Is migration in the Mediterranean getting safer? - A comparison of three different routes and its changing pattern over time *

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Introduction

The number of migrants, especially forced migrants are increasing at a rapid phase worldwide. According to the 2018 report from the International Organization for Migration (IOM) [IOM's Global Migration Data Analysis Centre, 2018], 68.5 million individuals are forced to migrate in 2017 because of persecution, conflict, generalized violence, or human rights violations. The issue gets notably salient in 2015 following so-called 'refugee crisis' due to the Syrian civil war. Meanwhile, on 2nd September 2015, the picture of drowned 3-year-old Syrian boy, Aylan Kurdi in the Mediterranean Sea alarmed the world the seriousness of the issue and the difficulties which migrants face during their journey. However, despite its political saliency, there are still a lot of data gaps in migration research. IOM pointed out the issue in its 2018 report, insisting the necessity to fill out data gaps in the topics such as irregular migration, missing migrants and migration flows. "Missing Migrants Project [IOM]" by International Organization for Migration (IOM) began to fill the gap in quantitative data concerning migrants' journey after the tragic accident at October 2013, when two ships have wrecked near the Italian island of Lampedusa which caused the death of at least 368 individuals. Missing migrants project tracks the missing of refugees and asylum-seekers during their migration journey combining different data sources. By providing information about missing migrants, missing migrants project not only notify the world with the precarious situation migrants face but also point out the possible improvement in regulatory or administrative system to ensure safe migration journey. This achievement is important to tackle the United Nations' Sustainable Development Goals (SDGs) [**?**]. Migration is a cross-cutting issue that is relevant to all SDGs. The Agenda's core principle is "leaving no one behind". Especially Goal 10.7 underlines an "orderly, safe, regular and responsible migration and mobility of people". Therefore, it is mandatory to understand patterns of migrants' journeys in order to achieve this goal by 2030. The number of missing migrants can serve as a helpful indicator. However, the data of the project should be seen as approximations because the true number of missing migrants is unknown. It is not possible to report all deaths and disappearances because many bodies will never be found or identified. IOM has recognized the importance of adopting the big data in migration research to fill the gap in quantitative data [Black et al., 2017a]. With acknowledgement of necessity to implement big data, Missing migrants project combine various sources and type of data to track the missing migrants information, from national authorities to interviews of migrants. To dedicate to the aim of the missing migrants project, this report tries to explain the present of migration route and the dangerousness of different routes in the Mediterranean area, taking full advantage of the data offered by missing migrants project. Since migration is a continuous process that never stops, it is necessary to keep a constant eye on the changing patterns of migrants' travel. Therefore, this report analyses different routes of migrants in the Mediterranean Sea and compares changes over time. Also, this report tries to figure out possible factors affecting the journey to prevent further incident. To achieve this aim, this report begins by explaining the various migration routes, especially focusing on three different routes in the Mediterranean area. Then this report proceeds to explain the missing migrants project and the uniqueness of the data, along with the necessity to use big data for migration research. After that, death and missing of migrants on those routes are presented, suggesting the possible cause of dangerousness of the routes. Lastly, the report discusses the limitation of the report and suggest a possible improvement of the report by combining the data with weather data.

Theoretical Background

All over the world people are trying to escape persecution, conflicts or violence. They leave their home country, family and friends in hopes that they will have better economic and social opportunities in the receiving country. However, migrants and refugees are often at high risks of serious human rights violations and death on their journey to better expectations. The route they take is often an important factor in calculating the risk of death. Each route has its own pattern, which change over time due to multilateral agreements or the development of conflicts. Moreover, migrants' economic situation also matters. Their financial security affects whether they can afford to pay smugglers. The price migrants pay a smuggler for their journey on the Mediterranean Sea is responsible for their place on a boat. Places on the top deck are more expensive, because in the event of a shipwreck, it is easier to escape from above than from the inside of the boat [IOM's Global Migration Data Analysis Centre, 2016]. Smugglers can charge a lot of money tickets because places on a boat to get to Europe are sought after. The popularity of the route is one reason why this report focuses on the Mediterranean area. Migrants' journey to Europe is closely linked to a high risk. According to the International Organization of Migration (IOM), about two thirds of the total number of deaths and disappearances worldwide occur on migrants' way to Europe. This is mainly due to oversea routes [Black et al., 2017b]. However, it is also possible that many more died on their way to the country of departure. But deadly incidents which happen overland are reported less frequently, as migrants are often alone or only accompanied by one or two other migrants compared to oversea journeys. The large number of reported incidents on the Mediterranean oversea routes is another reason why this report focuses only on this area [Black et al., 2017b]. There are mainly three main routes to come to Europe oversea: Eastern Mediterranean route from Turkey to Greece, Central Mediterranean route from North Africa to Italy and Malta and finally the Western Mediterranean route between Morocco and Spain. At the beginning of the "refugee crisis" in 2015, the route through the Eastern Mediterranean was migrants' most important irregular entry to Europe, mainly used by Syrians and Afghan citizens but also by migrants from South Asia. After the implementation of the European Union - Turkey announcement on March 18, 2016, arrivals declined rapidly. The goal of the agreement was to restrict irregular migration routes from Turkey to the EU, create better living conditions for migrants who need to stay in Turkey before they can continue their journey, and to guarantee legal migration to Europe. In addition to reducing the number of migrants entering Europe irregularly, the agreement has brought financial and political benefits for Turkey. As a result, arrivals to Turkey dropped by around 97 percent [European Commission, 2019]. The consequences for migrants on their way to Europe were immediately obvious. 83 percent of deaths were reported before the implementation of the agreement in March 2016 [IOM's Global Migration Data Analysis Centre, 2017a]. Hence, migrants had to consider other options to get to Europe and the importance of the Central Mediterranean route increased. Embarking to Italy or Malta mainly takes place in Libya, but also in Egypt, Tunisia or Algeria some vessels start their journey to Europe. The route is mainly used by migrants from Sub-Saharan Africa, Horn of Africa or Western Africa [Black et al., 2017b, The UN Refugee Agency, 2018]. According to the International Organization of Migration, the Central Mediterranean route is considered to be the deadliest migration route in the world. It has the highest number of deaths and missing migrants in the Mediterranean sea. Between 2014 and 2017, 1 in 50 migrants died on their way crossing the sea from Africa to Italy. This number is especially striking in comparison to the Eastern Mediterranean route where 1 in 900 migrants died or disappeared [Black et al., 2017b]. Although the number of migrants arriving in Italy fell by 65 percent between July and September 2017, the number of reported dead and missing migrants decreased by only 47 percent [Black et al., 2017b]. There are many hypotheses as to why the total number

of migrants has decreased, but the number of fatalities has not. One explanation is based on reports which indicate that migrants are stranded in Libya. The government is preventing them from making their way to Europe [Amnesty International, 2015]. Another possible factor is the increased use of less-seaworthy vessels by smugglers. The IOM assumes that a higher proportion of rubber dinghies are used. These vessels are less robust than wooden boats and may deflate during the journey. The increased number of deaths on this route may also be related to increasingly dangerous smuggling practices, where more than one boat leaves Libya at a time or embarking is not restricted to better weather and sea conditions anymore [Black et al., 2017b]. The third route, which is less covered by media, is the Western Mediterranean route. Comparatively few migrants use this route for their crossing, which is one reason for the lower level of global attention. This makes it difficult to estimate the number of deceased and missing migrants as the incidents are less well known. However, the importance of this route is raising. While between January and September 2016 only 3,808 migrants crossed the Mediterranean Sea from Morocco to Spain, which is only 14 kilometers wide at its narrowest point, 12,122 migrants crossed the borders in the same period in 2017 [IOM's Global Migration Data Analysis Centre, 2017b]. So far, the number of dead and missing migrants has increased every year of the IOM's project. Of course, this is partly a result of the increased total number of migrants. One reason for the raising arrivals in Spain is the uprisings in the Moroccan Rif region in 2016/ 2017. However, the increase in deaths in relation to the number of arrivals in Spain shows that migration is becoming increasingly dangerous here too. On reason for the rising number of deaths is that the successful crossing of border fences between the two countries over many years has been made more difficult by the increase in the number of security forces. Nowadays, the escape from Morocco has increasingly shifted to boats or to trying to cross the Mediterranean by swimming through the ocean.

The literature review reports that the patterns and dangers of the Mediterranean routes are constantly changing due to intergovernmental agreements, increased frontier protection or emerging conflicts. With regard to the United Nation's Sustainable Development Goal 10.7 which aims an orderly and safe migration, current literature indicate that migration has become less and not more safe. Nonetheless, former literature only concentrate in their reports on a particular year or route. This reports aims to provide an overview of the changing patterns in all three Mediterranean routes from 2014 - 2019. Does a comparison of all routes reveal that migration has become less safe? What are consequences of the EU-Turkey agreement? Can the data confirm the hypothesis that embarking is no longer restricted to good weather conditions? What is the general trend for developments in 2019? For the descriptive analysis, this report uses the latest available data from the UN's missing migrants dataset, which was updated on May, 09 2019. To the best of our knowledge, a report on the latest developments in 2019 has not yet been published.

Data and Methods

The present report uses the data provided by the 'Missing Migrants Project', conducted by the International Organization for Migration (IOM). The missing migrants project has begun after witnessing the tragic incident at October 2013 near the Italian island of Lampedusa, where two shipwrecks led to the deaths of at least 368 migrant individuals. In response to the incident and the total rising number of migrants, IOM launched the missing migrants project to report the present migration. The aim of the project is to improve the precarious situation migrants encounter during their journey. Missing migrants project provides information about the missings and death of the migrants at the external borders or during their journey due to transportation accidents, shipwrecks, violent attacks, or medical complications. Missing migrants project;s data and content is freely available at the project's website. The missing migrants project has its strength in

the fact that they gather information from diverse sources, employing not only traditional media but also social media to find data. The information sources range from official records to media reports, NGOS, and surveys and interviews of migrants. To provide latest data, missing migrants provide the number of arrivals and crossings for the current year every Monday and Thursday. To be specific, in the Mediterranean region, national authorities deliver the information to IOM field missions. At landing points in Italy and Greece, IOM and other organizations which receive survivors obtain the data. Also, IOM cooperates with UNHCR, the United Nation Refugee Agency, at the Mediterranean region to validate the data on missing migrants. On the other hand, on the United States and Mexico border, U.S county medical examiners, coroners, sheriff's officers and media reports covering the death on the Mexican side of the border provide and accumulate the data. Lastly, in Africa, media, NGOs, such as Regional Mixed Migration Secretariat and International Red Cross or Red Crescent gather the data concerning the issue. The missing migrants project covers various information about migrants' missings and death. It includes the region of incident, reported date, reported year, reported month, number dead, number missing, total dead and missing, number of survivors, number of females, males, and children, age, country of origin, region of origin, cause of death, location description, location coordinates, migration routes, UNSD geographical grouping, source quality, and further comments. The number of deaths indicates the total number of people confirmed dead in an incident. The people who are presumed to be dead due to an incident such as shipwrecks are left to be blank. Meanwhile, the number of missing migrants covers the shipwreck in general. It is recorded by subtracting the number of bodies recovered and the number of survivors from the total original number of migrants on the boat. The information also relies on a report by surviving migrants or witness. Where there are no reported missing migrants, it is left blank. The age of decedents is occasionally substituted with estimated age range. If it is not reported, it is left blank. Region of origin of the decedent's are at times recorded as 'Presumed' or (P) and if it is unknown, 'unknown' is recorded. When the cause of death could not be identified, the reason for the missing of identification is recorded (e.g., Unknown - Skeletal remains only). Migration routes show the migration route where the incident took place. With the help of this variable it is possible to examine changing patterns of the different routes mentioned above in the Mediterranean Sea. Lastly, source quality describes the quality of the incident's information with the 1-5 level. Level 1 incidents are based solely on a media source, level 2 incidents are based on uncorroborated eyewitness or data from survey respondents, and level 3 are based on information from more than one media reports. On the other hand, level 4 incidents have to be based on information from at least one NGO, IGO, or another humanitarian actor with direct knowledge of the incident. Level 5 incident is the information from official sources such as coroners, medical examiners, or government officials from multiple humanitarian actors. Hence, the methodologies seeking for maximal accuracy and timeliness are employed. However, it is important to keep in mind that the data can only be seen as approximations due to the difficulty in obtaining these data. Nonetheless, the project's data can serve as a good starting point to analyse the scale and trends of the routes that migrants take.

All the analysis is done with the software R and Python. To make data comprehension easier, many graphs and charts are used to describe the data. Furthermore, ANOVA test is done to test the differences between the months.

Results

The following section presents the results based on the latest available data from the IOM's Missing Migrants Project from 2014 to 2019 (up to the most recent dataset available). In the case of this report, this is the one from May, 09 2019. Hereby, the analysis concentrates on different patterns

of different routes and their changes over time. Of particular interest are changes by months and the development of survival rates per incidents.

As already suspected by literature, most fatalities occur in the Mediterranean region (see figure 1). This finding is stable over all years. During the peak of the "refugee crisis" in 2015, the number of missings and deaths reached its maximum. Although the total number of incidents decreases year to year, the general trend that most deaths and disappearance are reported in the Mediterranean continues until 2019. Figure 1 confirms the hypothesis in other reports that many migrants die before they reach the country of departure. This is emphasized by the changing patterns of incidentes in Southeast Asia and Africa, reflecting the development of migration following the implementation of the EU-Turkey Agreement in March 2016. As already stated in the theoretical background, the Eastern Mediterranean route, mainly used by migrants from the Middle East and South Asia, lost its importance due to the changing circumstances for migrants after the announcement. Hence, the new preferred option of migrants goes through Africa and and the route of the Central Mediterranean is increasingly being used.
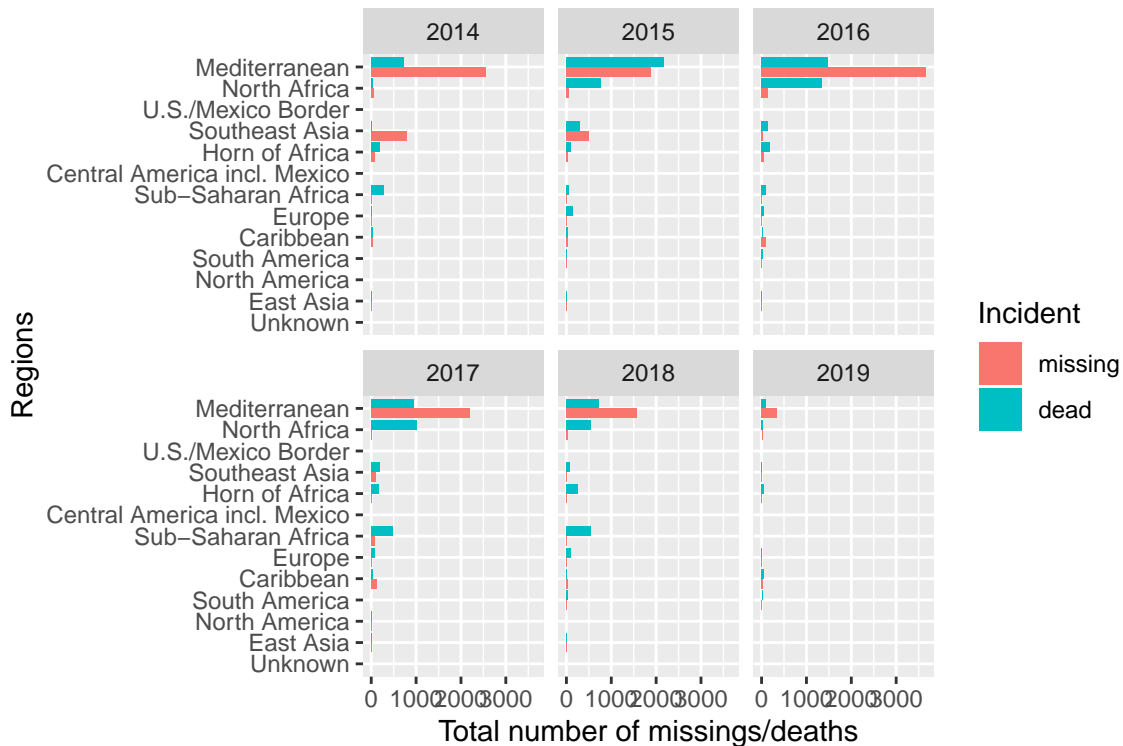

Figure 1: Total number of missings and deaths by region

The implementation of the agreement and the associated increase in the use of the central routes serves as an explanation why incidents in South Asia decreased in 2016 and increased simultaneously in Sub Saharan Africa and the Horn of Africa. A closer look at the three different routes also reveals different patterns over time.

Figure 2 shows the total number of deaths and missings per incident over time. Firstly, it stands out, that the Central Mediterranean route is responsible for most deaths and missings. This is consistent with literature in which the IOM declares the route to be the most dangerous migration route in the world. Even before the peak of the migration crisis in 2015, many migrants died crossing the Mediterranean from Africa to Italy. Another peak of fatalities is in 2016, which may
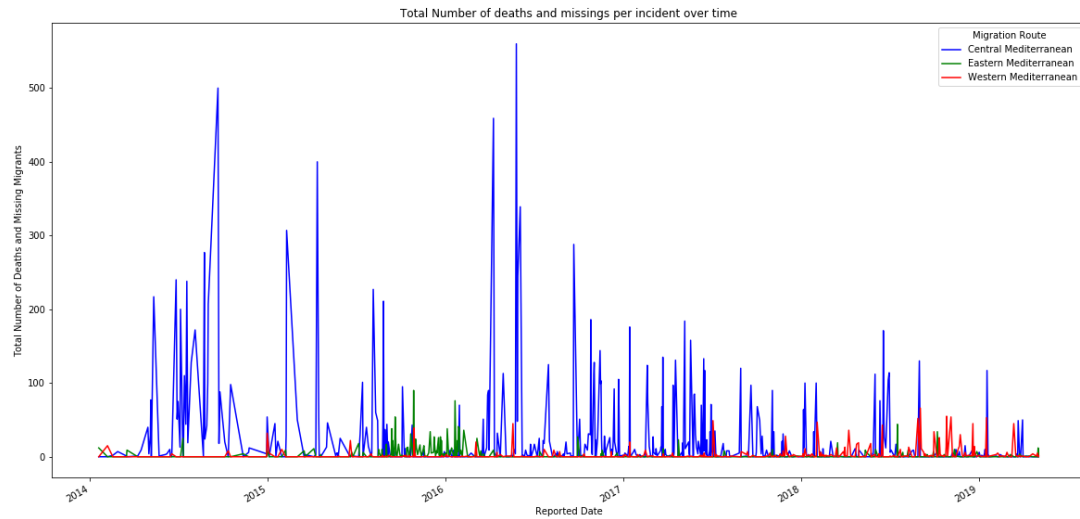
5

Figure 2: Total Number of Incidents in the Mediterranean over time

also be a consequence of the increased use of this road after the implementation of the EU-Turkey agreement. The consequences of this agreement is also present in the analysis of the patterns of the Eastern Mediterranean route. After 2016 the number of deaths decreased which is due to less intensive use of this route. Looking at the Western Mediterranean route, the number of deaths and missings has increased from year to year. This finding is also consistent with literature which mentions in reports that this route is becoming increasingly dangerous. In summary, the overall trend is that the number of deaths and missings is decreasing. Nevertheless, according to the literature, the number of dead migrates increases compared to the decreasing number of migrates. Hence, the reports indicate that migration is becoming more dangerous.

Comparing the proportion of deaths and survivors within an incident, the data pictures a more positive view of changing patterns of migration over time (figure 3). At first glance, it is striking that the percentage of survivor was lowest in 2014. However, one has to keep in mind that the survival rate is not based on the total number of arrivals in the destination country but on the number of survivors within a reported incident. Starting with the Eastern Mediterranean route, the figure shows that each year the percentage of survivors within an incident increases. While only 32 percent survived in 2014, the survival rate rose to 71 percent in 2017 and up to 90 percent in 2019. This finding may be due to the fact that smugglers used smaller boats after the implementation of the EU-Turkey agreement to avoid detection by authorities. Fewer people on the boats facilitate rescue operation by lifeguard boats in the event of any difficulties at sea, thus increasing the survival rate. When focussing on the Central Mediterranean route, no clear pattern can be displayed. As on every route, the survival rate was lowest in 2014 at 60 percent and peaked in 2016 with 77 percent and 75 percent, respectively, in 2018. Analysing patterns of the Western Mediterranean route, the high proportion of deaths and missings in 2016 is striking. This year, only 27 percent survived an incident. Thereafter, however, the survival rate rises again and reaches 68 percent in 2018. The low percentage of survivors in 2016 might be due to the increase in migrants using the route in 2016 because of the emerging conflict in Morocco. Hence,

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Figure 3: Precentage of incident by Mediterranean route

migrants have not yet had helpful information to rely on for their journey from Morocco to Spain and have had to search for safe option themselves. Moreover, rescue operations were probably not yet ready to intervene in this region. To conclude, although according to the literature the total rate of deaths and missings is increasing, the proportion of deaths and missings within incidents is decreasing. Regarding the SDGs the results show that the probability of migrants surviving a hazardous event like a shipwreck increased over time. A finding that indicates a step forward in achieving the goal of ensuring safe migration. This result, combined with the above-mentioned finding that the average number of deaths of migrants per incident has decreased, suggests better and more effective rescue operations.

Another hypothesis of earlier reports as to why the rate of deaths and missings has increased was that embarking is no longer restricted to good weather and sea conditions. To answer this question, the number of incidents per months can serve as an indicator, assuming that conditions in the summer months - from May to September - are better than in the winter months - from October to April - (see figure 4). A descriptive analysis shows that each year, most incidents happen from May to September. To analyse this question in more detail, a One-way Anova test is performed. Whereas the null hypothesis assumes no difference between means, the alternative hypthesis states that a difference between means exist. For significance value 0.05, overall model is significant (F= 2.115, p = 0.0171). The p-value is less than the significance level, so the null hypothesis is rejected so it can be concluded that not all of population means are equal. Hence, there is a significant difference in the number of fatalities across months. The Tukey's post-hoc test reveals exactly where those differences lie, by comparing all possible pairs of means. It controls for type I error and maintains the familywise error rate at 0.05 (for whole results, see appendix). However, even though the ANOVA is siginificant, a comparison of each month doesn't represent significant differences. In that, to answer the question if there is a significant difference in the number of
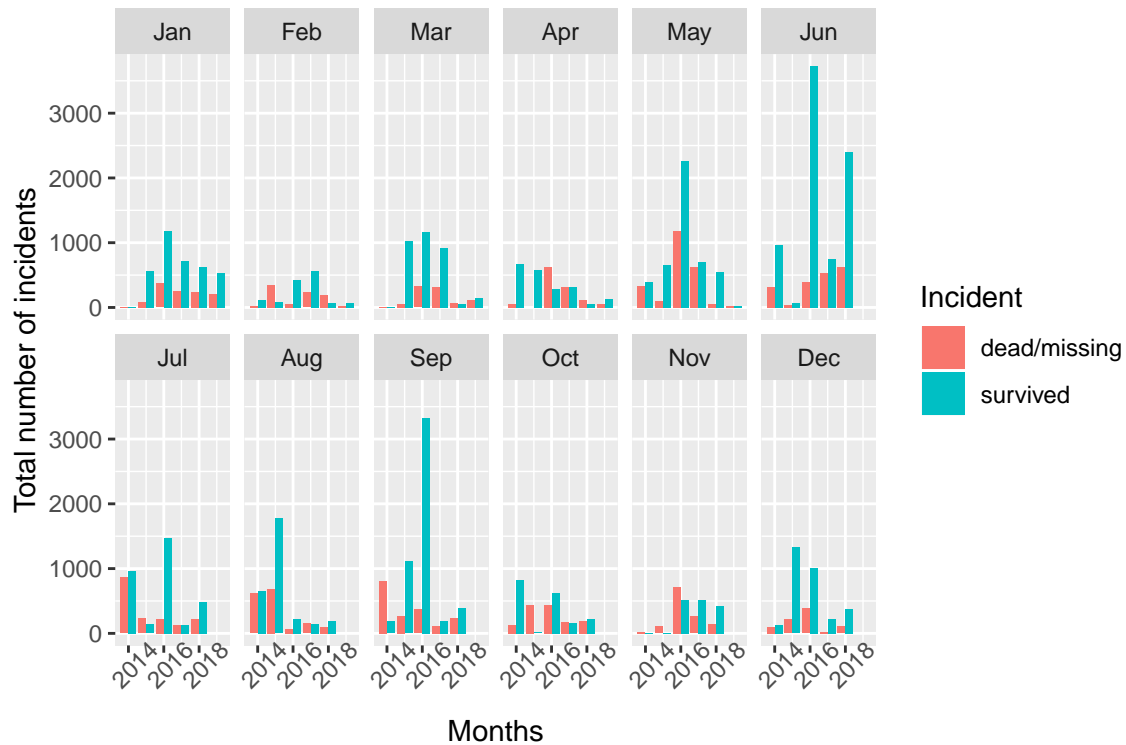
7

Figure 4: Number of incidents by month

deaths and missing between the seasons, months are grouped into Summer (May-September) and Winter (October-April). To test this, a two sample t-test is conducted. Null hypothesis is that the mean of summer months is equal to the mean of winter months and alternative hypothesis is that the mean of summer months is not equal to the mean of winter months . T-test reveals that summer season's average deaths and missing (M= 24.465, SD= 59.91) is larger and has slightly larger variation than Winter season (M= 12.995, SD= 34.206). There is a statistically significant difference between the Total deaths and missings in Summer and Winter season (t(996)= 9.3.846, p= 0.0001, r= 0.1210). Hence, the hypothesis that the proportion of deaths and missings has increased because embarking is no longer restricted to good weahter conditions cannot be confirmed by the data used in this report (for whole results, see appendix). To sum up the results, this report can confirm, that most of the deadly incidents occur in the Mediterranean area. A trend is consistent over time. Moreover, the data underline the different patterns of each route reported in former articles (figure 5).

The results mirror the consequences of the EU-Turkey agreement. After the implementation, the number of deaths and missings increased on the Central Mediterranean route and declined on the Eastern Mediterranean route. The incidents on the Western Mediterranean route are also on the increase over time. Although the literature claims that the proportion of deaths is increasing, the report reveals that the proportion of survivors within an incident is increasing rather than decreasing. A finding, which is partly due to a smaller number migrants involved per incidents and possibly also to better rescue techniques. This has important implications for the UN's Sustainability Agenda 2030. According to the results, the likelihood of dying in case of an event decreases. This indicates that migration is becoming safer and it goes towards achieving SDG goal 10.7, which aims at orderly and safe migration. However, it should be noted that due to difficulties in obtaining data on deaths and missing migrants, the results can only be seen as an
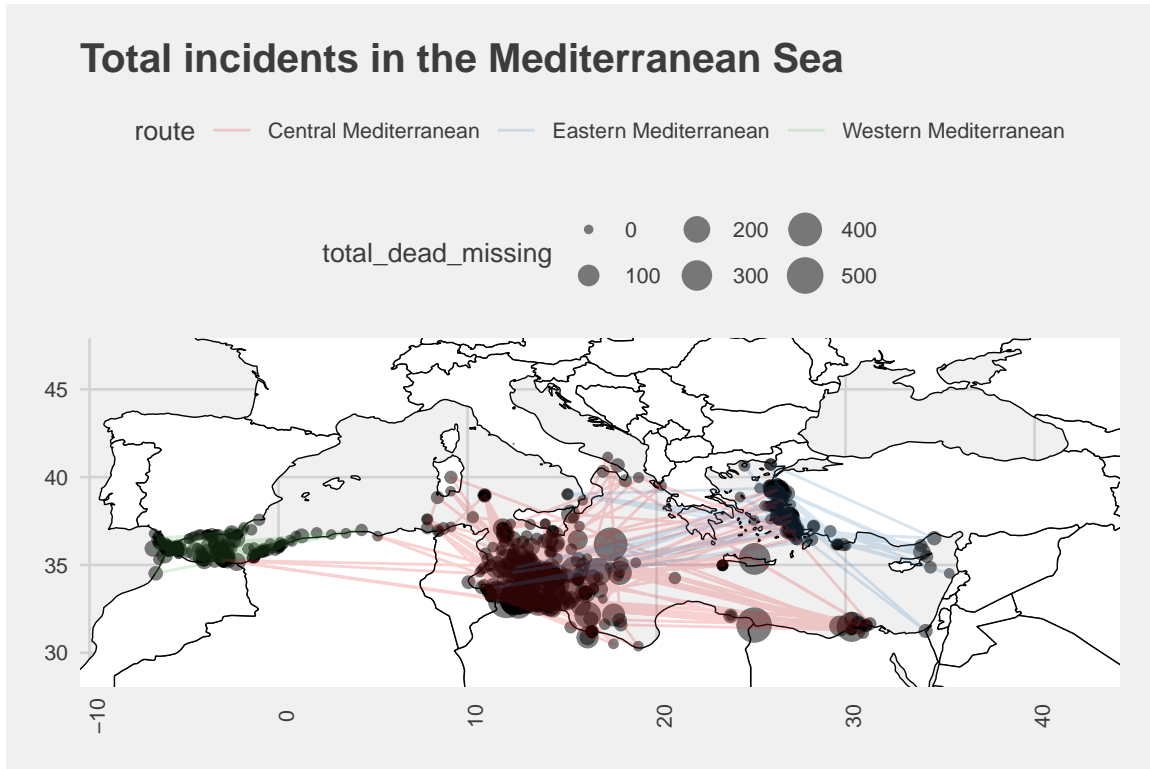
Figure 5: Incident and route map

approximation.

Discussion

The present report tries to figure out the migration routes and the fatalities of it considering policy situation of the destination country and months a migrant start journey by using the data provided by IOM's missing migrants project. A main findings is that the peak of fatalities occurs during the summer months, which contradicts the hypothesis of previous reports, that the number of deaths and missings is increasing because embarking is no longer restricted to good weather and sea conditions anymore. In addition, the total number of fatalities on each route decreases. However, the dataset does not include the total number of arrivals, which makes it difficult to generalize this finding. Another important result of the descriptive analysis is that the survival rate within an incident increases over time, suggesting that migration has become safer, bringing the SDG goal closer to being achieved. However, the present report has limitation in the fact that it mainly focuses on the descriptive analysis. As this report has presented the basic background behind migration flows, merging missing migrants data with external data is expected to bring synergy into the migration research. IOM has already demonstrated the advantages of big data in migration research [Black et al., 2017a]. Big data refers to the new type of data and is often defined with 3V characteristics; Volume, Velocity, Variety [Japec, Lilli and Kreuter, Frauke and Berg, Marcus and Biemer, Paul and Decker, Paul and Lampe, Cliff and Lane, Julia and O'Neil, Cathy and Usher, Abe, 2015]. Volume refers to its sheer big size of the data. Velocity indicates the rapid speed at which the real-time data is collected and lastly, variety means various forms in which data could exist without being limited to traditional structured data. Following these trends, the

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use of big data for migration research has been constantly insisted. IOM suggested some examples of big data in migration research at its 2017 report [Black et al., 2017b]. One example is the use of Automatic Identification System data (AIS). AIS is a maritime communications system and its information is mainly used to avoid collisions but as this information is gathered in a relatively short interval and covers the maritime movement, AIS data makes a systematic analysis of quantified migrant rescues in the ocean possible. As AIS data example, combining missing migrants project data with other external big data is expected to broaden the migration research's possibilities. In this regard, this report suggests combining the weather data with the missing migrants project's data firstly, to improve the systematic analysis of fatality in migration journey and secondly, build safety guidelines for the migrants. To begin with, even though the causes of deaths and missings are specified in the data, precise factors lead to the dangerousness is not described in the data and only months are presumed to affect the safety of journey. Since the deaths and missings mainly take place during the journey through the ocean, which is heavily affected by the ocean currents and weather, weather data might provide further explanation for the factors lead to a dangerous journey. Also, this report has revealed that summer months has significantly different results. On top of that, if the weather is found to be the main determinant of successful arrival, safety guideline for migrants and the administrations could be built by exploring the weather and the location. To be specific, it could inform migrants who intend to take a specific migration route at specific weather, specific season and location the dangerousness level of the journey based on previous data. Also, based on the weather and the routes, the administrations could reinforce its rescueship infrastructure. However, due to a budget issue, this report couldn't implement weather data into the analysis. Future improvement by researchers is expected.

Appendix

You can find the replication materials here

OLS Regression Results

Dep. Variable:	Total_Dead_and_Missing	R-squared:	0.023
Model:	OLS	Adj. R-squared:	0.012
Method:	Least Squares	F-statistic:	2.115
Date:	Mon, 20 May 2019	Prob (F-statistic):	0.0171
Time:	19:12:16	Log-Likelihood:	-5226.2
No. Observations:	998	AIC:	1.048e+04
Df Residuals:	986	BIC:	1.054e+04
Df Model:	11		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	11.1333	4.468	2.492	0.013	2.366	19.900
C(Reported_Month)[T.Feb]	3.0280	7.332	0.413	0.680	-11.360	17.416
C(Reported_Month)[T.Mar]	0.5550	6.868	0.081	0.936	-12.923	14.033
C(Reported_Month)[T.Apr]	13.2398	7.158	1.850	0.065	-0.807	27.287
C(Reported_Month)[T.May]	20.7000	7.005	2.955	0.003	6.954	34.446
C(Reported_Month)[T.Jun]	8.9509	6.482	1.381	0.168	-3.770	21.671
C(Reported_Month)[T.Jul]	14.6513	7.225	2.028	0.043	0.473	28.829
C(Reported_Month)[T.Aug]	12.6167	7.126	1.771	0.077	-1.367	26.600
C(Reported_Month)[T.Sep]	11.4417	6.794	1.684	0.092	-1.890	24.774
C(Reported_Month)[T.Oct]	0.3036	6.129	0.050	0.961	-11.725	12.332
C(Reported_Month)[T.Nov]	2.8444	6.576	0.433	0.665	-10.060	15.749
C(Reported_Month)[T.Dec]	-2.6435	6.430	-0.411	0.681	-15.261	9.974

Omnibus:	1183.018	Durbin-Watson:	1.813
Prob(Omnibus):	0.000	Jarque-Bera (JB):	104781.385
Skew:	6.032	Prob(JB):	0.00
Kurtosis:	51.726	Cond. No.	11.6

Figure 6: OLS Output

```
Multiple Comparison of Means - Tukey HSD,FWER=0.05
=================================================
group1 group2 meandiff lower upper reject
-------------------------------------------------
 Apr    Aug      nan     nan   nan   False
 Apr    Dec      nan     nan   nan   False
 Apr    Feb      nan     nan   nan   False
 Apr    Jan      nan     nan   nan   False
 Apr    Jul      nan     nan   nan   False
 Apr    Jun      nan     nan   nan   False
 Apr    Mar      nan     nan   nan   False
 Apr    May      nan     nan   nan   False
 Apr    Nov      nan     nan   nan   False
 Apr    Oct      nan     nan   nan   False
 Apr    Sep      nan     nan   nan   False
 Aug    Dec   -15.2602   nan   nan   False
 Aug    Feb    -9.5887   nan   nan   False
 Aug    Jan   -12.6167   nan   nan   False
 Aug    Jul     2.0346   nan   nan   False
 Aug    Jun    -3.6658   nan   nan   False
 Aug    Mar   -12.0617   nan   nan   False
 Aug    May     8.0833   nan   nan   False
 Aug    Nov    -9.7722   nan   nan   False
 Aug    Oct   -12.313    nan   nan   False
 Aug    Sep    -1.175    nan   nan   False
 Dec    Feb     5.6715   nan   nan   False
 Dec    Jan     2.6435   nan   nan   False
 Dec    Jul    17.2948   nan   nan   False
 Dec    Jun    11.5944   nan   nan   False
 Dec    Mar     3.1985   nan   nan   False
 Dec    May    23.3435   nan   nan   False
 Dec    Nov     5.488    nan   nan   False
 Dec    Oct     2.9472   nan   nan   False
 Dec    Sep    14.0852   nan   nan   False
 Feb    Jan    -3.028    nan   nan   False
 Feb    Jul    11.6233   nan   nan   False
 Feb    Jun     5.9229   nan   nan   False
 Feb    Mar    -2.473    nan   nan   False
 Feb    May    17.672    nan   nan   False
```

Figure 7: Tuckey test results I

```
Feb     Jul      11.6233    nan    nan    False
Feb     Jun       5.9229    nan    nan    False
Feb     Mar      -2.473     nan    nan    False
Feb     May      17.672     nan    nan    False
Feb     Nov      -0.1835    nan    nan    False
Feb     Oct      -2.7243    nan    nan    False
Feb     Sep       8.4137    nan    nan    False
Jan     Jul      14.6513    nan    nan    False
Jan     Jun       8.9509    nan    nan    False
Jan     Mar       0.555     nan    nan    False
Jan     May      20.7       nan    nan    False
Jan     Nov       2.8444    nan    nan    False
Jan     Oct       0.3036    nan    nan    False
Jan     Sep      11.4417    nan    nan    False
Jul     Jun      -5.7004    nan    nan    False
Jul     Mar     -14.0963    nan    nan    False
Jul     May       6.0487    nan    nan    False
Jul     Nov     -11.8068    nan    nan    False
Jul     Oct     -14.3476    nan    nan    False
Jul     Sep      -3.2096    nan    nan    False
Jun     Mar      -8.3959    nan    nan    False
Jun     May      11.7491    nan    nan    False
Jun     Nov      -6.1064    nan    nan    False
Jun     Oct      -8.6472    nan    nan    False
Jun     Sep       2.4908    nan    nan    False
Mar     May      20.145     nan    nan    False
Mar     Nov       2.2895    nan    nan    False
Mar     Oct      -0.2513    nan    nan    False
Mar     Sep      10.8867    nan    nan    False
May     Nov     -17.8556    nan    nan    False
May     Oct     -20.3964    nan    nan    False
May     Sep      -9.2583    nan    nan    False
Nov     Oct      -2.5408    nan    nan    False
Nov     Sep       8.5972    nan    nan    False
Oct     Sep      11.138     nan    nan    False
----------------------------------------------
```

Figure 8: Tuckey test results I

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	sum_sq	df	F	PR(>F)
C(Reported_Month)	4.874565e+04	11.0	2.114546	0.01714
Residual	2.066345e+06	986.0	NaN	NaN

Figure 9: Overall ANOVA Result

Season	count	mean	std	min	25%	50%	75%	max
Summer	380.0	24.465789	59.951664	0.0	1.0	4.0	17.0	550.0
Winter	618.0	12.995146	34.206139	0.0	1.0	3.0	10.0	459.0

Figure 10: T-Test descriptive

	Independent t-test	results
0	Difference (Total_Dead_and_Missing - Total_Dea...	11.4706
1	Degrees of freedom =	996.0000
2	t =	3.8466
3	Two side test p value =	0.0001
4	Mean of Total_Dead_and_Missing > mean of Total...	0.9999
5	Mean of Total_Dead_and_Missing < mean of Total...	0.0001
6	Cohen's d =	0.2508
7	Hedge's g =	0.2506
8	Glass's delta =	0.1913
9	r =	0.1210

Figure 11: T-Test results

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