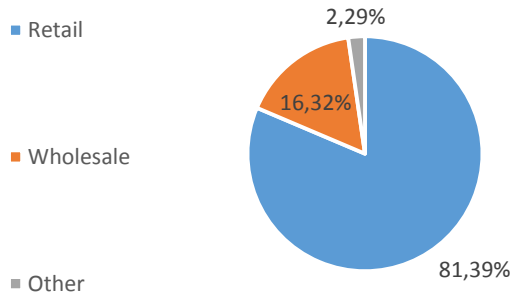
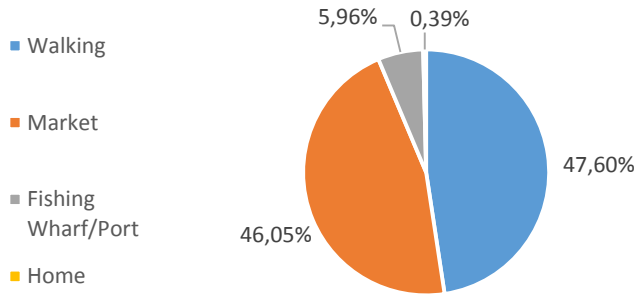


Chart A1.58: Location of fish sale



Fish preservation and unsold fish

92.36% of the interviewees reported that they preserve fish, and out of those who preserve fish, 95.48% use ice for this purpose. Most of the respondents sell today's unsold fish on another day, however participants from Sal prefer salting fish. Chart 64 is the result of a Multiple Answer Question (with dummy variables), which is why the percentages in the chart don't add up 100%.

Chart A1.59: Preservation method

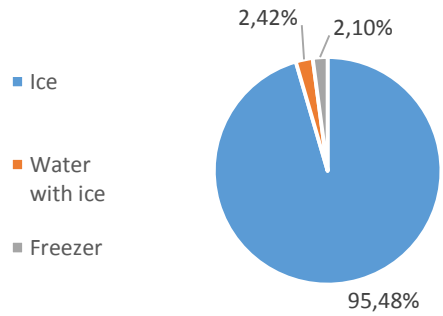
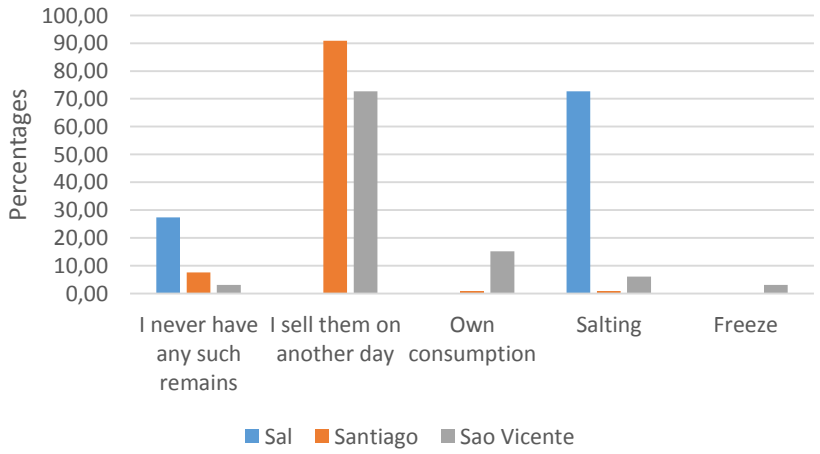
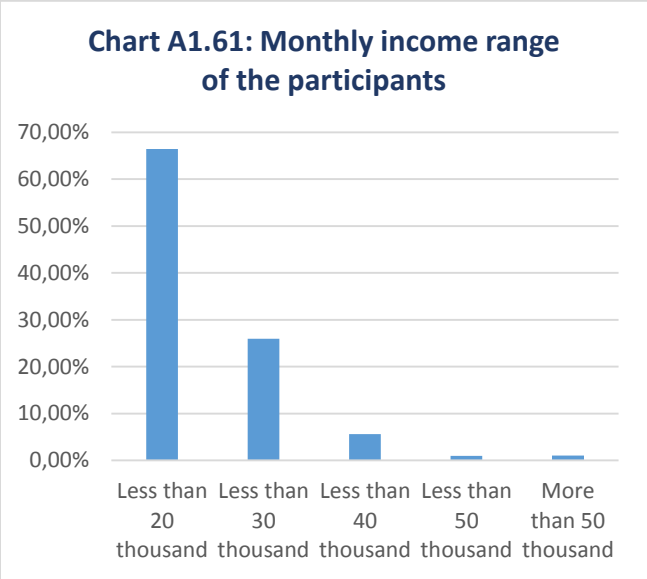


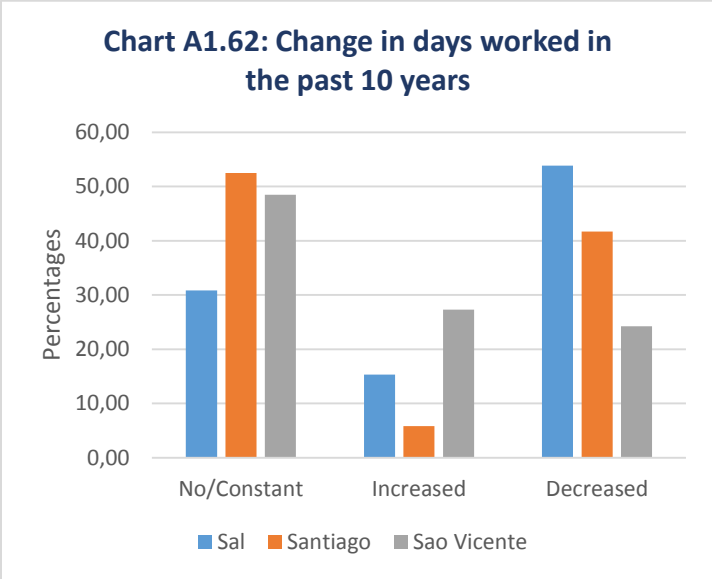
Chart A1.60: What is done with unsold fish



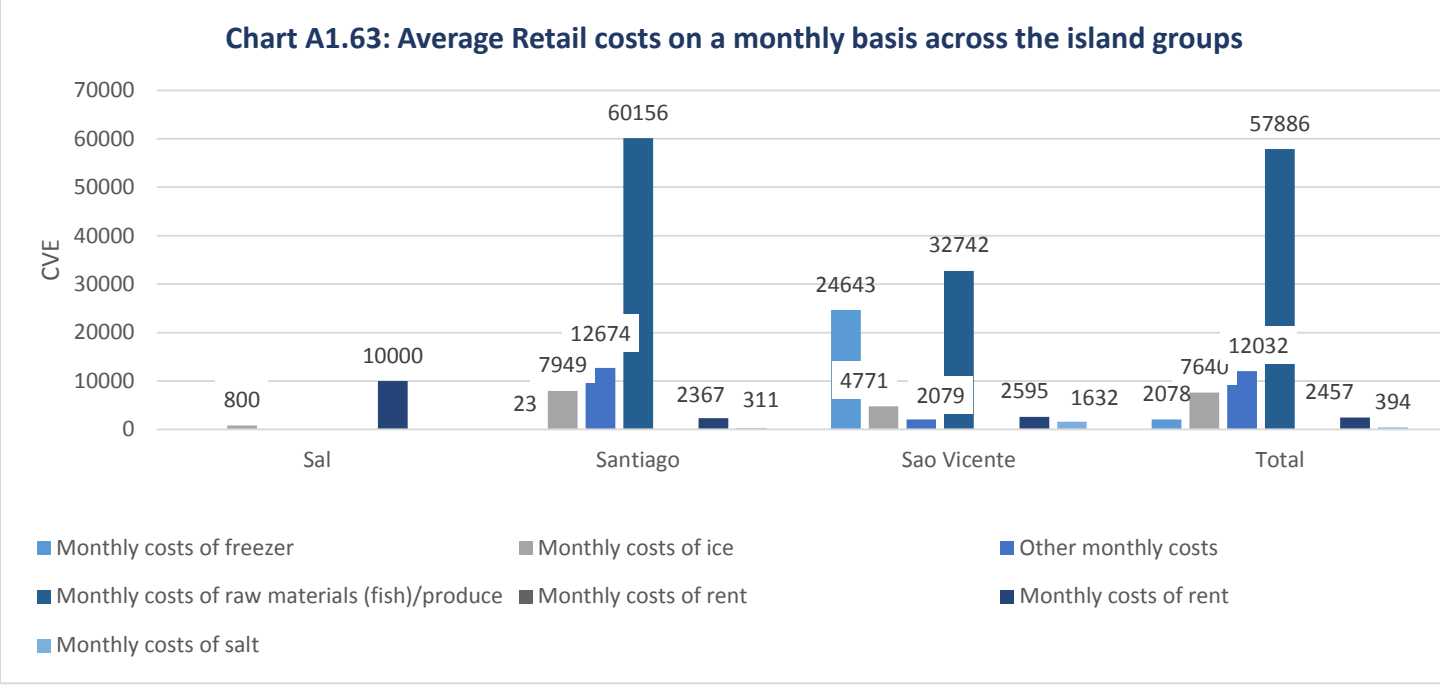
Income in retailing

More than half of the respondents earn less than 20 thousand (CVE) per month from all income sources. And about 25% earn less than 30 thousand (CVE). Most of the respondents say that they number of working days either remained constant or decreased in the past 10 years and only 8.41% said that the number of working days increased. Respondents from Sal mostly answered that the number of working days decreased, while those from Santiago or Sao Vicente mostly answered that the number of working days did not change at all. Only 12.09% responded that they are self-insured. Chart 62 is the result of a Multiple Answer Question (with dummy variables), which is why the percentages in the chart don't add up 100%.

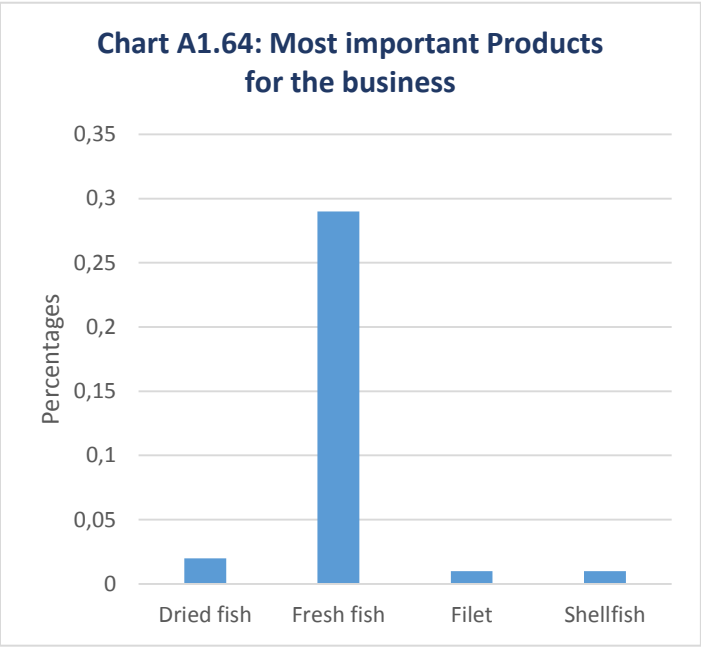


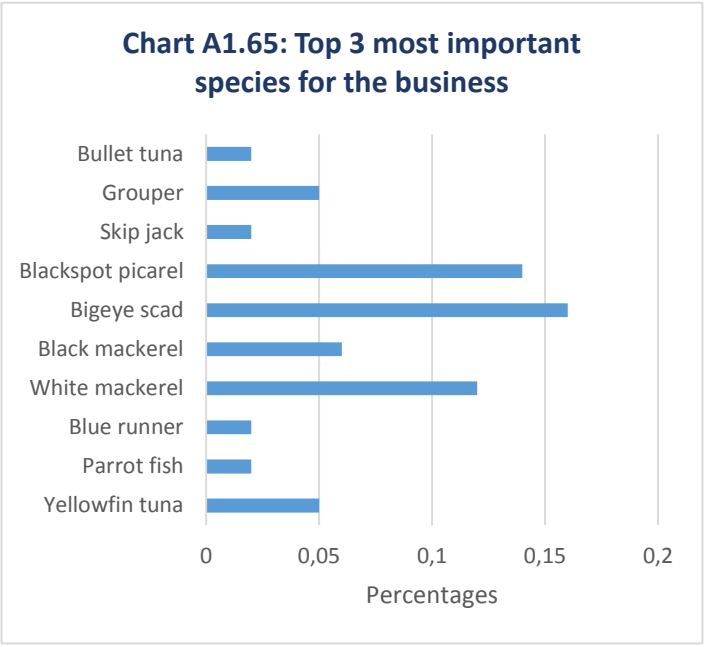


When it comes to the costs in retailing, Chart 63 shows the average costs of different types of costs on each of the island groups and as whole. We can see that the monthly costs of ra materials (fish)/produce is one of the highest in both Santiago and Sao Vicente, whereas Sal lacks an indication of these costs. Furthermore, Sao Vicente is susceptible to relatively high Monthly Freezer costs.



For the Retailers as whole, Chart 68 indicates the most important products sold. Fresh fish is by far the most important product, followed by dried fish. Finally, the most important species for business are given in Chart 69 below. From this Chart, The Bigeye scad, Blackspot picarel and White mackerel are the 3 most important species for business. Both charts are the result of Multiple Answer Questions (with dummy variables), which is why the percentages in the chart don't add up 100%



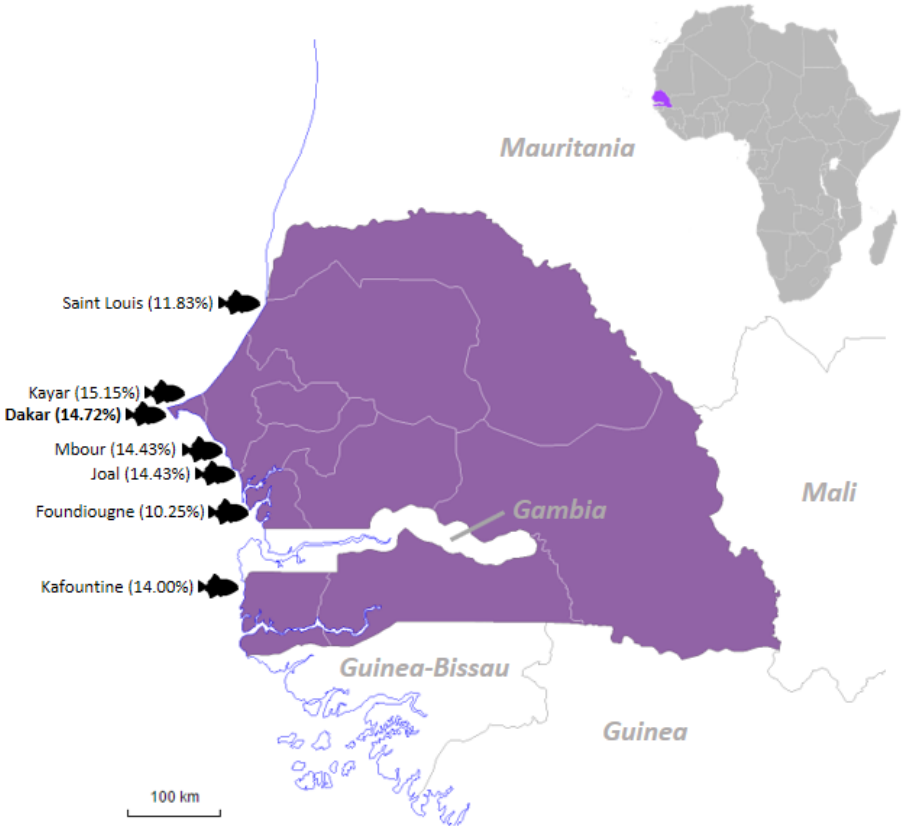


3 ANNEX 2: Descriptive summary: Artisanal fishing sector survey in Senegal in the framework of PREFACE WP 13

3.1 Profile of respondents

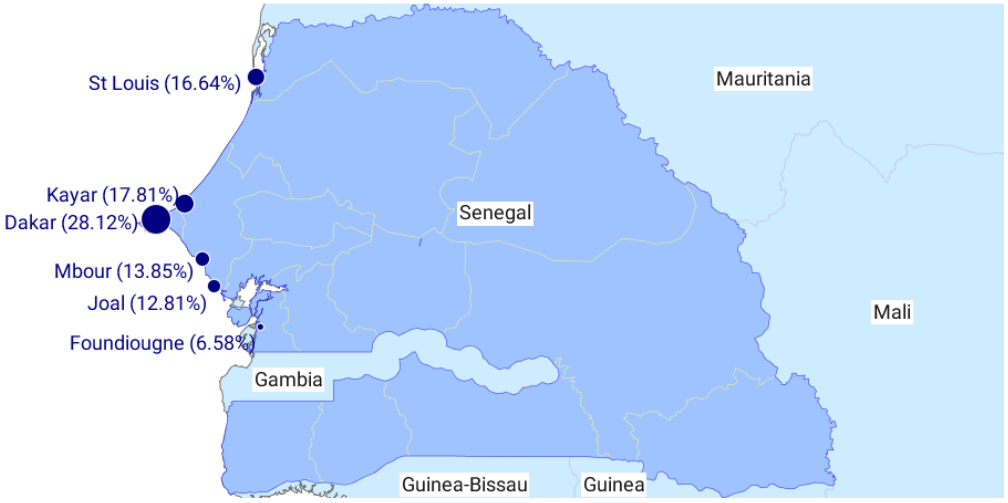
A total of 691 people were interviewed at the principal landing sites of the Senegalese coast. Seven landing sites account for 94.81% of all interviews conducted, including the capital city, Dakar (Figure 1).

Figure A2.1. Main landing areas where participants were interviewed



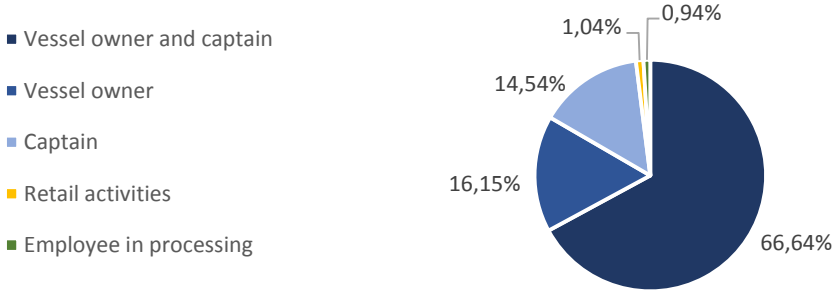
After the dataset was weighted accordingly, Casamançe area was left out due to weighting difficulties. Only six landing sites now account for 95.81% of all interviews conducted (Kafountine is not included anymore).

Figure A2.2. Main landing areas where participants were interviewed



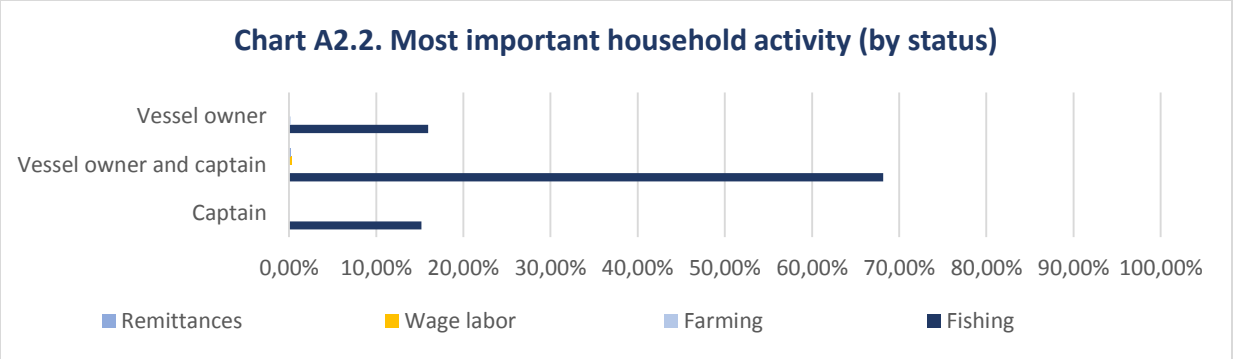
To collect key information (e.g. financial standing of the firm, climate change views, perspectives on regulation), focus was mainly on individuals in managerial roles, with 66.64% of respondents being both the owner and captain of their vessel(s). The majority of the sample is male (98.66%), married (93.41%), and most are the head of their household (75.01%).

Chart A2.1. Status in the firm



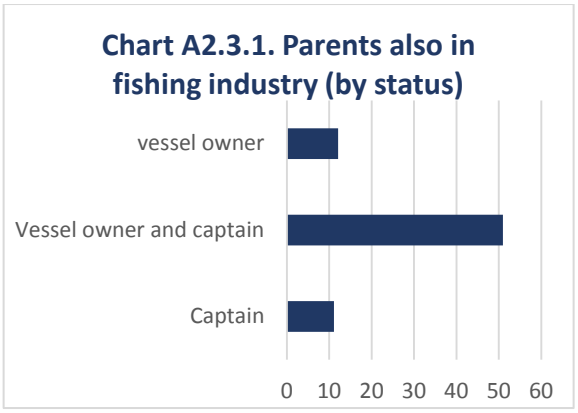
Fishing is a way of life…

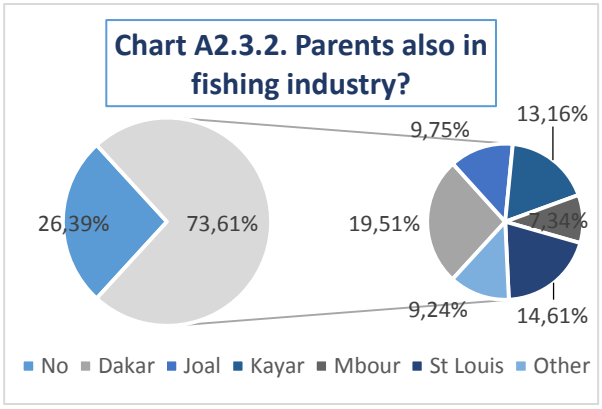
For 98.89% of respondents, fishing is the most important income-generating activity of the household, indicating that we targeted the right group of respondents. It is the only source of personal income for 12.90% of those interviewed.

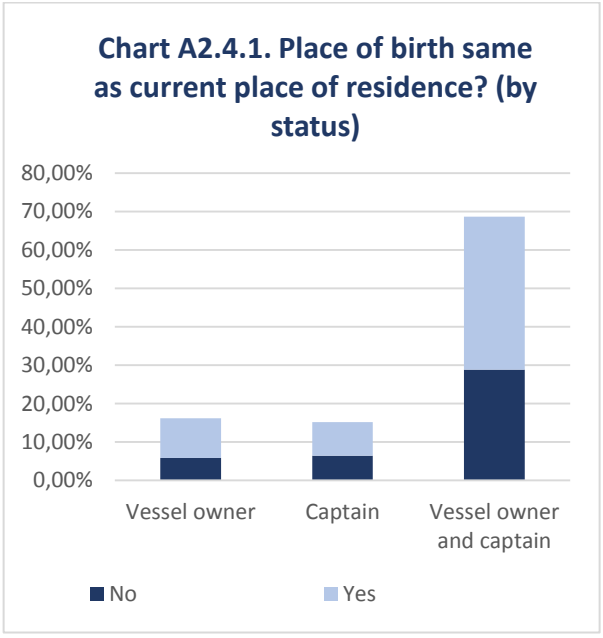


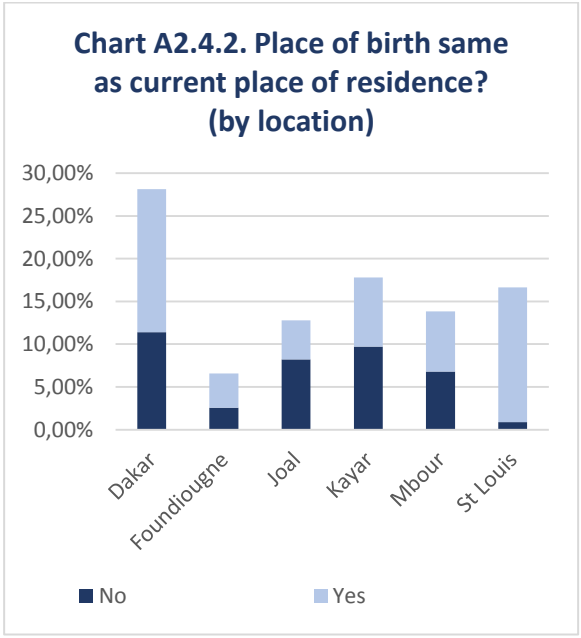
…and, for many, it runs in the family…

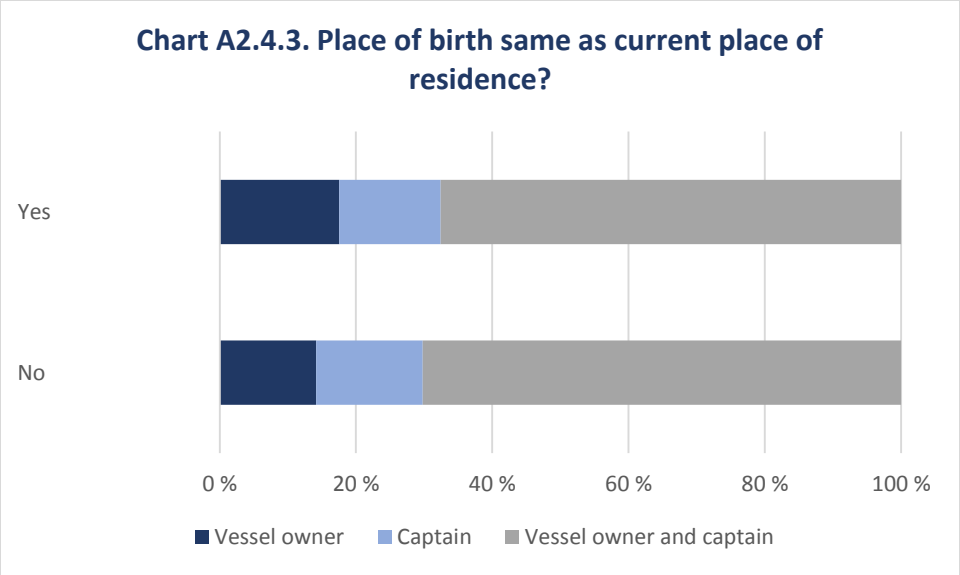
More than half of the respondents (73.61%) were born to parents who also worked in the fishing industry. Fishing as a family business strongly persists in respondents that are both vessel owners and captains. In 66.79% of all cases, the parents worked at the same location (whether they were fishermen or not).

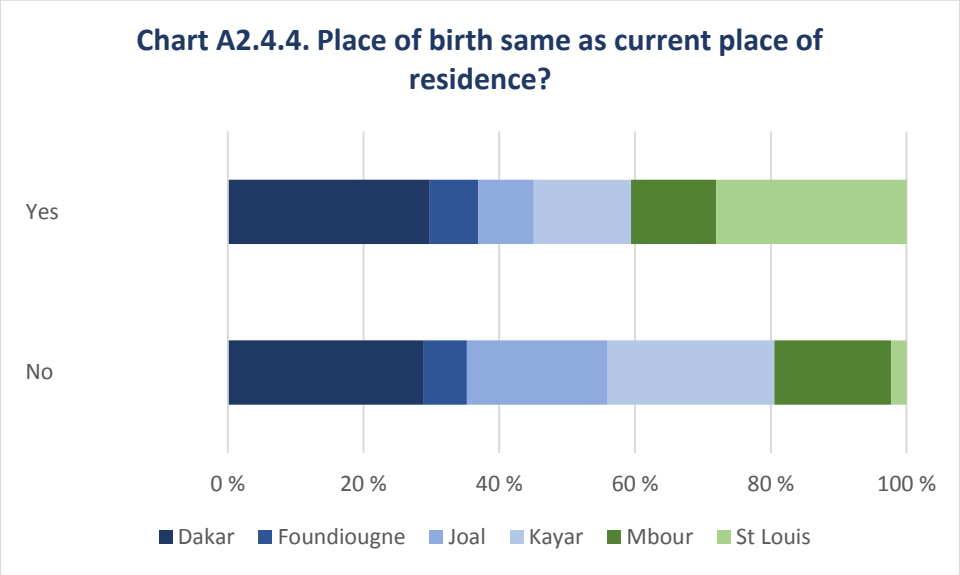












…although it is hardly ideal

A substantial 54.81% of participants described the standard of living they can achieve working in the fishing industry as “Unacceptable” and only 13.66% find it "Good" or "Very good". Few live in huts or shacks (0.93% and 0.71%, respectively), but the homes of most participants are built houses made from slate (49.70%), zinc (24.32%) and cement (15.00%). Only 38.40% own the dwelling and, of these, around 4.43% is paying a mortgage.

Public or private running water is available in 94.05% of the homes, and electricity in 94.47%, although wood, charcoal and gas are widely used as fuel in the kitchen (22.35%, 40.39% and 37.02%, respectively). A large majority has no refrigerator (82.73%) or computer (93.90%) at home, but 75.93% reported their household owns more than three mobile phones and 26.72% has internet access.

Chart A2.5.1. Standard of living from fishing (by location)

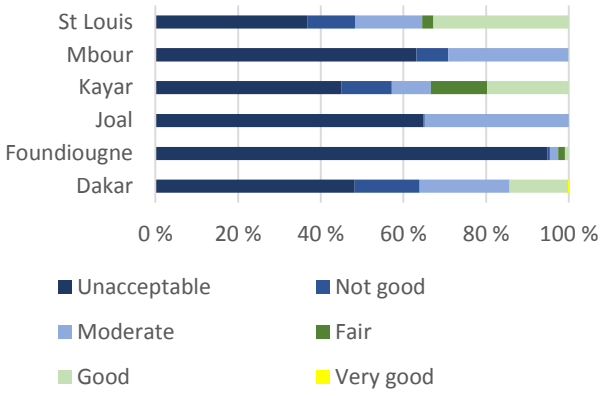


Chart A2.5.2. Standard of living from fishing (by status)

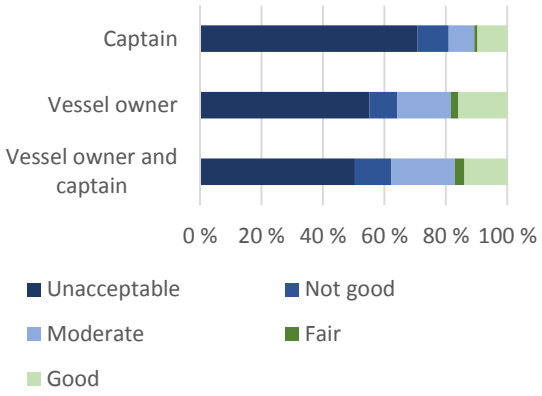
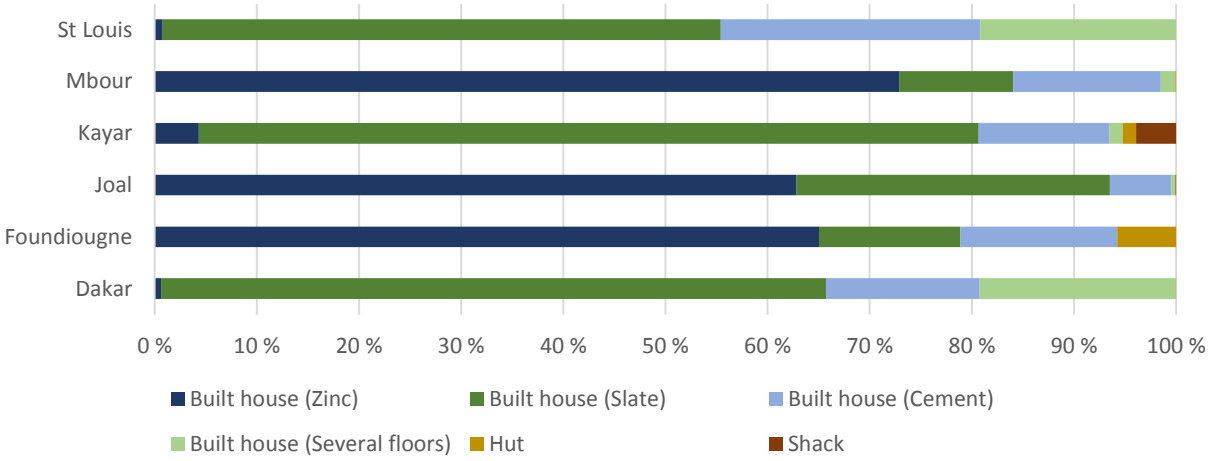
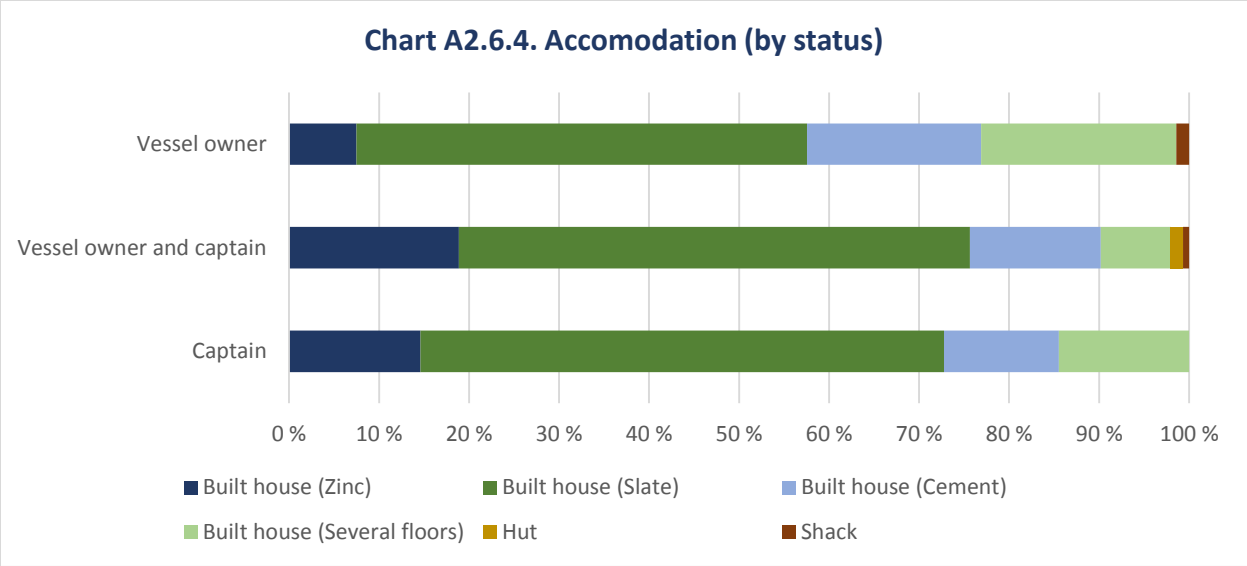


Chart A2.6.3. Accomodation (by location)





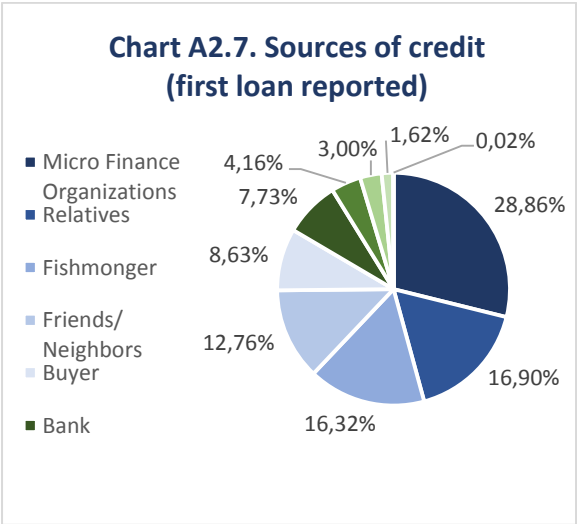
Educational attainment is low and may impact the business

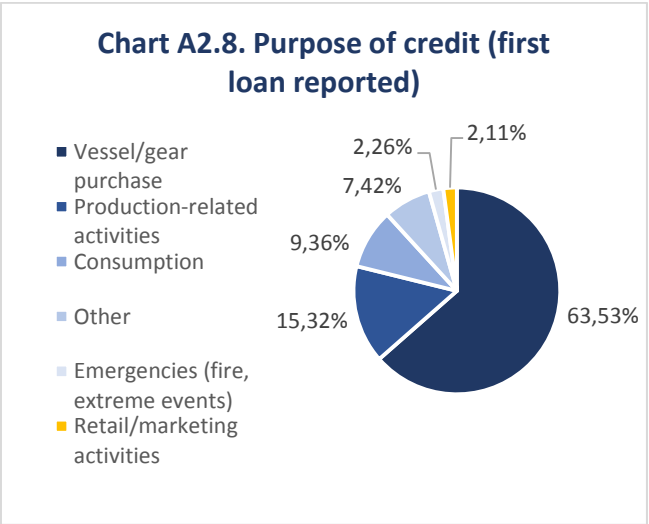
Only 36.32% of participants can read and write, even though 76.82% reported having some formal Primary education. Regarding the education levels in the household, 44.83% have a household member with some formal Primary education, 12.34% with some formal Secondary education and 20.76% with some High School.

Participants were given a series of tasks to measure their knowledge of business concepts like interest rates, inflation and diversification, as well as test their basic math skills. 43.04% and 51.99% gave a correct answer to inflation and diversification questions respectively, but 57.28% and 51.27% reported they do not know how to calculate percentage of a number or sum up two numbers.

Participants are largely uninsured, but they do have access to credit

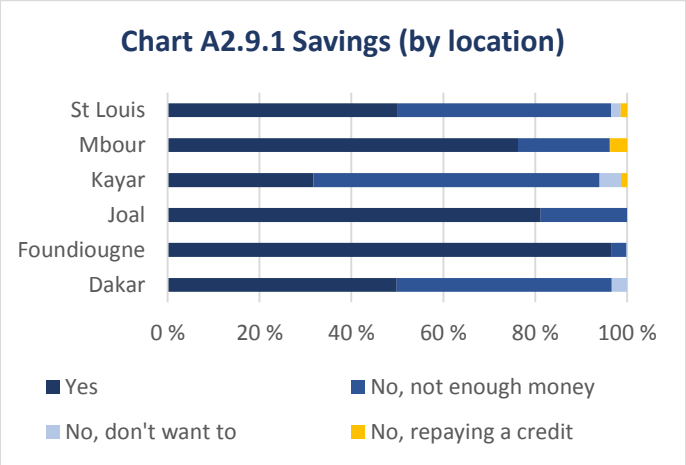
98.25%, reported having no health insurance, life insurance or unemployment insurance of any kind. A majority of respondents (58.78%) is not indebted, but 32.57% reported having one outstanding loan, 4.75% had two and 3.90% had three. While most of these debts were acquired with financial institutions, an important share is owed to fishmongers, relatives and friends.

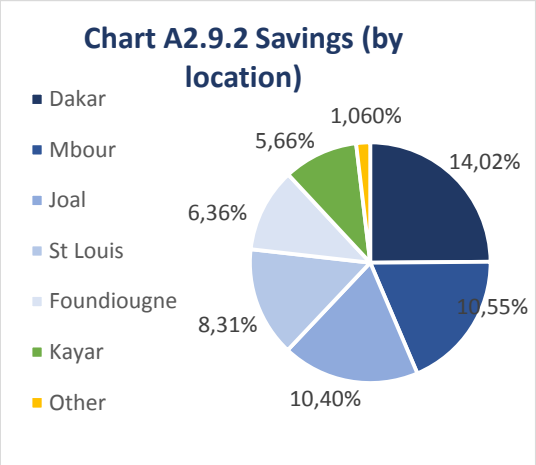


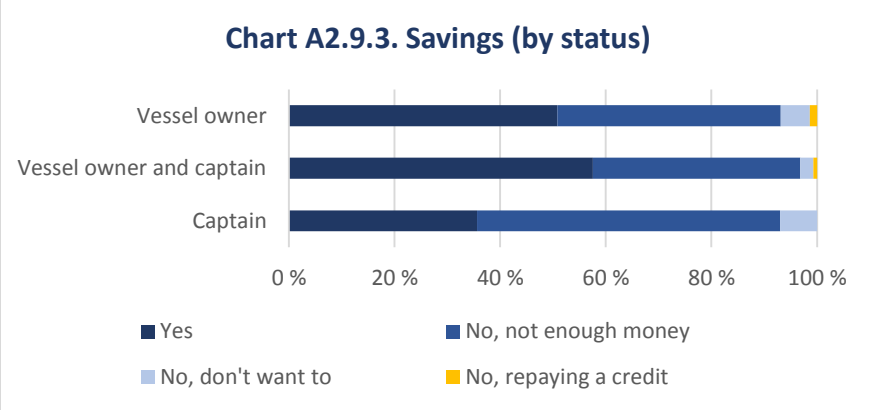


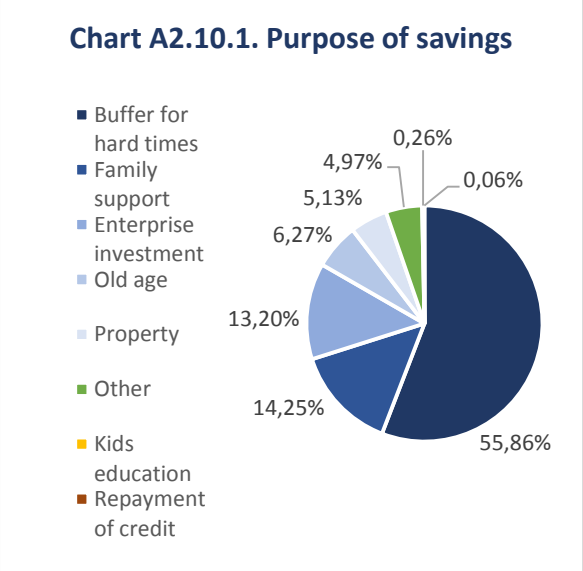
…and savings are reportedly high

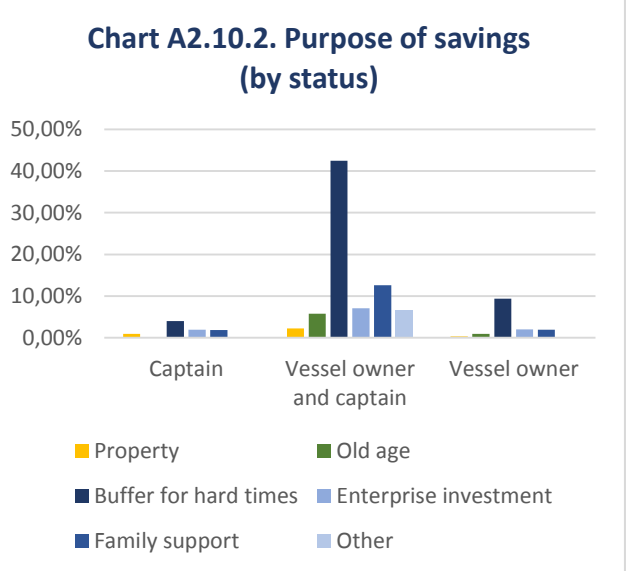
Over half of all participants (56.36%) reported to have some amount saved, while 39.65% said they could not afford to have savings. Of those with savings, 91.14% had a specific purpose in mind for the fund.









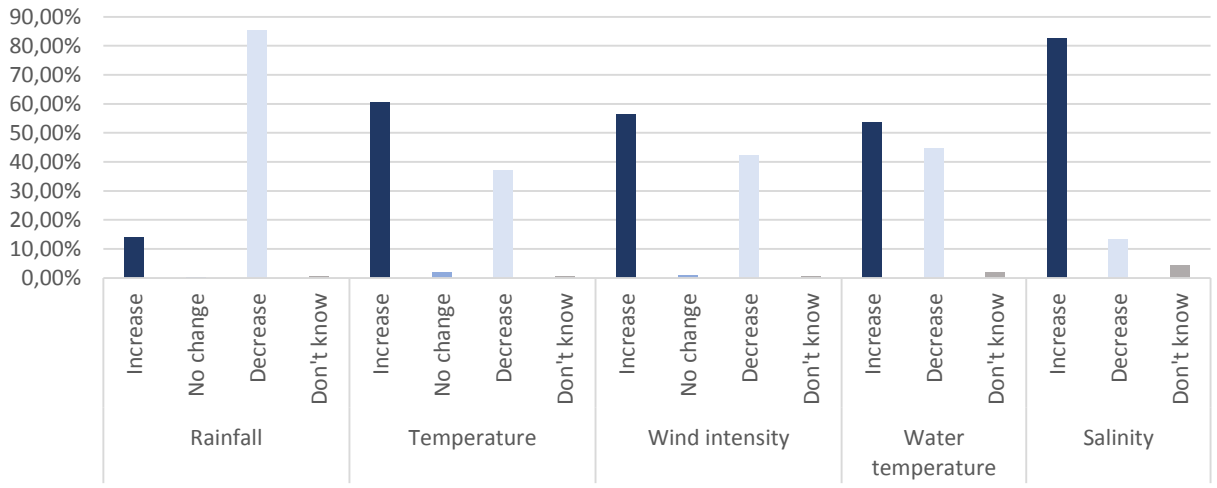


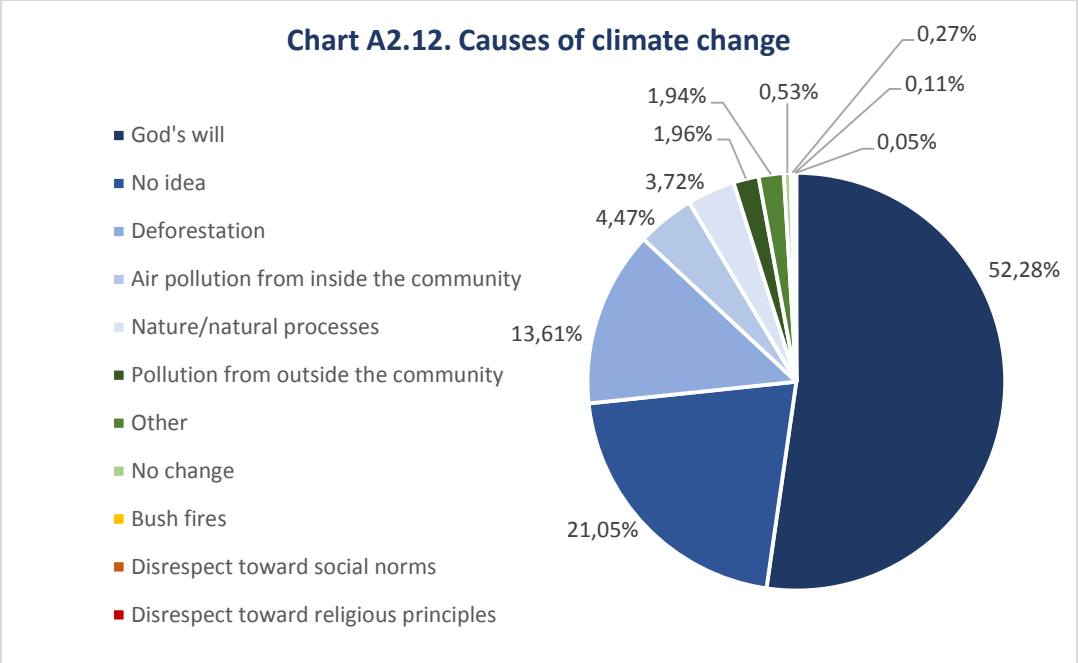
3.2 Climate change and regulation perspectives

Participants were asked for their perceptions regarding phenomena associated to climate change, and the impact of these on their fishing activities. Opinions were strong, with as many as 94.16% of participants answering “yes” when questioned whether they noticed any changes in rainfall in the last 5 years, 85.97% with regard to changes in wind and 74.67% regarding changes in temperature. However, when asked for the direction of change, perceptions were quite ambiguous. Water temperature and salinity changes were less noticeable to participants, with 58.45% and 21.27% answering they noticed any change, respectively.

Of 73.45% participants that said they had heard about climate change, 37.53% and 45.72% received this information via radio and television, respectively, and 5.19% heard about climate change when talking to people. Less than one quarter of respondents linked climate change to anthropogenic causes.

Chart A2.11. Perception of environmental changes



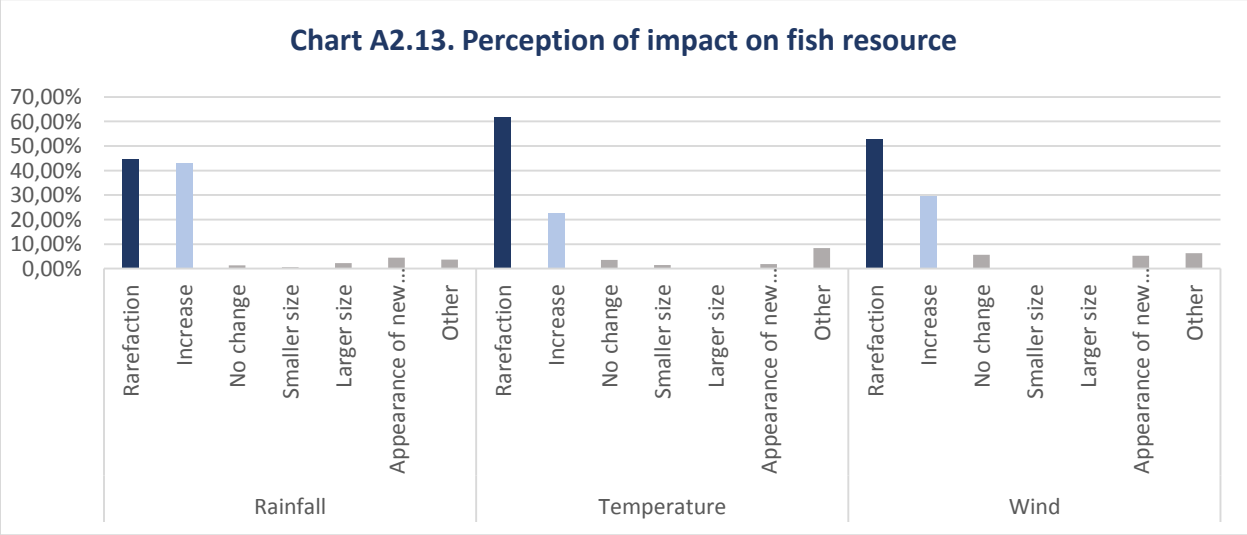


Perceived impacts are considerable

When questioned about the effects of these phenomena on fishing activities, opinions were again strong, indicating in most cases a rarefaction of fish resources. Data is also available as to which species are perceived to have increased/decreased in abundance.

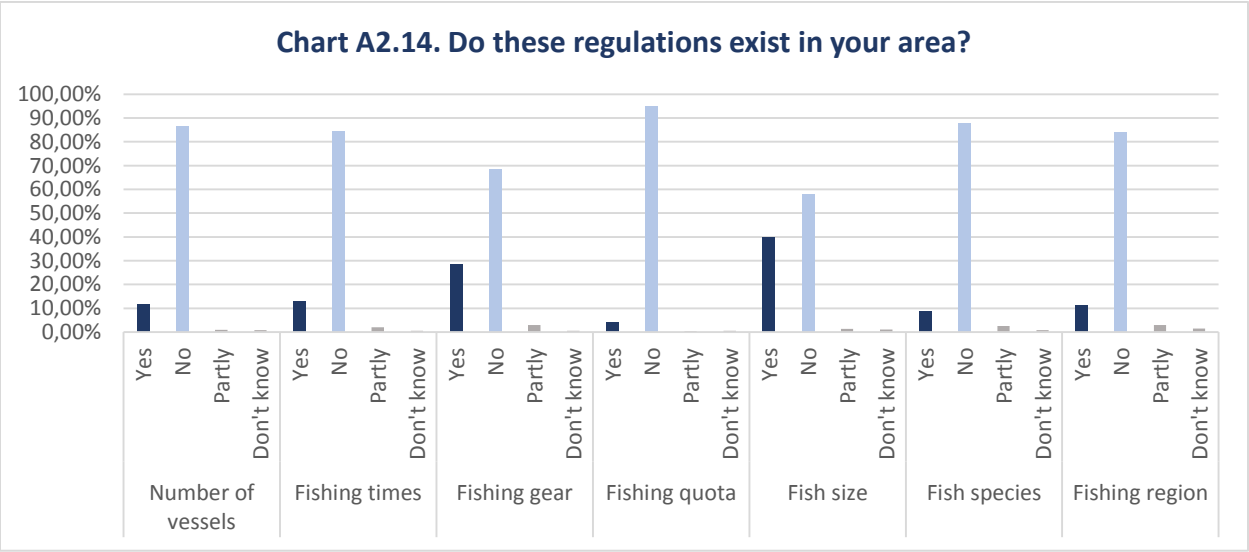
Existence of an impact of rainfall pattern changes on fish resources reported 95.46% of participants, of temperature – 87.92% and of wind – 92.97%. Importantly, especially concerning rainfall, the direction of this impact was again ambiguous. An important step therefore will involve the analysis of perceptions according to target species and regions.

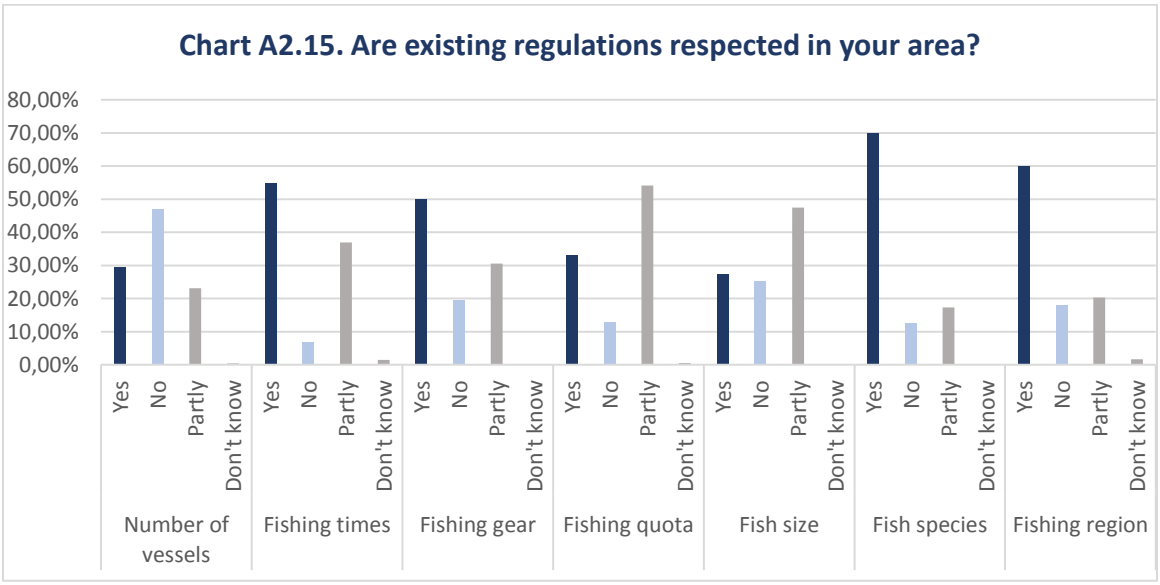
73.34% of participants reported an impact on revenues, and in 98.71% of these cases the impact was negative.



Regulatory issues emerged

Participants were asked about the regulatory environment of their region, and 92.89% said fishing industry regulations were necessary. Fish size regulations appear to be the most prevalent, as well as the most respected in areas where they are present.

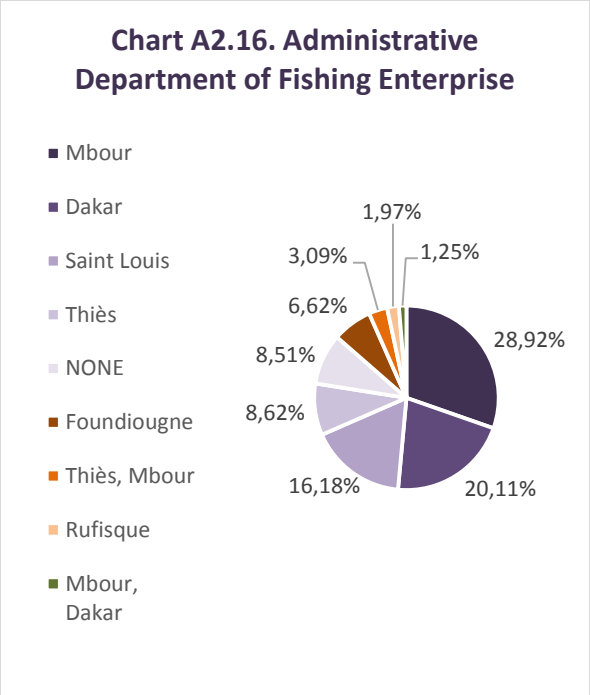


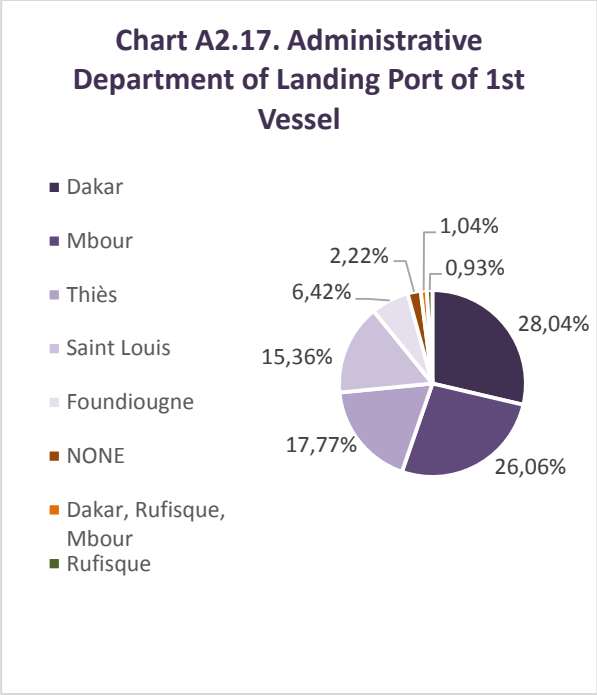


3.3 The Fishing Enterprise

Location

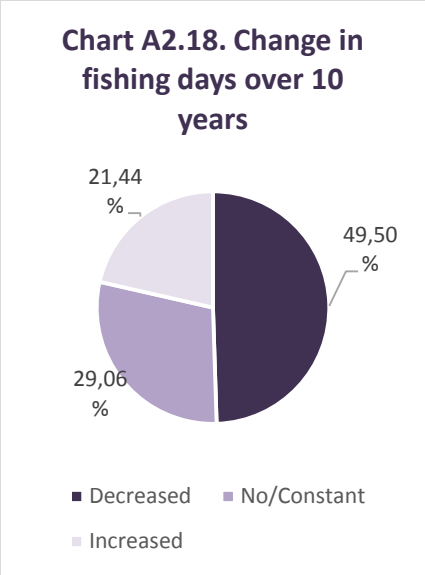
Charts 16 and 17 show our sampling strategy with regard to administrative department of the fishing. A little more than half of the participants locate their first vessel in Dakar or Mbour.

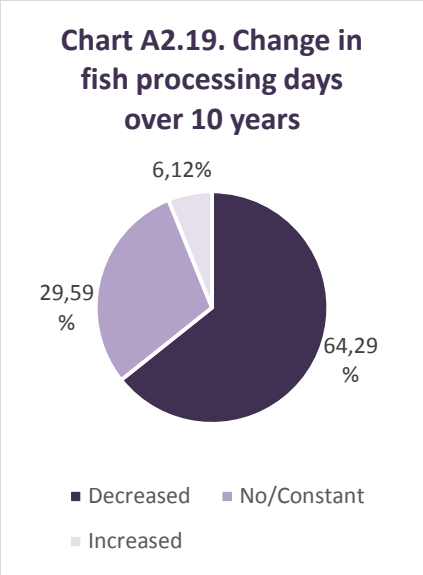


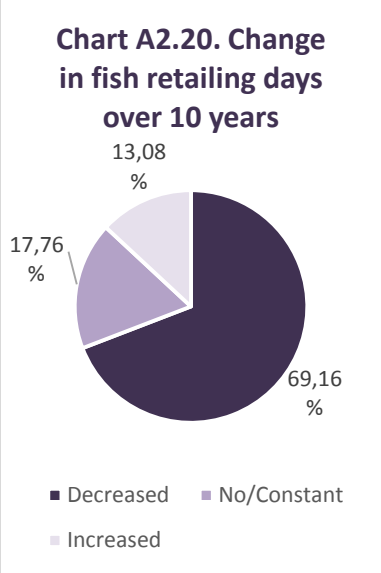


Change in fishing and fishing related activities over the last 10 years

Participants were asked to report how the days of fishing, the fish processing and fish retail processing has changed in the last 10 years (from 2004-2014). The result is shown in charts 18-20 below. A decrease in processing and retailing days points towards less fish being available to the local market. We suspect this to be largely driven by the advent of exports. A decrease in fishing days could either be due to an increase in the resource, a decrease in the resource price or changes in weather patterns disallowing trips to fish. Combined with participant's perceptions on extreme weather events, we suspect the latter to have a remarkable influence.

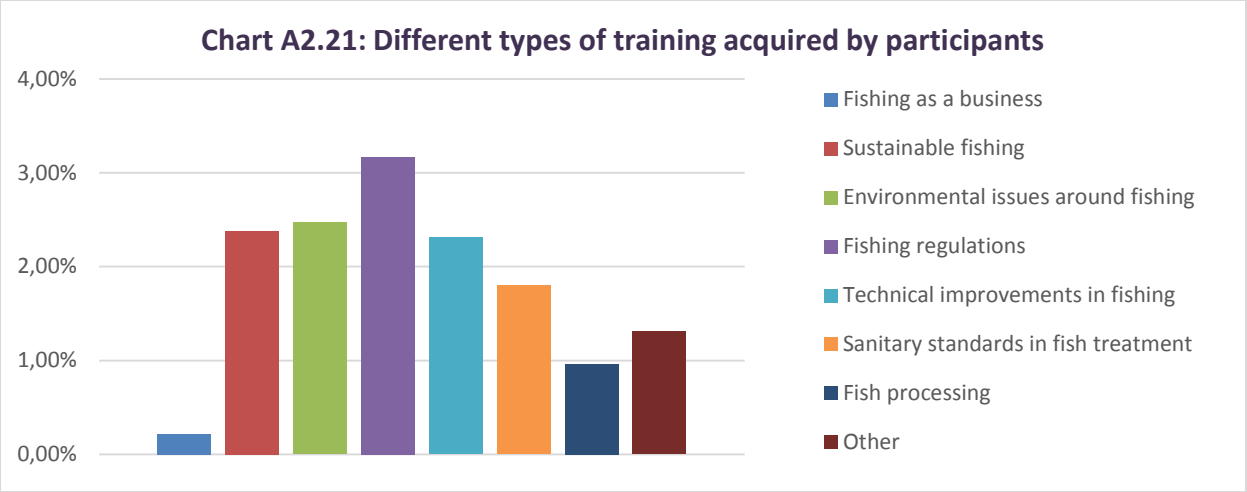




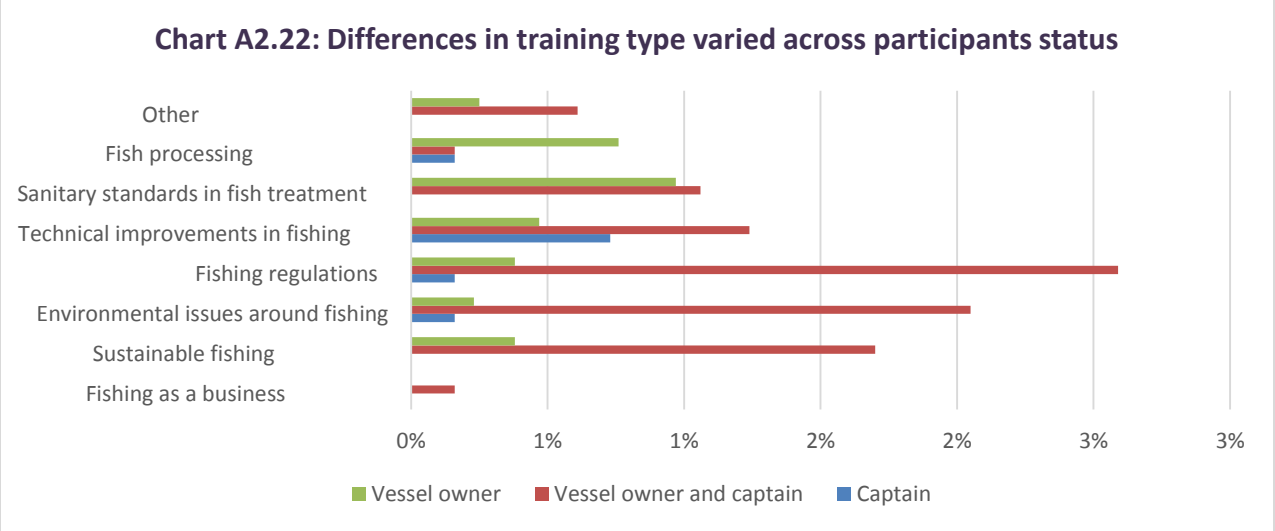


Training

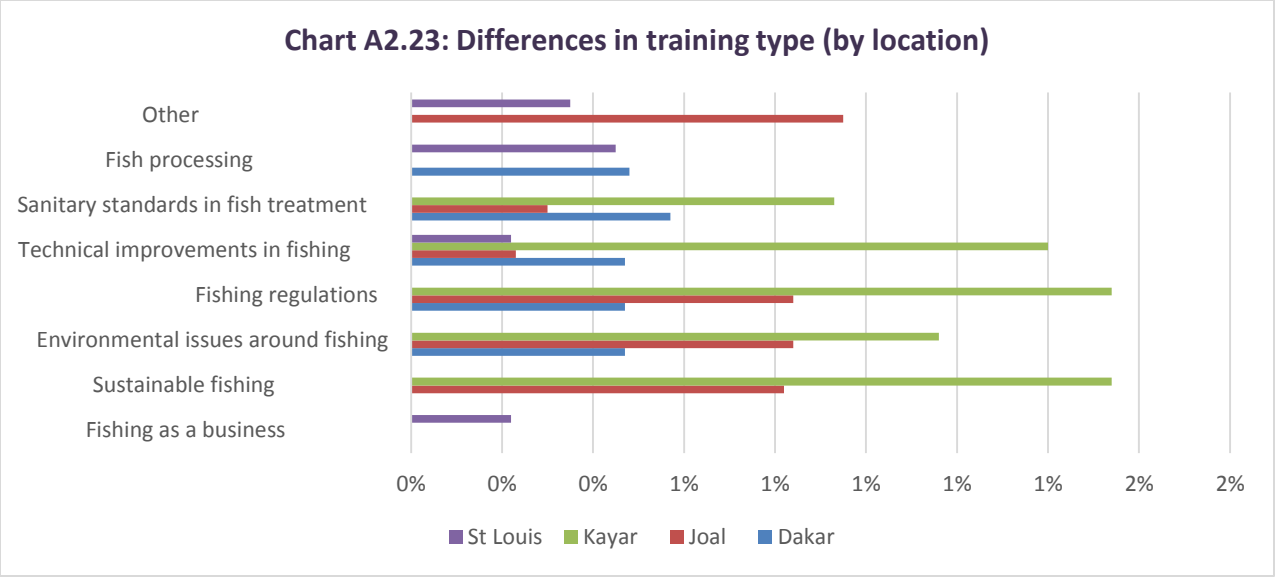
Only 8.95% of all the participants has received a training on fish or fish treatment. Chart 21 below shows the distribution of the different types of training acquired by the trained participants. One of the most common training types is on "Fishing regulations" followed by "Environmental issues around fishing" and "Sustainable fishing".



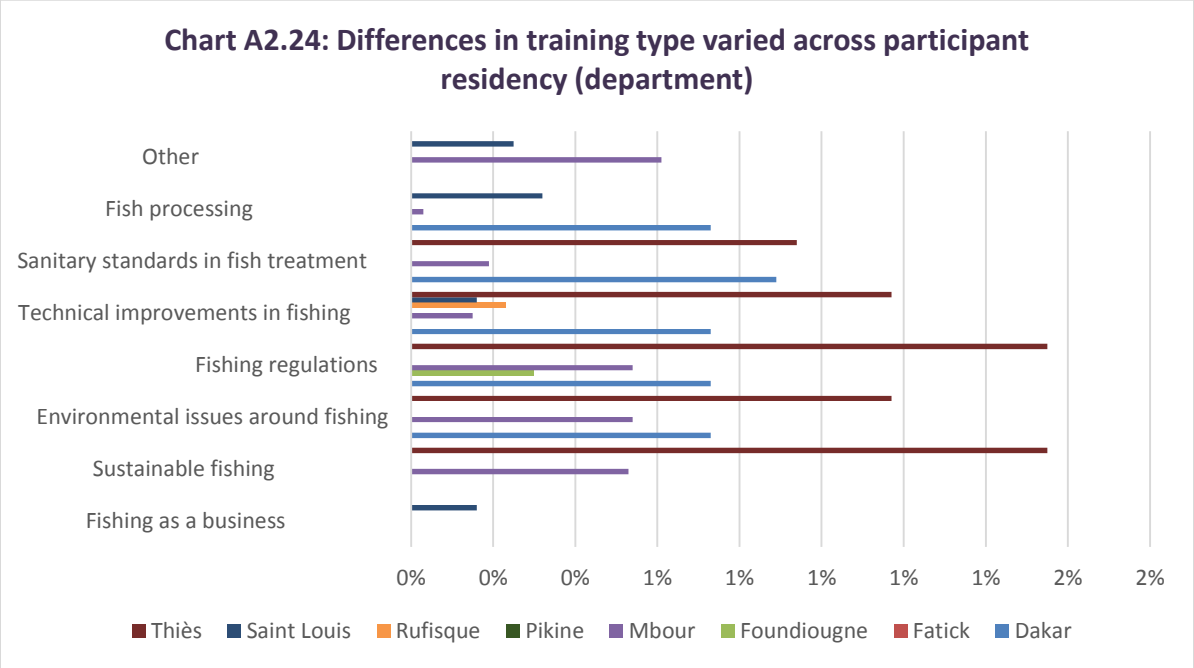
It is also interesting to look at how the different types of training are spread among the different statuses of the participants. From Chart 22 you can read that Vessel owners have had more training on "Fish processing" than the participants belonging to another status group. Overall "vessel owner and captain" group has got the most training.



Furthermore, when visualizing how training is spread across locations, which is done in Chart 23, you can see that participants from Kayar have gotten most training overall. It also seems that participants from Kayar are most educated in "Sustainable fishing" followed by those from Joal. Participants residing in St Louis are mostly trained in "Fish processing". Interviewees from Dakar got the most training on "Sanitary standards in fish treatment" and on "Fish processing".



In Chart 24 it is clearly seen that interviewees with residency in Thiès received the most training followed by residents of Dakar and Mbour. Respondents from Rufisque were trained only on technical improvements in fishing while respondents from Foundiougne were trained only on fishing regulations.



The reaction to increases and decreases in the abundance of fish

Participants were asked how they would react in case the abundance of fish would either increase or decrease. Participants could choose between a set of 9 answers, equal for both an increase and decrease. Chart 25 below shows the distribution of each of the strategies and whether they are chosen more frequently in case of a decrease or rather in case of an increase. As expected, increasing the fishing effort is done more often under an increase than under a decrease, and the other way around.

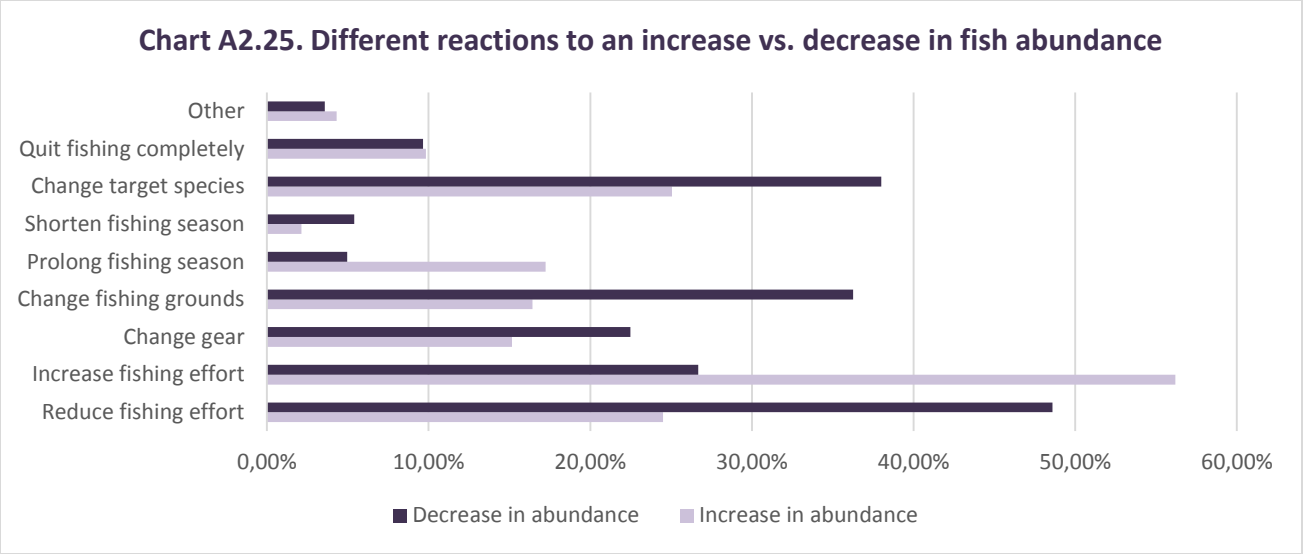


Chart 26 below shows how the top 6 locations react differently to an increase in the fish abundancy. Participants from Dakar are most likely to increase fishing effort or to change target species, whereas participants from Joal are most likely to prolong fishing season. Interviewees from Kayar and St Louis chose option "Quit fishing completely" more than interviewees from other locations.

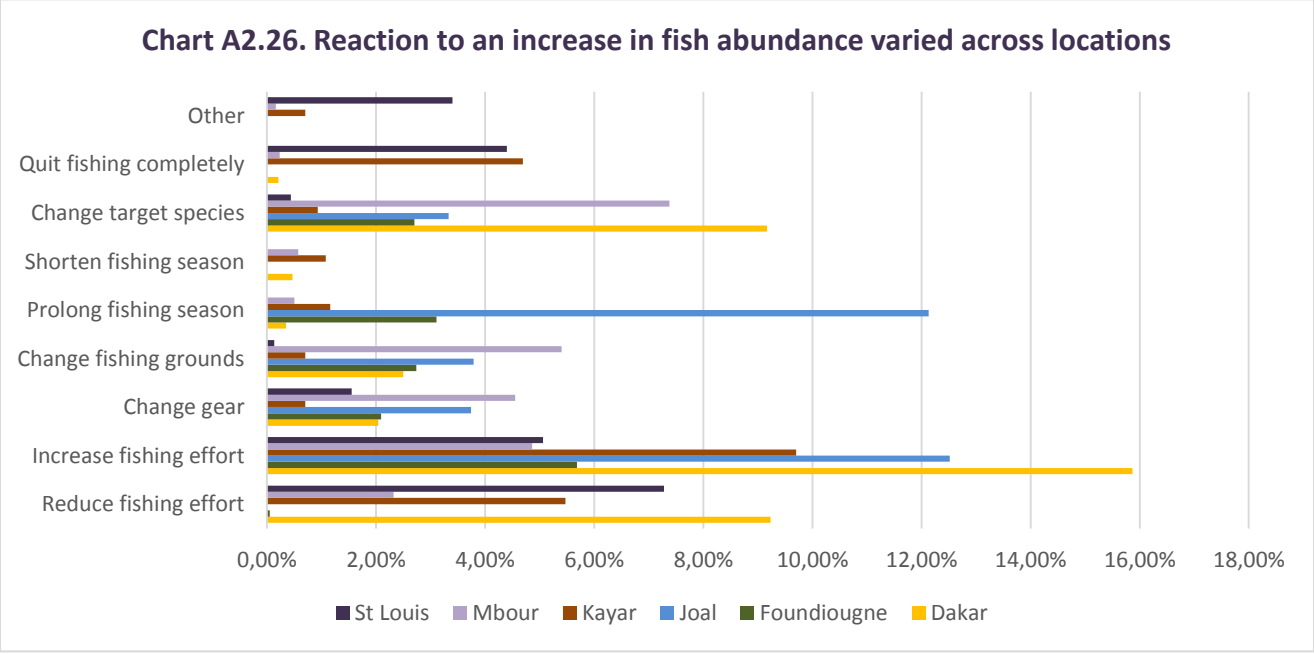
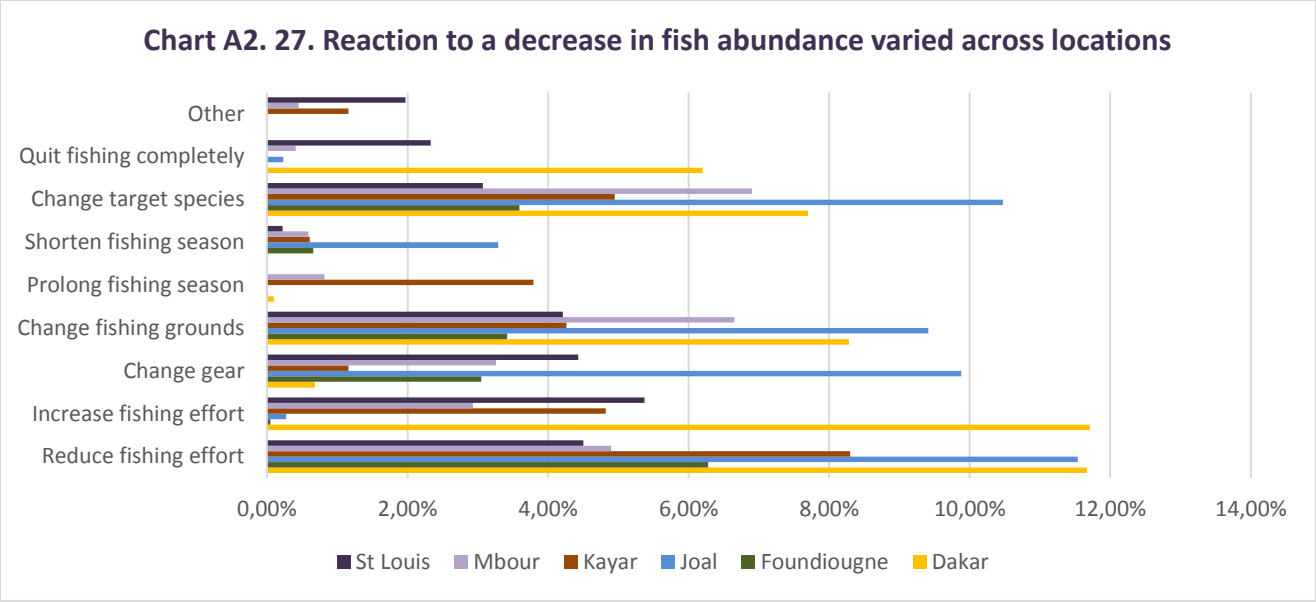
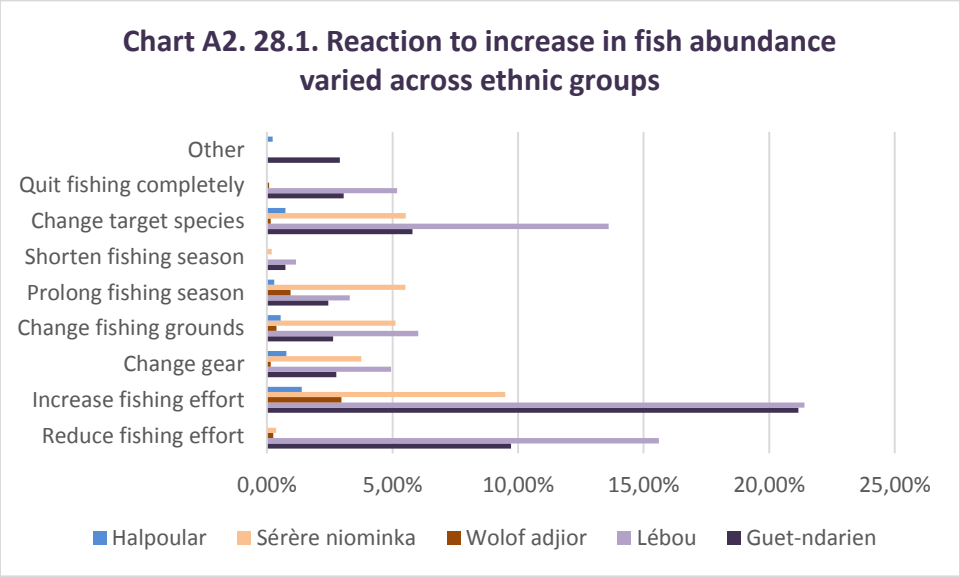
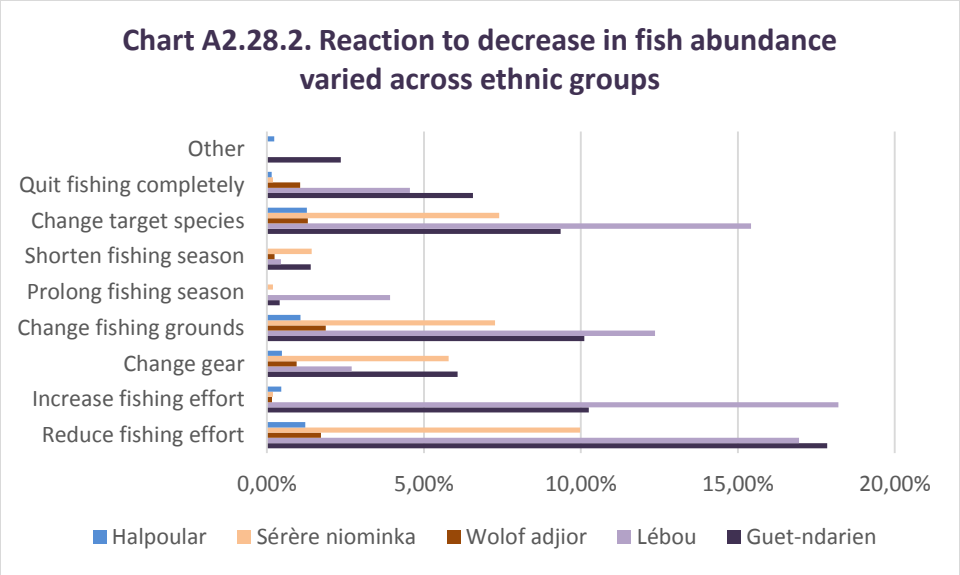


Chart 27 shows the same as Chart 26, but now for a decrease in the fish abundance. Participants Dakar are more likely to increase or reduce fishing effort and to change target species, whereas participants from Joal are more likely to reduce fishing effort or change target species or fishing grounds. Interviewees from St. Louis are more likely to quit fishing than participants from other locations.



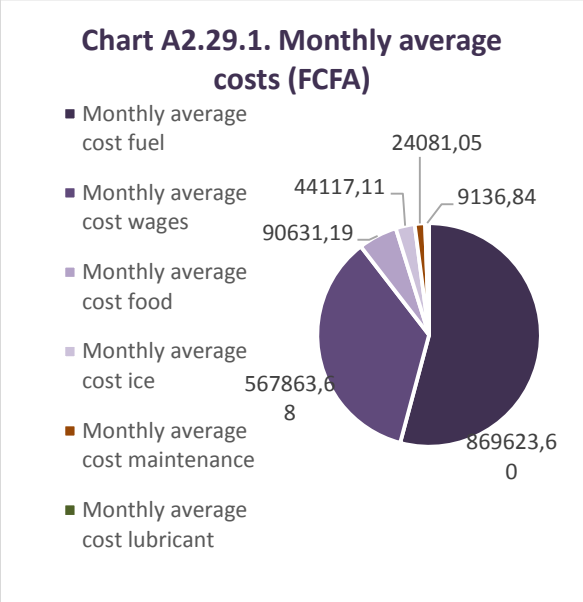
All ethnic groups chose in the first place to increase fishing effort when there is an increase in fish abundance and most of them chose to reduce fishing effort when there is a decrease in fish abundance. However, respondents that belong to Lébou ethnic group chose in the first place to increase fishing effort when there abundance of fish decreases.

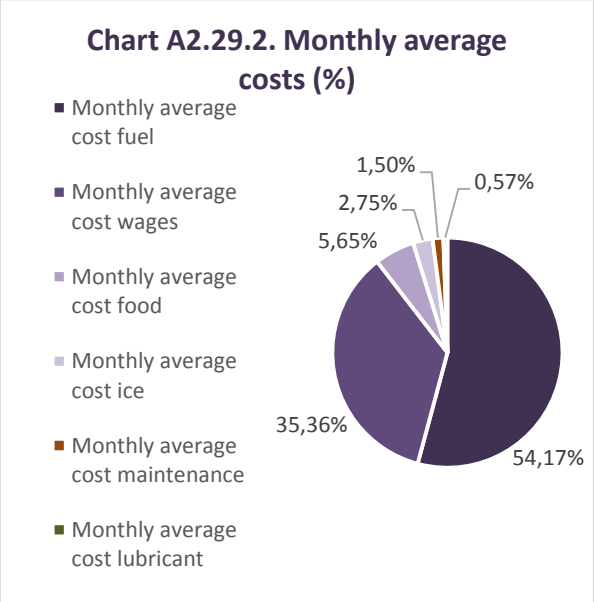




Costs

Charts 29.1 and 29.2 provide information about monthly average cost distribution. More than half of all costs are fuel costs (54%) followed by costs on wages (35%). Lubricant costs are almost negligible (0.57%) compared to other costs.





3.4 Fishing Activity

Reasons for specializing

In Chart 30 below one can see the top reasons for participants to specialize in a specific type of fish. Unfortunately 30% has answered with an invalid answer, which means that instead of giving a reason for specialization in a particular type of fish participants named the type of fish they specialize in. 14.5% of the participants is specializing because this type of fish is more available and 13% because it is more profitable. Only 7% do not specialize in any specific type of fish and almost no one (0.23%) is following family traditions when it comes to fish specialization.

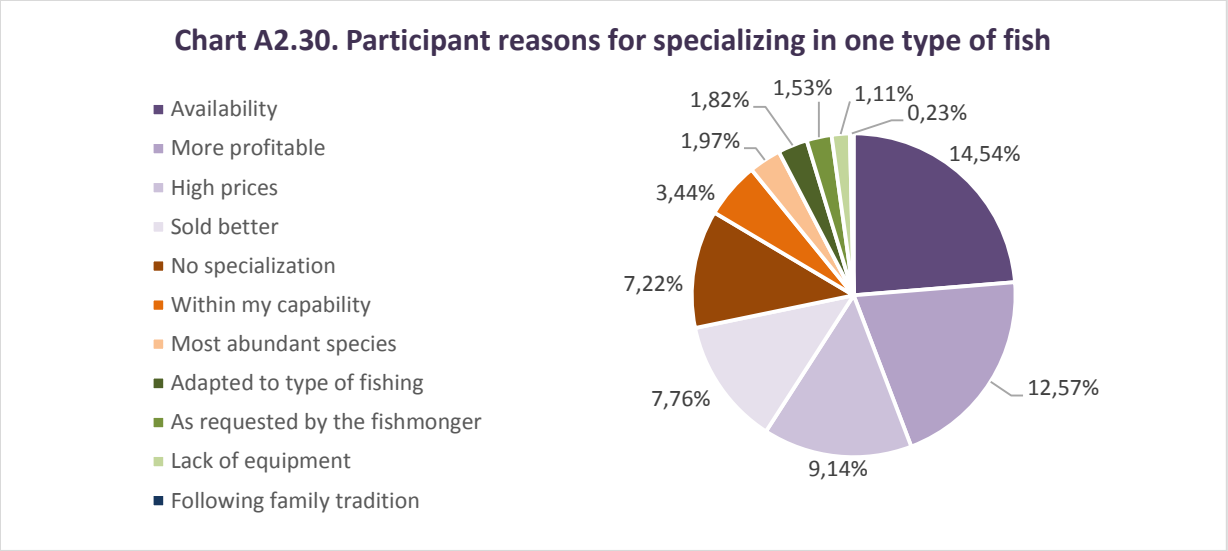


Chart A2.30. Participant reasons for specializing in one type of fish

In Charts 31 and 32 you can see how the most important target species of participants vary with the season. *Noble Fish* (a composite of high-value, scarce species going into export) is the most important target group in both seasons. Furthermore, during the hot season, *Octopus* and *Bluespotted Seabass* are targeted while during the cold season, it is mostly *Bluespotted Seabass* and *False Scad*. Some species are only caught part-time, such as little tunny which is only mentioned to be an important target during the hot season.

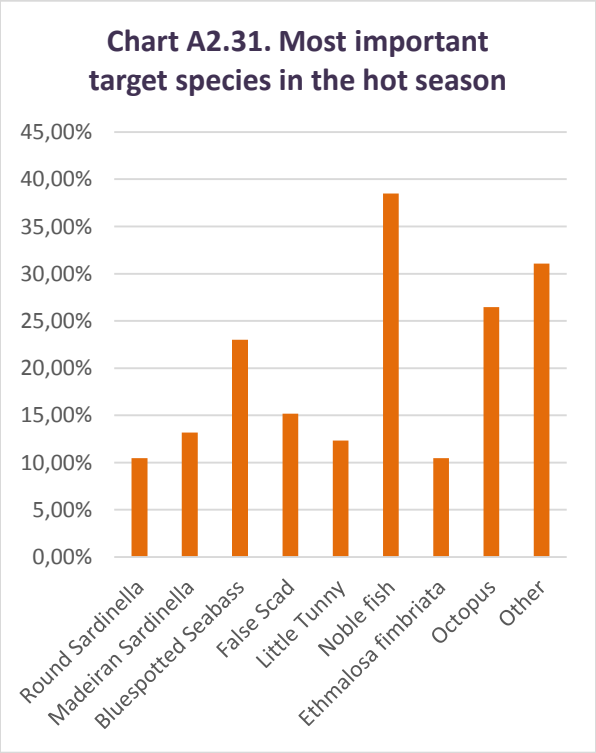


Chart A2.31. Most important target species in the hot season

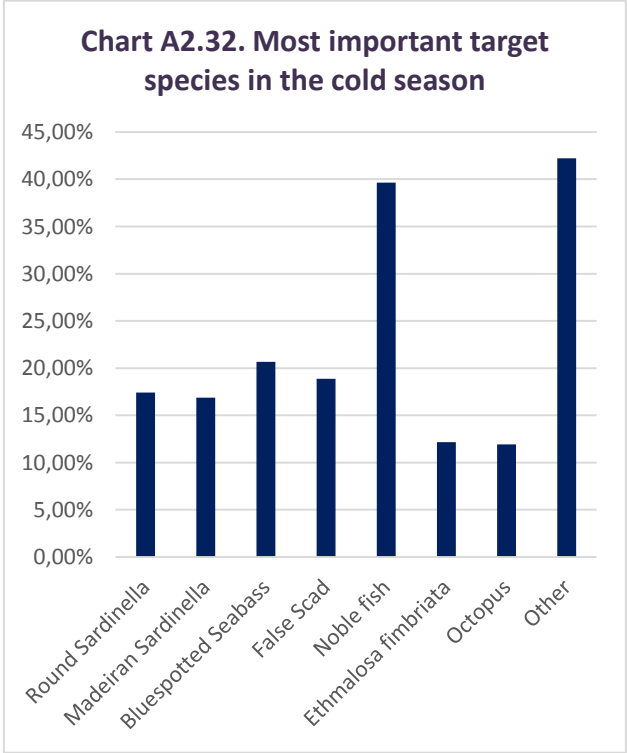
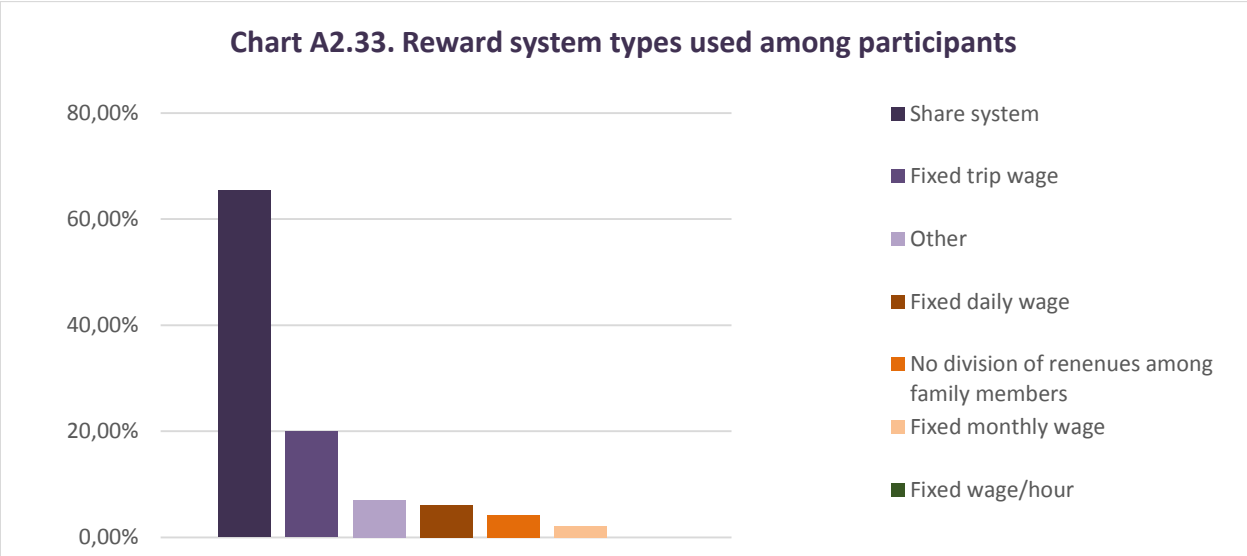


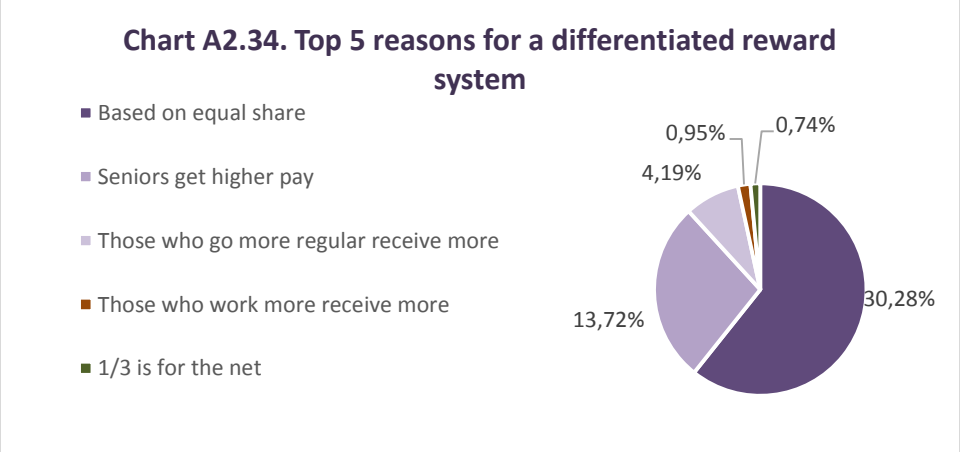
Chart A2.32. Most important target species in the cold season

3.5 Fishing Crew

Reward System

Charts 33 and 34 below show some details on the reward system used among the participants and also on the reasons for differentiating rewards among the crew members. The type of reward system used the most is a share system followed by a fixed trip wage. None of the participants receives a fixed wage/hour (which is not surprising given that we asked mostly owners or captains). Apart from an invalid answer (46%), which in this case corresponds to answers such as "yes" or "no" that do not offer any reason for differentiated reward system, the most common reasons for differentiating rewards among crew members is actually no differentiation but equal share (30%). 12% of the differentiation happens based on seniors getting a higher pay.

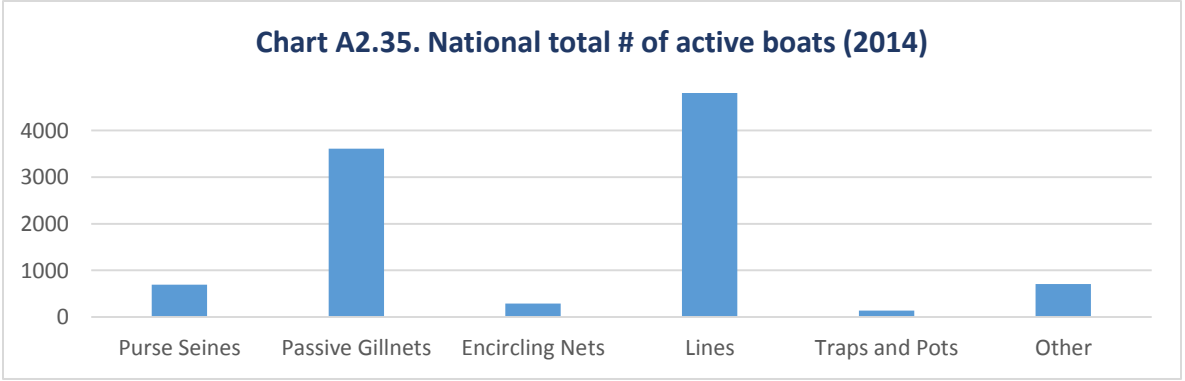




3.6 Data on Vessels

Fishing Method

Fishing methods are given by the 2014 census survey done by CRODT. While the number of purse seine and encircling gillnet vessels is small compared to those for lines, the catch value is highest for purse



seines, followed by encircling gillnets (Thiao & Ngom-Sow 2015).

The preferred gear varies substantially along the Senegalese coastline: While purse are common in all regions but mostly used along the coast close to Mauritania, Encircling nets are near exclusively used along the petite coast in Thiès Sud.

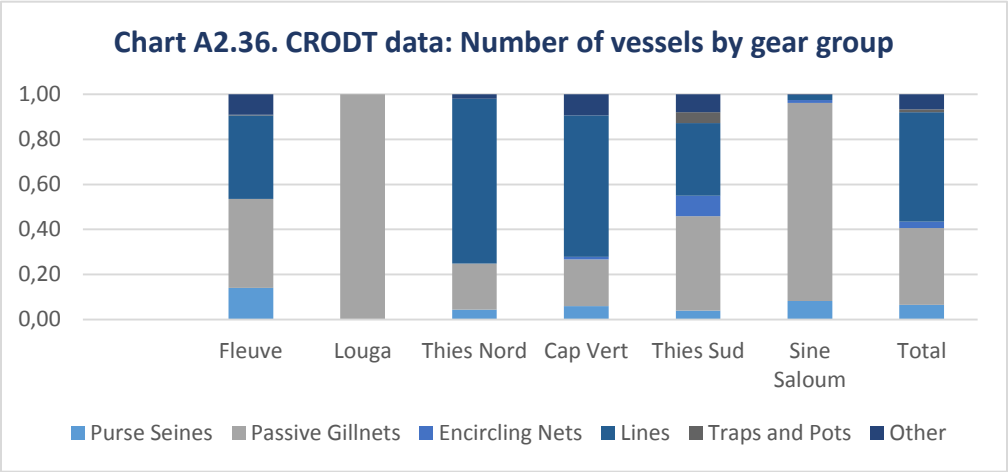
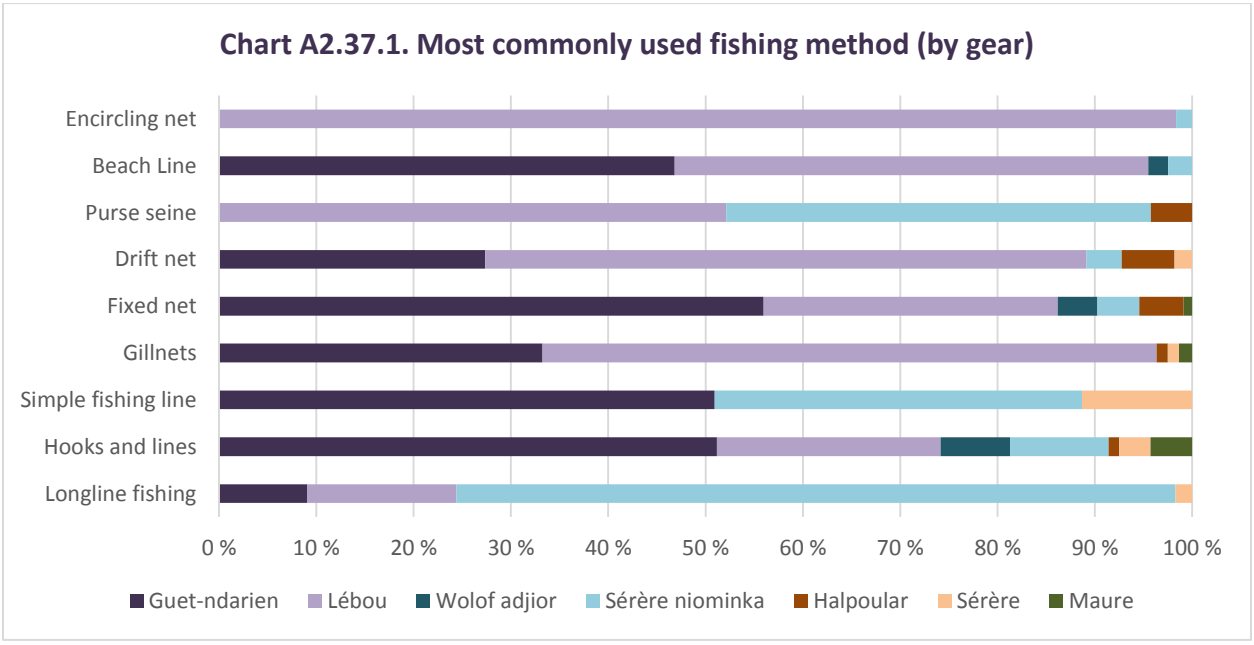
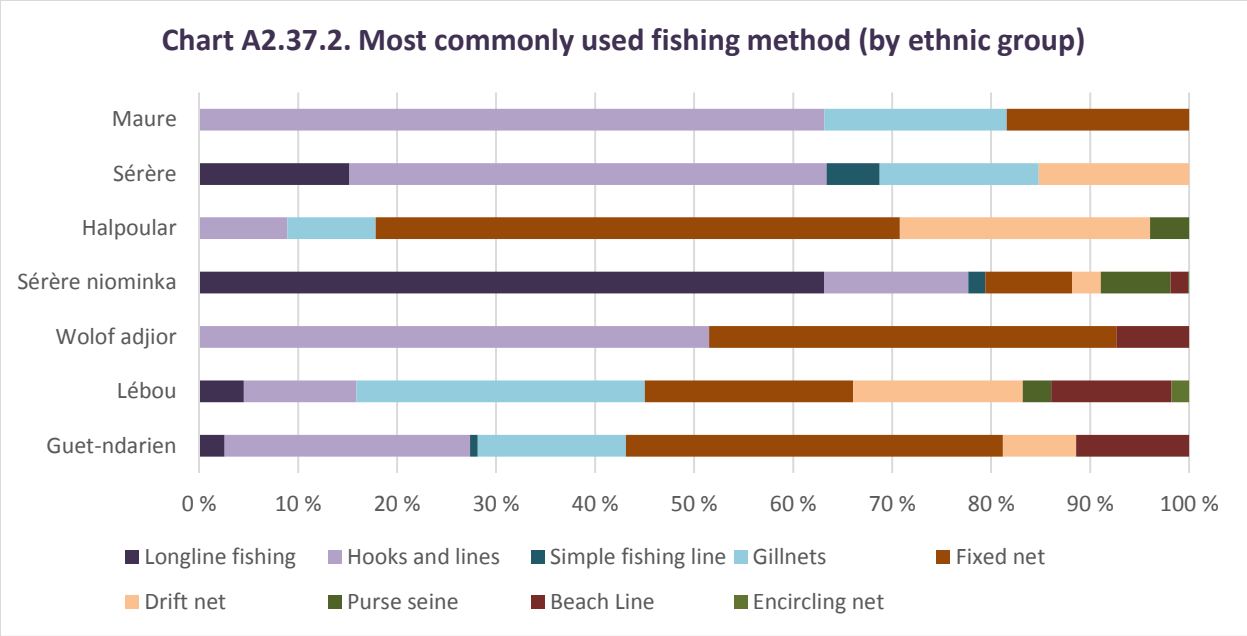


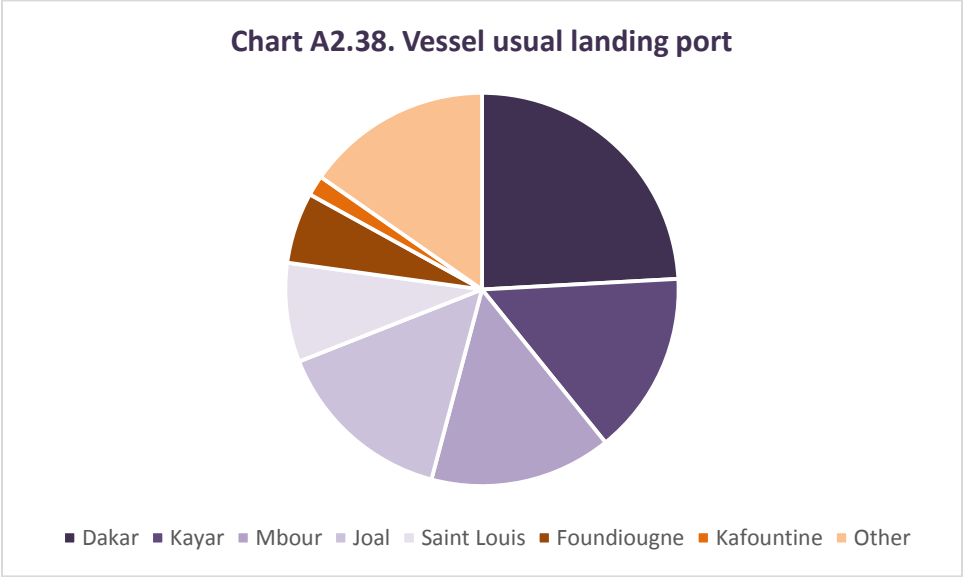
Chart 36 presents preferred fishing methods by locations. We can see that participants from Dakar use almost all of fishing methods, while those from Kayar use only hooks and lines, gillnets, fixed net and pot. According to the literature, this could hinge on traditional ethnic fishing methods. This view is partly supported by our survey results:

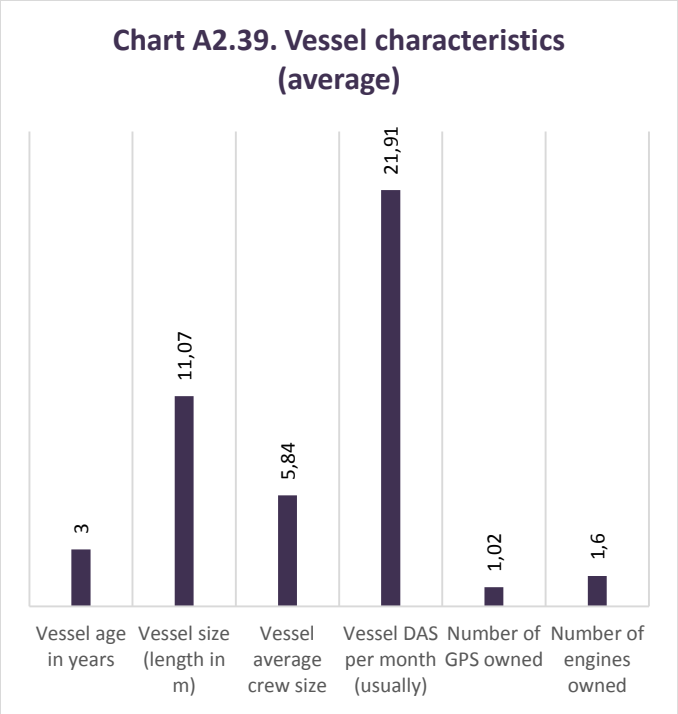
Charts 37.1 and 37.2 present preferred fishing methods by ethnic group of the participants. Participants that belong to Guet-ndarien prefer using fixed net and hooks and lines the most (13.20% and 8.60% respectively). Lébou participants use is spread over a wide range of gears. Interviewees belonging to Sérère niomka prefer using Longline fishing more than any other ethnic group.

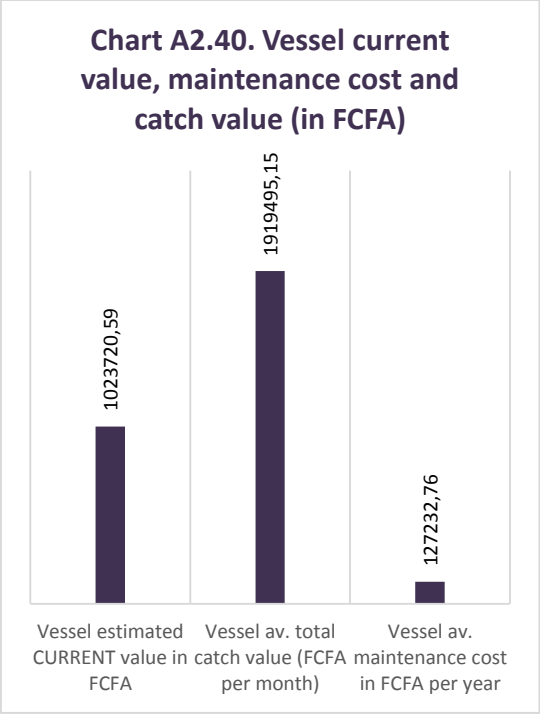




The following series of Charts (38-40) provides information on the landing port and characteristics of the vessel such as: age, size, crew size, days at sea per month, number of GPS and engines owned, vessel estimated current value, total catch value and maintenance cost.







Vessel details across departments and locations

Adding the administrative department or location as a second dimensional variable can help in clarifying the variation in vessel size, crew size and average monthly catch value. This is visible in the charts 41-43.

On charts we can clearly see that respondents from Kafoutine reported the highest vessel size, crew size and vessel value in opposite to those from Kayar. We can see the positive correlation between vessel size and its value when comparing two graphs.

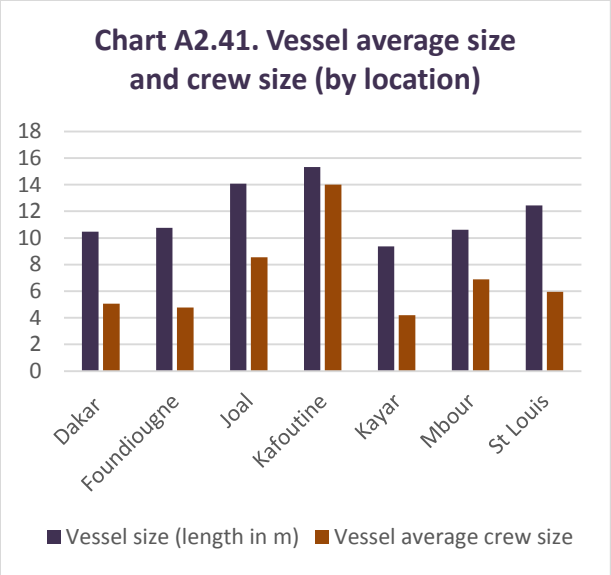


Chart A2.41. Vessel average size and crew size (by location)
18
16
14
12
10
8
6
4
2
0
Dakar
Foundiougne
Joal
Kafoutine
Kayar
Mbour
St Louis
Vessel size (length in m)
Vessel average crew size

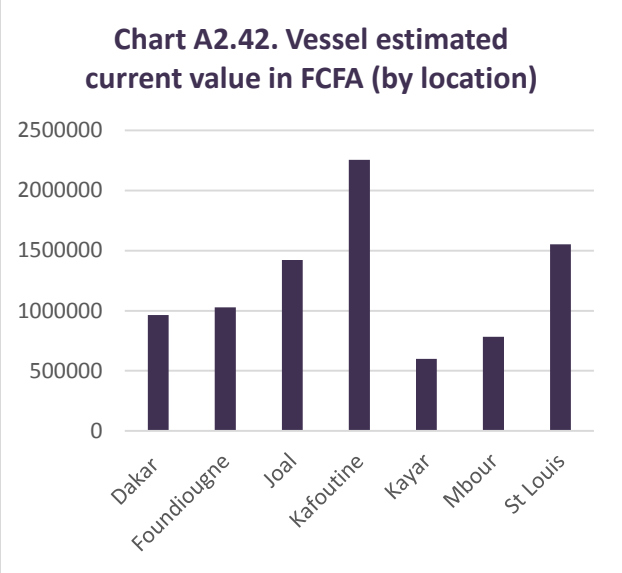
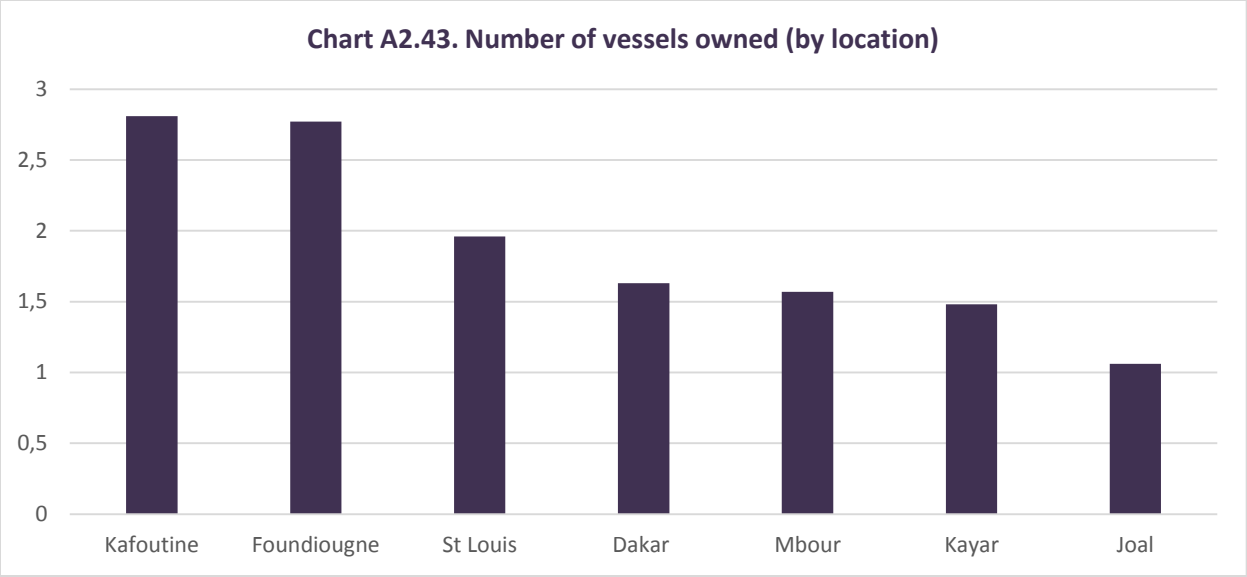


Chart A2.42. Vessel estimated current value in FCFA (by location)
2500000
2000000
1500000
1000000
500000
0
Dakar
Foundiougne
Joal
Kafoutine
Kayar
Mbour
St Louis



Respondents from Kafoutine and Foundiougne own more vessels on average than respondents from other locations (more than 2). Those from Joal own the smallest number of vessels on average (a little more than 1).

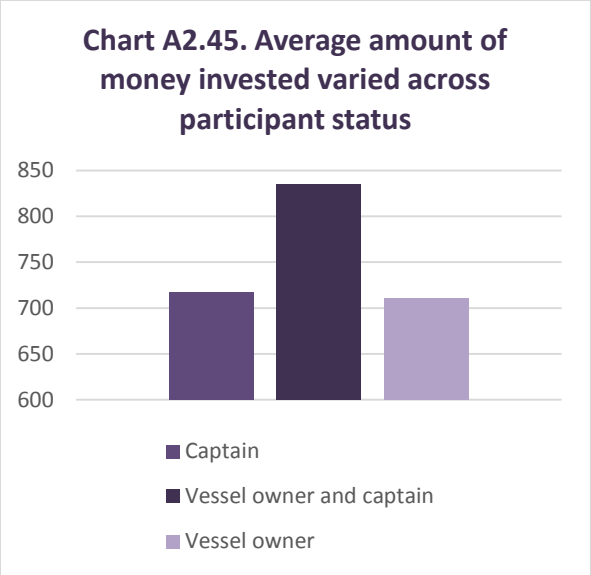
Chart 44 shows that residents of Saint Louis own the biggest vessels and residents of Joal own the smallest ones on average. Vessel and crew size is related to gear used.

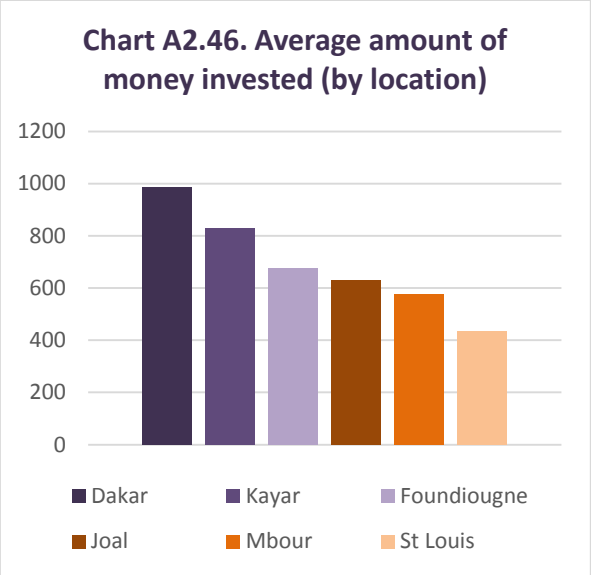
3.7 Experiment

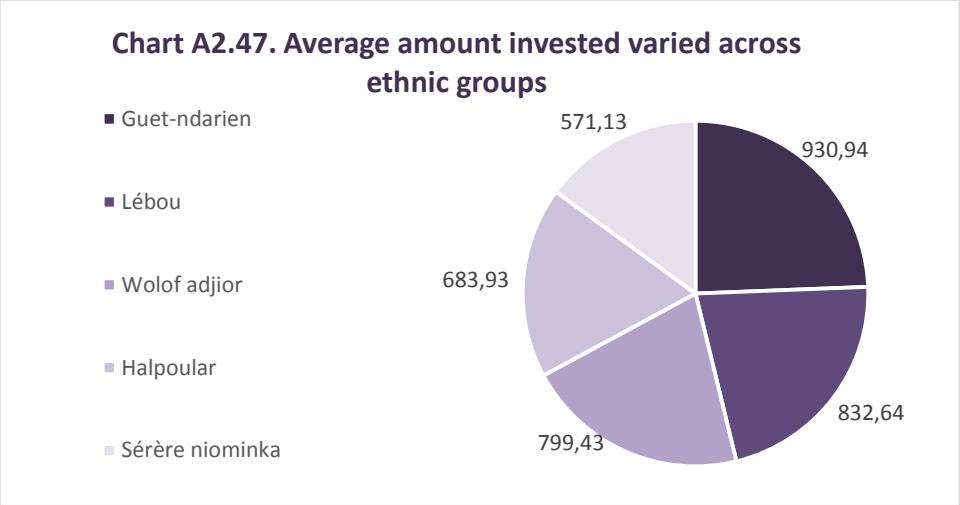
Participants were asked to conduct an experiment in which they could choose to save or invest a part of their payment (1200 FCFA) for completing the survey. The invested money would increase by 2.5 times depending on whether the participant drew a blue ball (asset wins, 50% draw chance) or a yellow ball (asset loses, 50% draw chance). The following charts show how the amount invested by participants vary across participant status and ethnic groups.

Chart 45 shows that participants that were both a vessel owner and captain invested on average more than other status groups (836 FCFA). From Chart 46 it seems that participants from Dakar have invested slightly more (988 FCFA) than the participants from other locations. The least amount was invested by interviewees from St Louis.

Respondents belonging to Wolof adjior invested the biggest amount on average (931 FCFA) and respondents belonging to Sérère niomka group invested the smallest amount on average (571 FCFA).







3.8 Processing Activities

Processing type

Chart 48 below shows the overall variation in processing among the participants. Kéthiakh, Guedj and Tambiadiang are the three most common processing types (multiple answers possible).

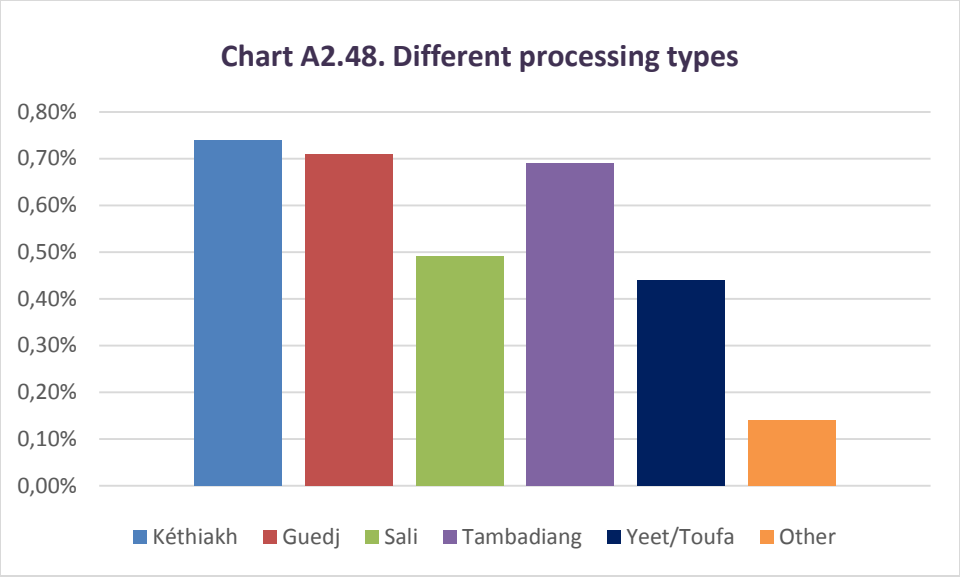
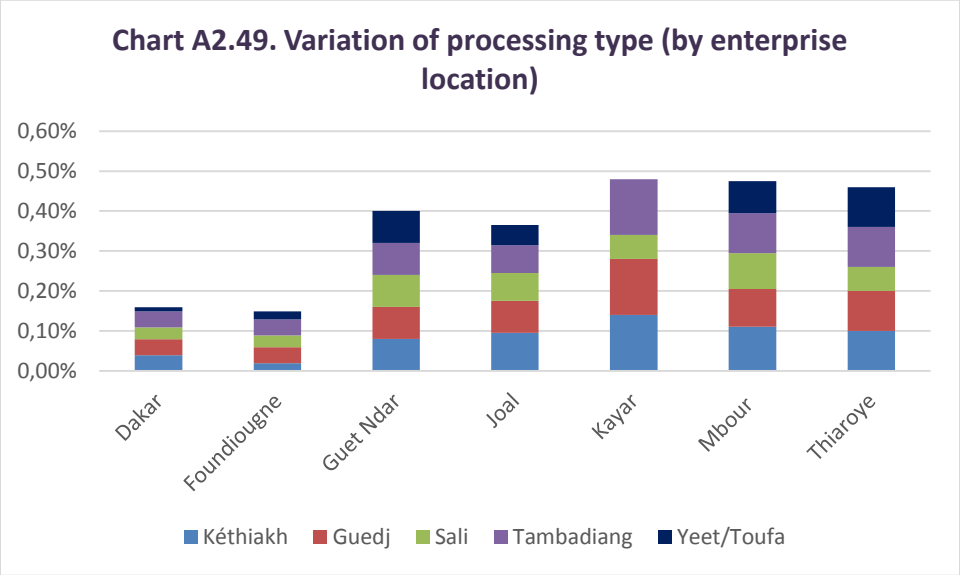


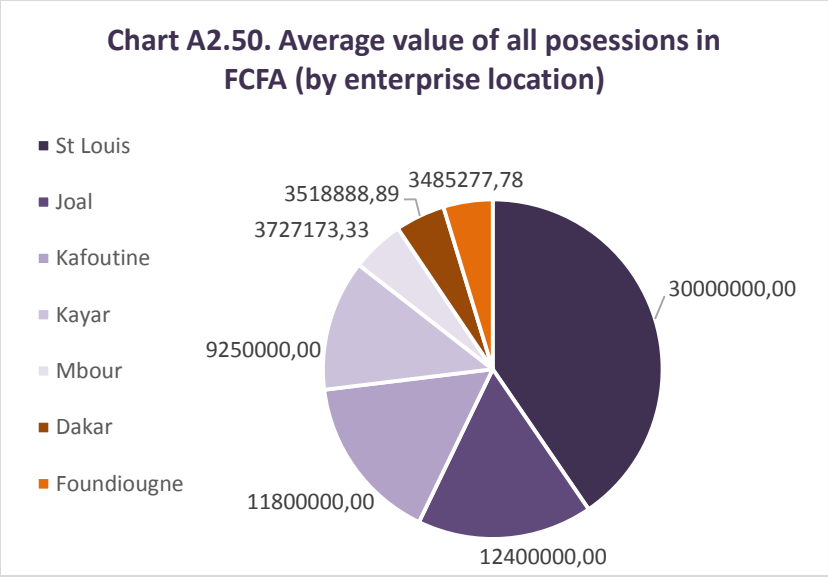
Chart 49 shows how the processing type varies across locations. Tambiading is the most common processing type across the different locations. Guet Ndar uses each processing type equally, while Kayar does not use Yeet/Toufa type at all.



3.9 Retailing and processing enterprise

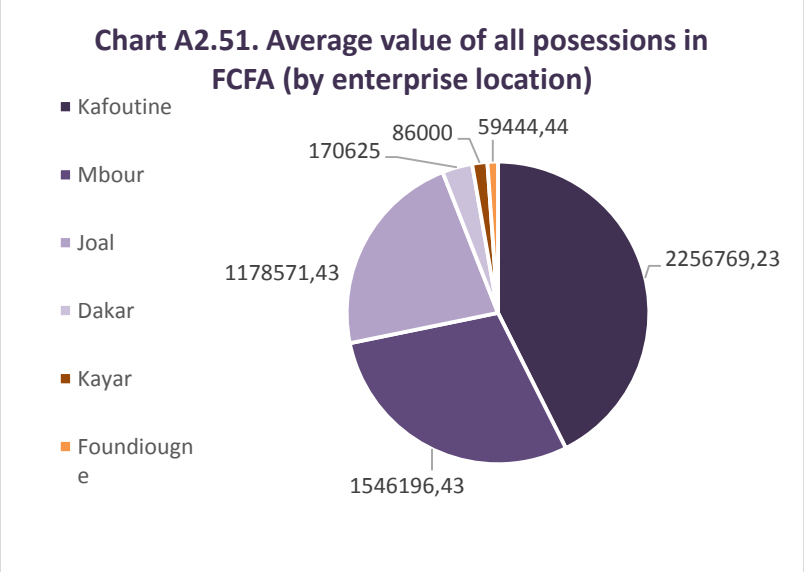
Retailing possessions

Chart 50 shows the average value of possessions interviewees from retailing business mentioned during the interviews. Those include: vehicles, vehicle refrigerators, cases, basins, scales, bins, boxes, balances, canoes, and other equipment. In total over all landing sites the average value is 7213691.30 FCFA. From the chart we can see that participants from St Louis spent the most amount of money on additional equipment followed by those from Joal and Kafoutine. The least amount of money is spent by participants from Dakar and Foundiougne.



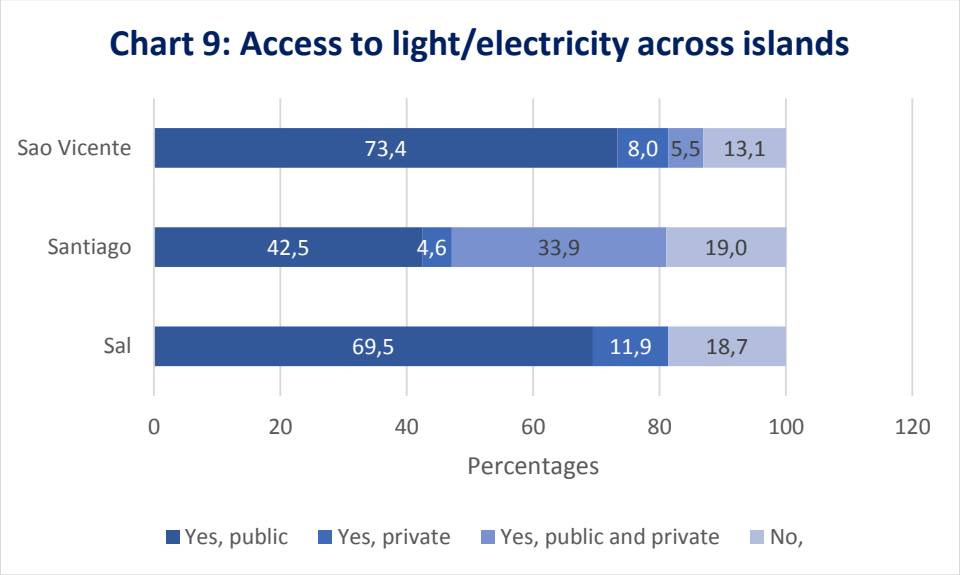
Processing possessions

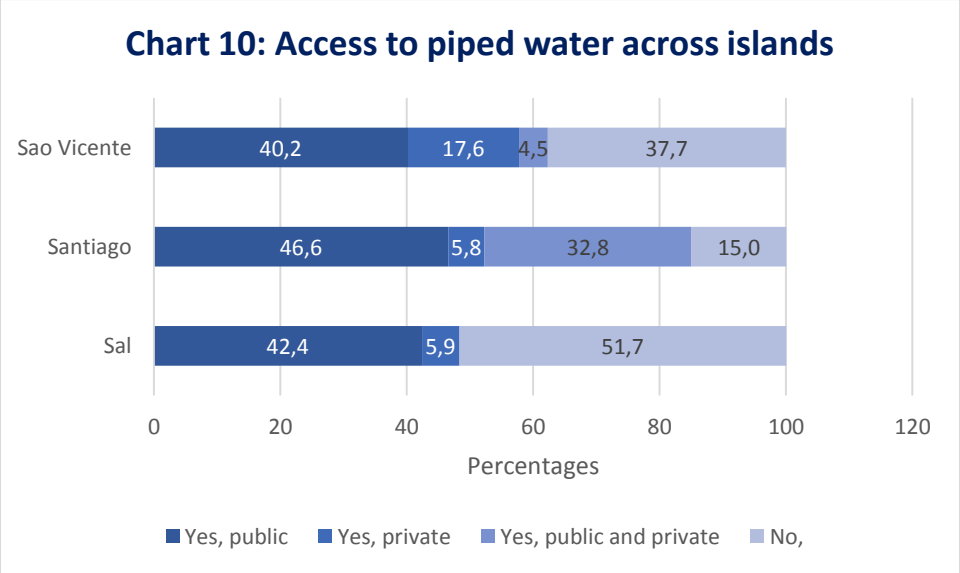
Chart 51 shows the average value of possessions interviewees from processing business mentioned during the interviews. Those include: tables, ovens, basins, scales, shovels, buckets, and other equipment. In total over all landing sites the average value is 1117316.27 FCFA. From the chart we can see that participants from Kafoutine spent the most amount of money on additional equipment followed by those from Mbour and Joal. The least amount of money is spent by participants from Kayar and Foundiougne.

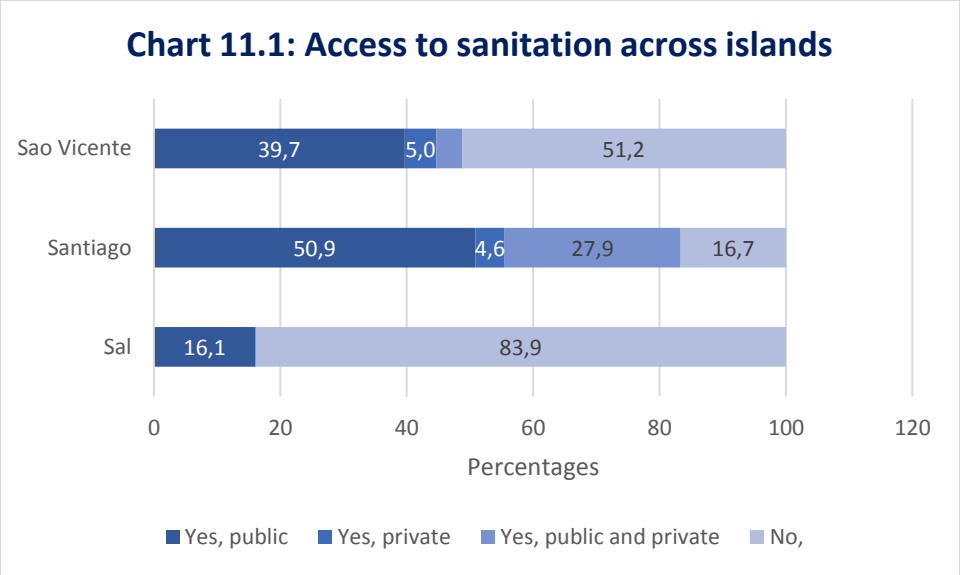


To break down these living standards, some three of the most important details of the living standards are depicted below, these are 1) access to light/electricity, 2) access to piped water and 3) sanitation. From the charts it is clear that access to light/electricity is the most enjoyed public service on all of the island groups, whereas access to sanitation is the least enjoyed service on each of the island groups but particularly lacking in Sao Vicente (51.24% does not have access to sanitation). Private access to each of

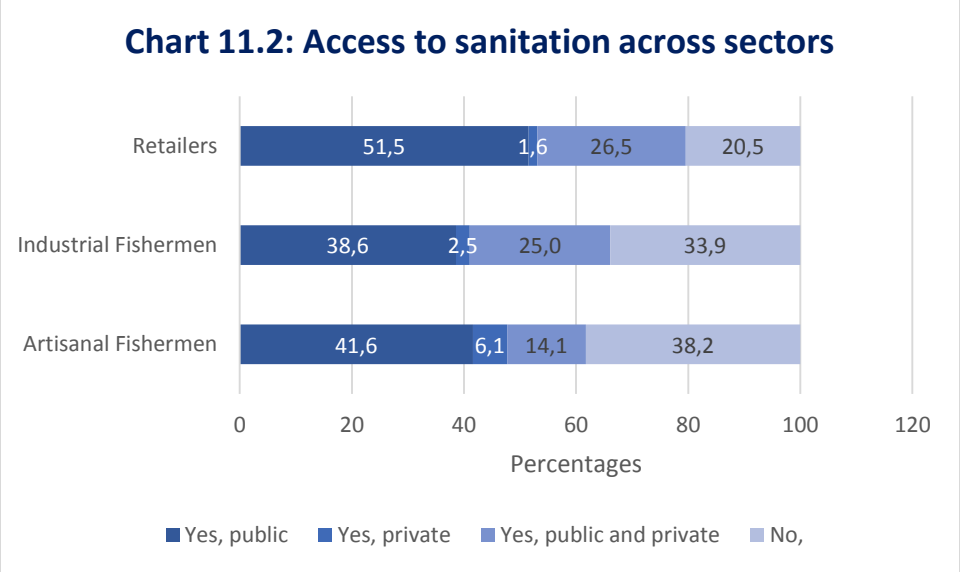
the mentioned services is very scarce on all three island groups, this is especially noteworthy for sanitation.



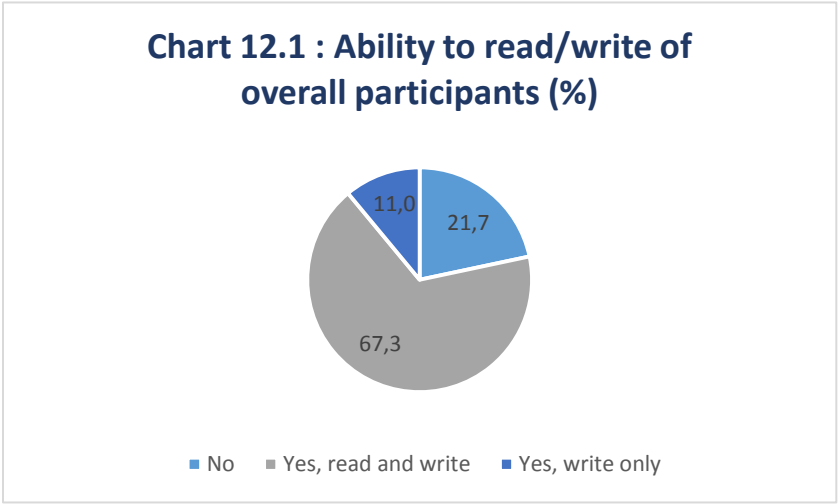




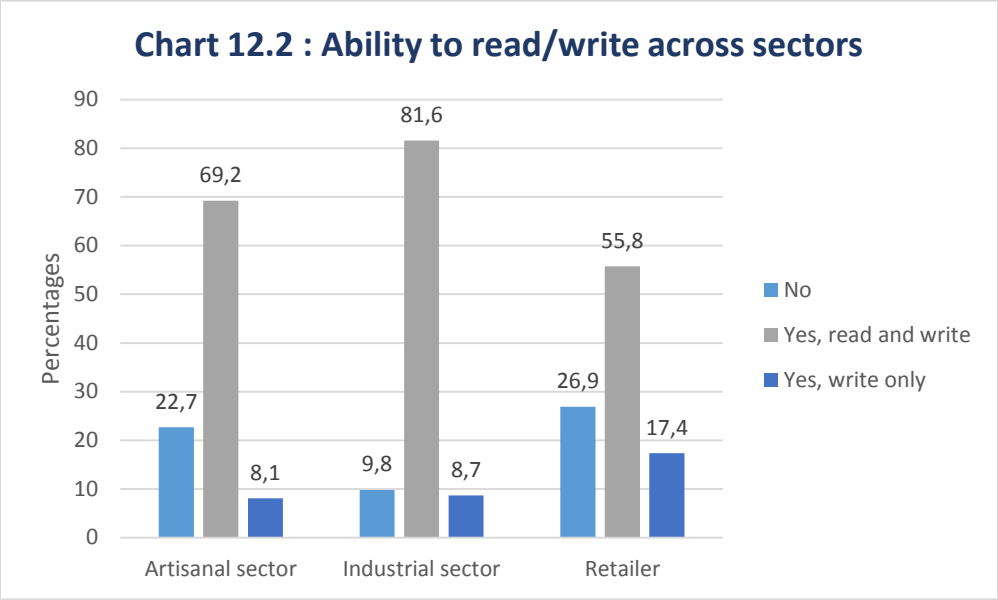
Because of this is it is interesting to see how access to sanitation differs across the different sectors, this is shown in Chart 11 below. From this chart one can read that the sector that has the least access to sanitation, are the artisanal fishermen. From this chart one can read that the sector that has the least access to sanitation, are the artisanal fishermen.



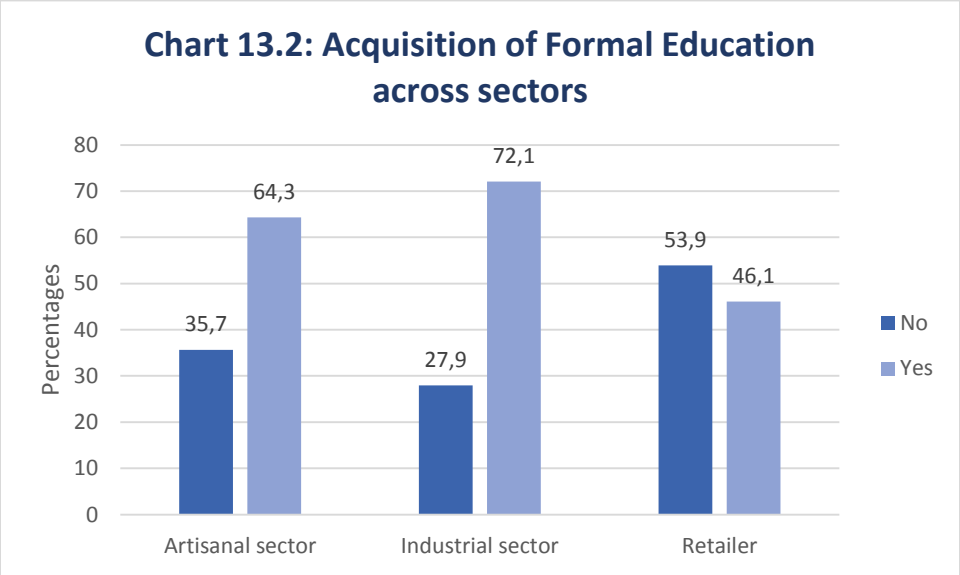
The ability to read or write of all the participants is shown in Chart 12 below. Most participants know how to read and write (67.3%), some can only read. The most significant result among the sectors is visible in the industrial sector, where 81.6% knows how to read and write, whereas the lower percentage appears for artisanal fishermen



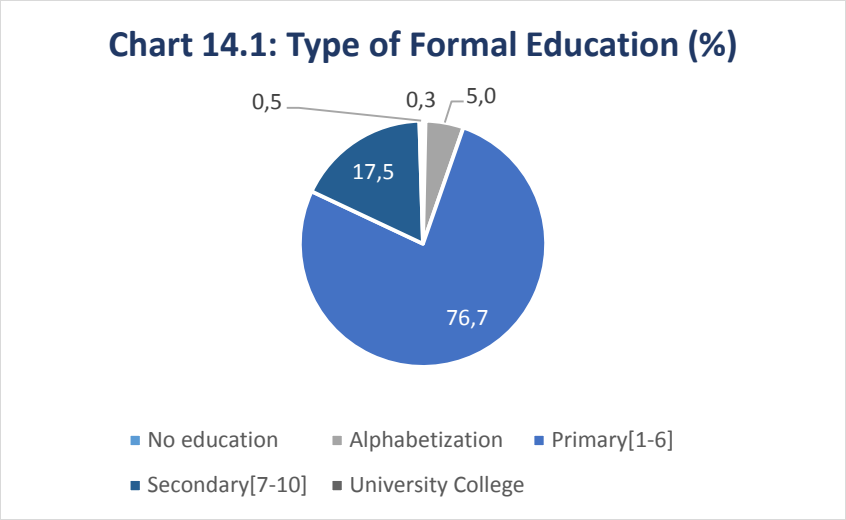
(69.2%). Apart from that, the highest illiteracy percentage appears in the retailer sector.

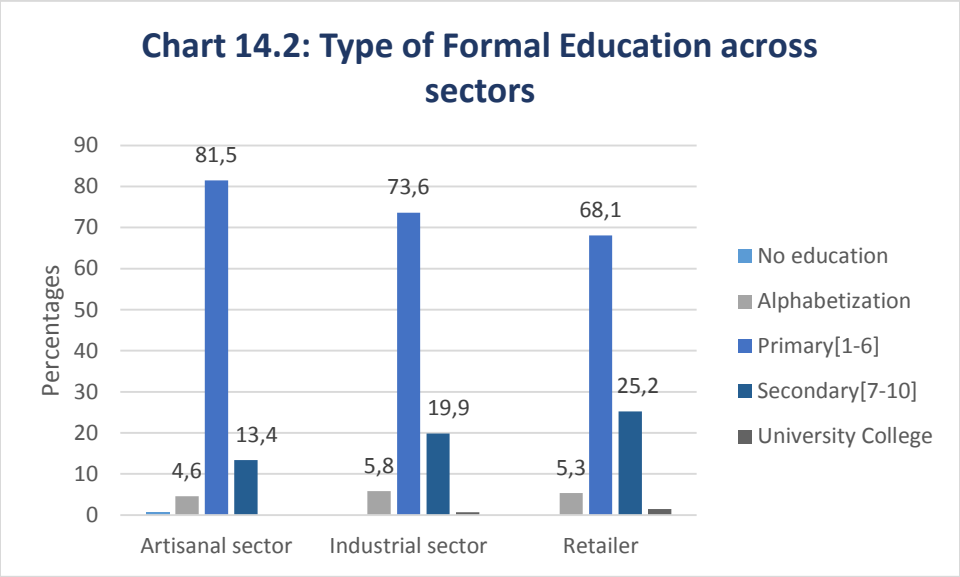


Whether participants hold formal education is given in Charts 13 below, 60.15% of participants hold formal education, the highest amount being in the industrial sector and the lowest amount being in the retail sector (72.1% vs 46.1%)

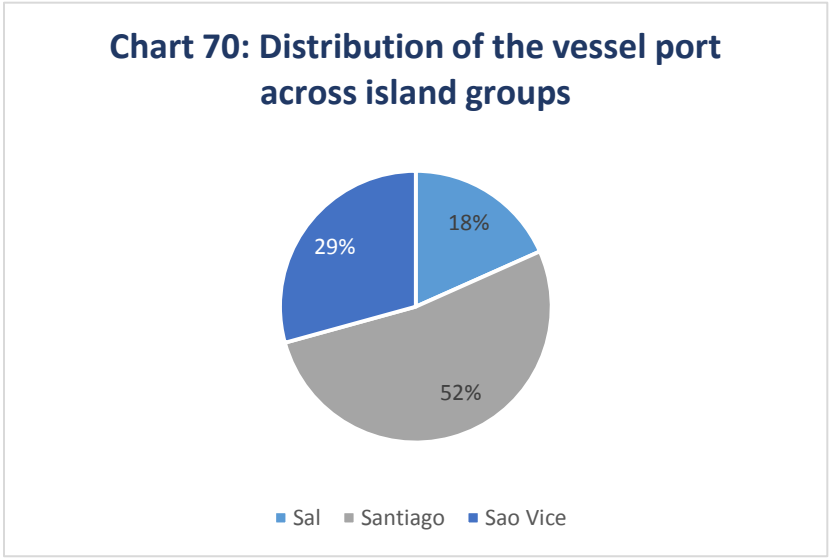


The distribution of the different types of formal education is given in Charts 14, 76.7% of the participants finished primary school, 17.5% finished secondary school and little as 0.33% finished university or college. Surprisingly, even though illiteracy and acquisition of formal education is highest in the retail sector, so is the acquisition of a university or college degree.

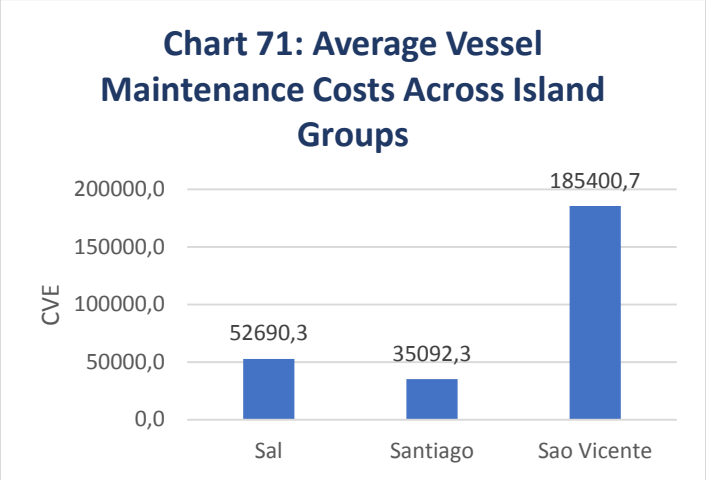




This part will analyze the vessel specific variables from a Vessel Database, each observation is thus a vessel and not a participant. First of all, the vessel ports are distributed among the island groups in the following way – Chart 70



When it comes to the vessel specific fishing method, we can see that the main fishing method in Sal is the Handline (100%), in Santiago the main fishing method is also the Handline (90%) followed by the Gillnet (6,8%). Lastly, in Sao Vicente, the two most used methods are the Handline (63,9%) and the Purse Seine (26,8%). Charts 71 – 77 gives an overview on how vessel specific characteristics differ across the island groups (which are based on the port's location).



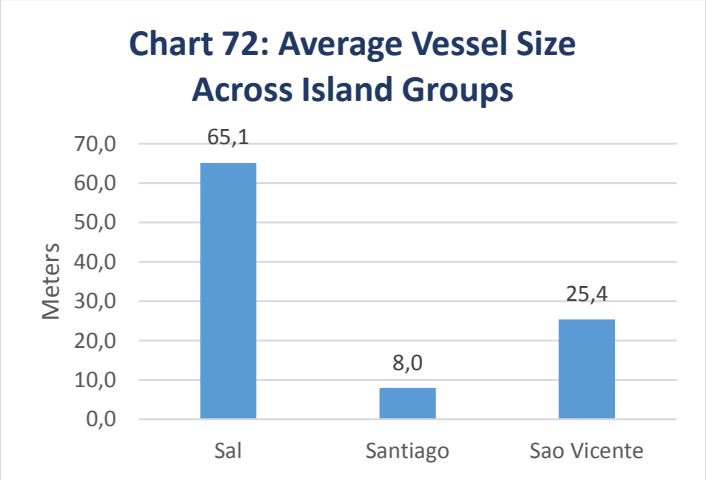


Chart 73: Average Vessel Value Across Island Groups

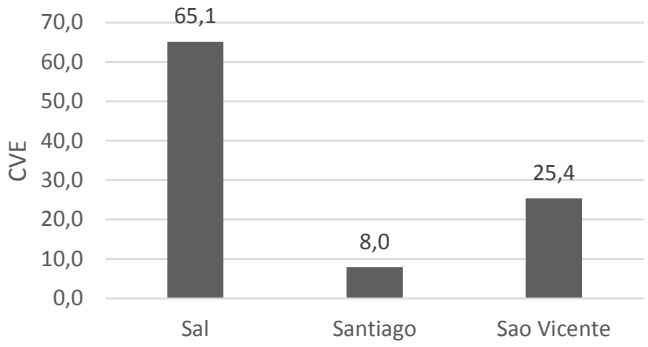


Chart 74: Average Vessel Monthly Catch Across Island Groups

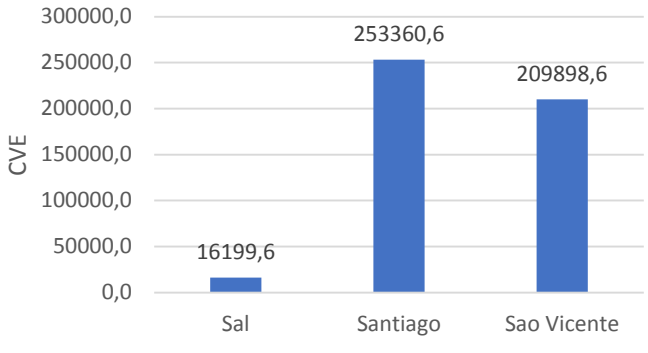


Chart 75: Average Vessel Age Across Island Groups

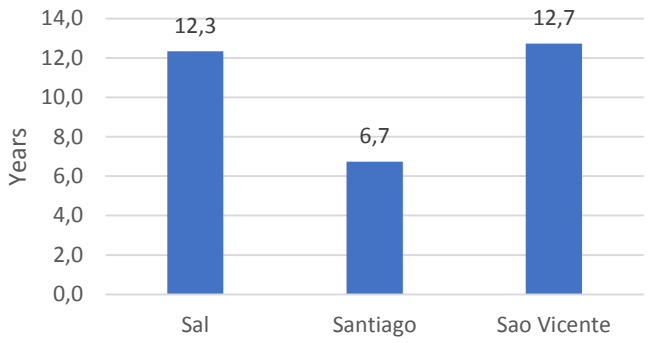


Chart 76: Average Vessel Travel Distance Across Island Groups

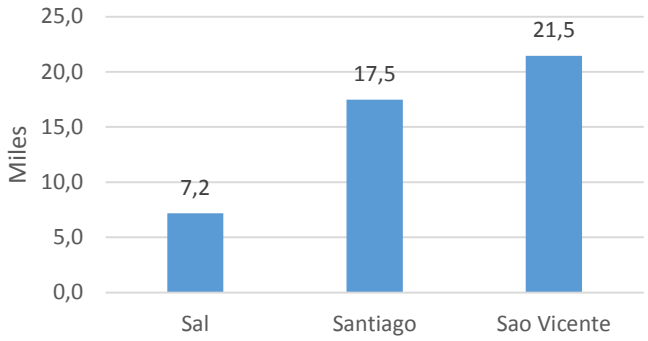


Chart 77: Average Vessel Crew Size Across Island Groups