# Are the Biscayne Universitary Students Ready to go to the Beach Safely?

Iranzu Sotés Cedrón (1), Imanol Basterretxea-Iribar (1) and María De Las Mercedes Maruri (2)

1. *Dpt. of Nautical Sciences and Marine Systems Engineering, University of the Basque Country, UPV/EHU, Portugalete, Bizkaia.*
2. *Dpt. of Applied Mathematics, Faculty of Engineering of Bilbao, UPV/EHU. Tecnalia Research & Innovation. Meteorology Unit. Euskalmet. Agency Basque of Meteorology*

*(E-mail: iranzu.sotes@ehu.eus)*

**ABSTRACT**

Beachgoers are not aware of many hazards they may find in the seawater. In 2015 58% of drowning that occurred in Spain took place on the beach. The risk may be reduced by action on the vulnerability and the exposition. Swimming ability may help to decrease vulnerability but it seems not to be enough and, as for exposition, the knowledge of beach hazards is a good aid to reduce bathers' incidents. The aim of this paper is to know which is the knowledge acquired by students who have finished secondary education. Three hundred and sixty four first year students from the University of the Basque Country were surveyed by means of a questionnaire with the purpose of knowing their swimming level, their profile as beach users, their knowledge of rip currents and how to recognize them, and their interpretation of the beach safety information and signals. The research shows that, although more than 95% of respondents go to the beach, the swimming level is low given that 51% can swim between 25 and 100 meters. On the other hand, their knowledge of rip currents is also very low. However it is surprising that there are more rescuers than people saved. These results lead us to think that an Aquatic Safety Educational Plan is necessary as soon as possible.

**KEYWORDS :**

Aquatic safety; Coastal risks; Rip current; Drowning prevention.

## 1. INTRODUCTION.

Along to Spanish coast there are more than 9,000 beaches representing a touristic attraction as well as a public natural space used by citizens for enjoying and well-being (Holden, 2000; James, 2000). In this way, beach visits from families show the wide range of psychological, social, and physical health benefits (Ashbullby et al., 2013). However, it should be taken into account that these spaces are continually moving by the action mainly of the wind and sea waves on the sediment of the beach (Davies, 1972; Pye, 1982; Martín-Prieto and Rodríguez-Perea, 1998). On the other hand, there are a great variety of risks for the beachgoers that may cause from minor consequences as traumatisms, cuts or bites (e.g., fish spider) up to fatal consequence as drownings. In this respect, the fact that the bather be caught by a rip current is one of the main causes of the drownings (Short and Hogan, 1994).

According to the Spanish National Drowning Report 2015 there were 414 deaths by drowning from which 58% occurred on beaches (RFESS, 2015). From this last percentage only 68% of

dead persons were Spanish which confirms the necessity to know the hazards the beach bathers have to face in Spain. 78% of the deceased persons were men which seems to agree with the worldwide tendency (WHO, 2014). Additionally, 7,5% of the people who drowned were between 18 and 25 years of age. In the same way, the results of the Royal National Lifeboat Institutions lifeguard rip current incident data from 2006 to 2011 show that most persons involved in a rip incident were men and teenagers (Woodward et al., 2013). The fact that male teenagers are the most likely demographic group to be involved in a rip incident has also been confirmed by other researches (McCool et al., 2008; Moran, 2006 and Moran, 2008; Woodward et al., 2015).

The World Health Organization (WHO) has proposed some recommendations to prevent drownings such as to teach school-age children basic swimming, water safety and safe rescue skills (WHO, 2014). Of course, swimming ability reduces vulnerability but it is not enough. It should be necessary to swim in open waters and to recognize in situ meteorology conditions and hazards (WHO UNICEF, 2008). In this respect, the training on basic knowledge of the beach dangers reduces the drownings caused by rip currents (Fletemeyer & Leatherman, 2010). Many authors have identified the rip currents as one of the dangers related to the most lifeguards' interventions as well as the main cause of drownings (Scott et al., 2008; Brander et al., 2011; Caldwell et al., 2013; Brannstrom et al., 2014; Woodward et al., 2015). Therefore, it may be concluded that the rip currents are a real danger for beachgoers (Klein et al., 2003; Hartmann, 2006; Scott et al., 2007; Short, 2007; Gensini and Ashley, 2010; Arun Kumar and Prasad, 2014; Arozarena et al., 2015) as well as for participants in aquatic activities and sports in the surf zone, above all in high and moderate swell conditions (Short, 2007; MacMahan et al., 2011).

Nowadays, flags and any additional information for beachgoers reduces danger exposure in adverse conditions. However, they do not reduce the incidents in sunny days and when waves in the surf zone are not so high (SLSA, 2010).

Rip current position and intensity vary in accordance to the wave energy in the surf zone and to the beach morphology and sedimentation (Wright and Thom, 1977; Cowell and Thom, 1994; Brander, 1999; Dalrymple et al., 2011). These vary from one hour to another due to waves and tides, and from one week to another due to the morph-dynamism of the beach (Scott et al., 2008).

A rip current is defined as a strong and narrow water flow (Brander et al., 2011; Dalrymple et al., 2011; MacMahan et al., 2011). Its intensity ranges from 0.5 to 2 m/s and its width and distance from the seashore is around 15-60 m. and 100 m., respectively (Woodroffe, 2002; MacMahan et al., 2006; Brander et al., 2014; Cervantes et al., 2015). Its direction is sea inside and, therefore, this psychological aspect reduces swimmer's possibility to escape due to panic and fatigue (Short and Hogan, 1994). It happens when waves have not broken which makes these areas attractive for beach users with less knowledge. "Don´t be fooled by calm, flat sections in the surf, because these are often rips" (Williamson et al., 2008).

According to data collected from swimming pools, non-professional swimmer's velocity is 0.89 m/s compared to 1,29 m/s for a professional swimmer (Costill et al., 1985). Nevertheless, the

velocity that a professional swimmer can reach in a pool is not comparable to that reached in a calm sea, which means that these figures are not a precise indicator on swimmers' skill (Tipton et al. 2002; Reilly et al., 2005). For example, the velocity range that a lifeguard can reach in a surf zone is only 0.7-0.9 m/s (Tipton et al., 2008). Moreover, this velocity would be smaller under a swimming simulation nearby rip currents (Aggar, 2014, McCarroll et al., 2015).

Although it is difficult to give a general recommendation on what to do into a rip current, recent research has shown that the best way to escape is to float and to go with the flow sea inside until the intensity disappears, then the swimmer can return to the beach through another area keeping a non-panic attitude (McCarroll et al., 2014a; Drozdzewski et al., 2012, 2015). The psychological aspect, related to the mental block, is one of the factors that makes the rip currents a real risk for both inexperienced and skilled swimmers (Sherker et al., 2008). Other recommendations are to avoid swimming alone, to do it within an area marked by flags and in a safeguarded beach and, if necessary, to cry out for help in case of getting caught in a rip current (Branche and Stewart, 2001; Hartmann, 2006; Wilks et al., 2007).

Figure 1.- Ereaga Beach December 7, 2015 (Bizkaia, Spain) about 13 h. It was Winter and no lifeguard services were available.

The Basque Country latitude varies from 42° to 43.5° North and, therefore, is located into the temperate climate area. At noon the solar inclination varies from 25° in winter solstice to 70° in summer solstice which means that the solar illumination is extended from 9 to 16 hours, respectively. The western Basque coast belongs to the Biscay Province which has a special regulation on its beaches. There are twenty eight beaches in Biscay which are safeguarded from 11 a.m. to 8 p.m. during summer, exactly from 1$^{st}$ of July to 30$^{th}$ of September. During summer of 2015 more than two and a half million beachgoers went to the Biscayne beaches. August is the month of maximum influx followed by July. According to the data provided by the Biscay Provincial Government (BPG), the day of maximum influx was Sunday 2$^{nd}$ of August with more than 100,000 beachgoers. Concerning beach safety, in 2015 lifeguards had to come to

the aid of 621 beachgoers from which 127 persons were saved from rip currents, 42 rescues were as a result of fatigue and the rest due to other reasons (Red Cross Bizkaia, 2015).

The climatic conditions on the coast of the Basque Country are very variable. Therefore, it is not difficult to find a hot and sunny day close to winter. Consequently, people may take this opportunity to go to the beach for swimming even though there are no lifeguard services. Figure 1 shows the December 7, 2015 photo from a beach in Bizkaia. Beach close to Bilbao where the temperature was near to 20° C and the waves higher than one meter. As can be seen, the beachgoers are bathing near the rip current on a beach without lifeguard services.The aim of this research is to determine the user profile of the Biscayne beaches concerning the knowledge of the dangers associated with the beach and the way to face them. In particular, this paper deals with the rip currents and aim to define actions to minimize the risks for the beachgoers.

The possibility of bathing inside a rip current is higher if the beachgoer has not been skilled on the basic knowledge of this type of currents (Sherker et al., 2010). Obviously, the education will reduce the vulnerability and exposure (Kennedy et al., 2013). In this respect, some countries or states such as Australia, New Zealand, Great Britain, Ireland or Hawaii have adopted an education plan regarding aquatic safety.

Another risk to be taken into consideration is the multiple drowning incident that happens when the life-savor and the helped bather decease during the rescue. The education of both rescuers and saved persons is considered fundamental to reduce this type of incidents (Franklin and Pearn, 2010; Turgut, A. and Turgut, T., 2012).

Most people consulted in this research are teenagers living near the coast of the Basque Country with a high probability of exposure to beach dangers. Therefore, a homogeneous sample of first year students from the Biscayne centers of the University of the Basque Country has been selected for the survey. The study aims to analyze their swimming ability, their education on beach safety, and their knowledge and identification of the rip currents and other dangers in the beaches.

## 2. METHODOLOGY

Methodology is based on the analysis of a group of junior citizens with the goal of obtaining qualitative and quantitative steps to improve their resulting profile with regard to education, safety and rip currents. In this way, risk indicators are defined to provide the vulnerability (obtained from their resulting profile) and the exposure (based on their knowledge and identification of hazards). The risk is defined as the IPCC (2012):

$$Risk = f\left(\text{hazard}, \text{exposure}, \text{vulneravility}\right) = probability \ \ \text{X} \ damage$$

The information necessary for the research has been collected by means of a survey form which is based on the methodology of Czaja and Blair (1996). Therefore, separate stages have been designed in this process to reach a questionnaire that allowed us to collect the information in a precise and objective way.

The first stage consists in designing and formulating the questions focusing on the objectives. The experiences in other countries are considered as a model in the questionnaire design and as a tool to carry out a comparative analysis between different researches. The questionnaire is individual and in folded sheet format. Two photos of a beach are also provided for the guidance of survey respondents. It includes 35 questions separated in the following sections: I. Swimming ability (six questions), II. Beach visit frequency (seven questions), III. Rip currents (seven questions), IV. Beach safety (six questions), V. Beach signals (two questions) and VI. Identification variables (seven questions).

The sources and local particulars related to every section are mentioned below:

I. Swimming ability (Drozdzewski et al., 2012; Matthews et al., 2014).
II. Beach visit frequency (Marin et al., 2009; Breton et al., 1996). The questionnaire includes questions to know the activities carried out on the beach and the factors taken into account when the beachgoers come to choose the beach.

Sections I and II let us define the beachgoer profile and the seasonal attendance. Additionally, the research carried out by Sherker et al. (2010) and Gensini and Ashley (2010) is taken into consideration to carry out a comparative analysis with other regions.

III. Rip currents (Caldwell et al., 2013; Fletemeyer and Leatherman, 2010; Cervantes et al., 2015; Gallop et al., 2016). It is important to determine precisely the objectives related to rip currents. Firstly, the state of the art literature is reviewed in relation to education and current types. MacMahan et al. (2006) is the most representative reference together with the public web sites anywhere in the world. Secondly, four information levels are considered: in the first level the beachgoer indentifies the rip current as a danger and knows how it is formed, in the second level the beachgoer knows where the current is placed, in the third level the beachgoer knows the communication tools warning the dangers and, finally, in the four level the beachgoer knows what he or she can do to escape from the current. This section will be analyzed together with other sections which deal with beachgoers' managing, education and communication (Matthews et al., 2014).
IV. Beach safety. Apart from evaluating the sample quantitatively the problems presented in the sample, the knowledge and the opinion on the present safety means on the beaches are analyzed. The results will be discussed considering the measures taken in other countries with the intention of improving local beach safety.
V. Beach signage. The questions are related to beach signals warning the beachgoers away from rip currents, rocks, submerged risks and dangerous marine fauna (Matthews et al., 2014).

In the second stage the questionnaire is tested with experts in similar matters before the survey actually takes place in order to avoid ambiguity and wrong interpretation. Thus, a survey feedback is obtained to make it interesting to the surveyed community.

The third stage is focused on determining and reviewing the questions to adapt them to the expected objectives (Table 1).

Table 1

| | |
|---|---|
| **I- SWIMMING ABILITY** | |
| **Q1** | Can you swim? |
| **Q2** | How many times per week do you swim? |
| **Q3** | Which is your swimming ability level (from 1 to 7 where 1 means very low and 7 very high, plot with X) |
| **Q4** | How far can you swim without stopping? |
| **Q5** | How did you learn to swim? |
| **Q6** | Where (place) have you learnt to swim |
| **II- BEACH VISIT FREQUENCY** | |
| **Q7** | How many times have you gone to the beach during the next months of 2015? (June, July and August) |
| **Q8** | How many times have you gone to the beach during the next months of 2015? (Jan, feb, Mar, Apr and May) |
| **Q9** | How many times have you gone to the beach during the next months of 2014? (Sept, Oct, Nov and Dic) |
| **Q10** | Which are your activities on the beach? |
| **Q11** | How often do you bathe in the seawater during the examined year? (June, july, Augu and sept) |
| **Q12** | How often do you bathe in the seawater during the examined year?(Jan, feb, Mar, Apr, May, Oct, Nov and Dec) |
| **Q13** | What have you taken into account to choose a beach to go to? |
| **III- RIP CURRENTS** | |
| **Q14** | Have you ever heard about the existence of rip currents on the beach? |
| **Q15** | How are the currents? |
| **Q16** | How is a current? |
| **Q17** | Why are the currents generated? |
| **Q18** | Where would you swim to in case you are moving away from the beach? |
| **Q19** | (PHOTO A) Which is the safest place to bathe? |
| **Q20** | (PHOTO B) Which is the safest place to bathe? |
| **IV- BEACH SAFETY** | |
| **Q21** | Have you ever had any problema when bathing in the beach? |
| **Q22** | What kind of problems? |
| **Q23** | Have you ever been rescued? |
| **Q24** | Who was the rescuer? |
| **Q25** | Have you ever rescued somebody? |
| **Q26** | Do you think necessary an Aquatic Safety Educational Plan? |
| **V-BEACH SIGNALS** | |
| **Q27** | What kind of warning signals do you consider necessary on the beach during the nonvigilance periods? |
| **Q28** | Do you include an additional warning signal to improve the users' safety on the beaches? |
| **VI-IDENTIFYING VARIABLES** | |
| **Q29** | Primary studies |
| **Q30** | Second studies |
| **Q31** | Bachelor studies |
| **Q32** | Where do you live? |
| **Q33** | Postal code |
| **Q34** | Age |
| **Q35** | Sex |

The fourth stage deals with the data collection and sampling particularities. In this respect, the authors think that swimming education and training should be provided in primary and secondary school, especially if the students are living near the coast. Survey respondents are youths from 18 to 20 years of age which means that consulted people are a risk group according to the global statistics (WHO, 2014). They are university students from technical and non-technical centers located less than 20 kilometers from the coast, which suggest that 100% of respondents may go to the beach. A total of 364 surveys were collected, the survey consist of 35 questions and respondents had 15 minutes to reply. 87.7% of respondents live in coastal provinces (particularly 80.2% in Biscay). And 18% of respondents live in a town with beach.

In the fifth stage the data is input in a spreadsheet and in the SPSS (Statistical Package for the Social Sciences) which is a useful tool for the analysis.

Data analysis is carried out in the sixth stage in the following way:

1. Selection of surveys and elimination of those ones in which the answers are random or not correlated.
2. Individual analysis of every question to recognize quantitatively sampling characteristics.
3. Combined analysis of several questions to identify similar behaviors, sampling groups or user profiles.
4. Sectional analysis of questions to obtain further information, to compare with other countries and to suggest improvements.

Other surveys carried out in Biscayne beaches during the summer 2015 (6273 surveys on 15 beaches) and the Red Cross annual report 2015 in Biscay are used as transversal sources in the present research.

## 3. RESULTS AND DISCUSSION

The surveys were carried out in the following university centers: Social and Communication Sciences Faculty (86 respondents), Education School of Bilbao (110 respondents), Engineering Technical School of Bilbao (111 respondents) and Nautical and Marine Engineering Technical School (57 respondents). The percentage of surveyed students is 7.9% of the whole of first year students in the University of Basque Country and 34.7% of the students belonging to the faculties surveyed.

### I. Swimming ability

**Q1. Can you swim?**

One per cent (5) of respondents cannot swim and four of them go to the beach once every fifteen days during summer

**Q2. How many times per week do you swim? Q3. Which is your swimming ability level (from 1 to 7 where 1 means very low and 7 very high)? Q4. How far can you swim without stopping? (Figure 2)**

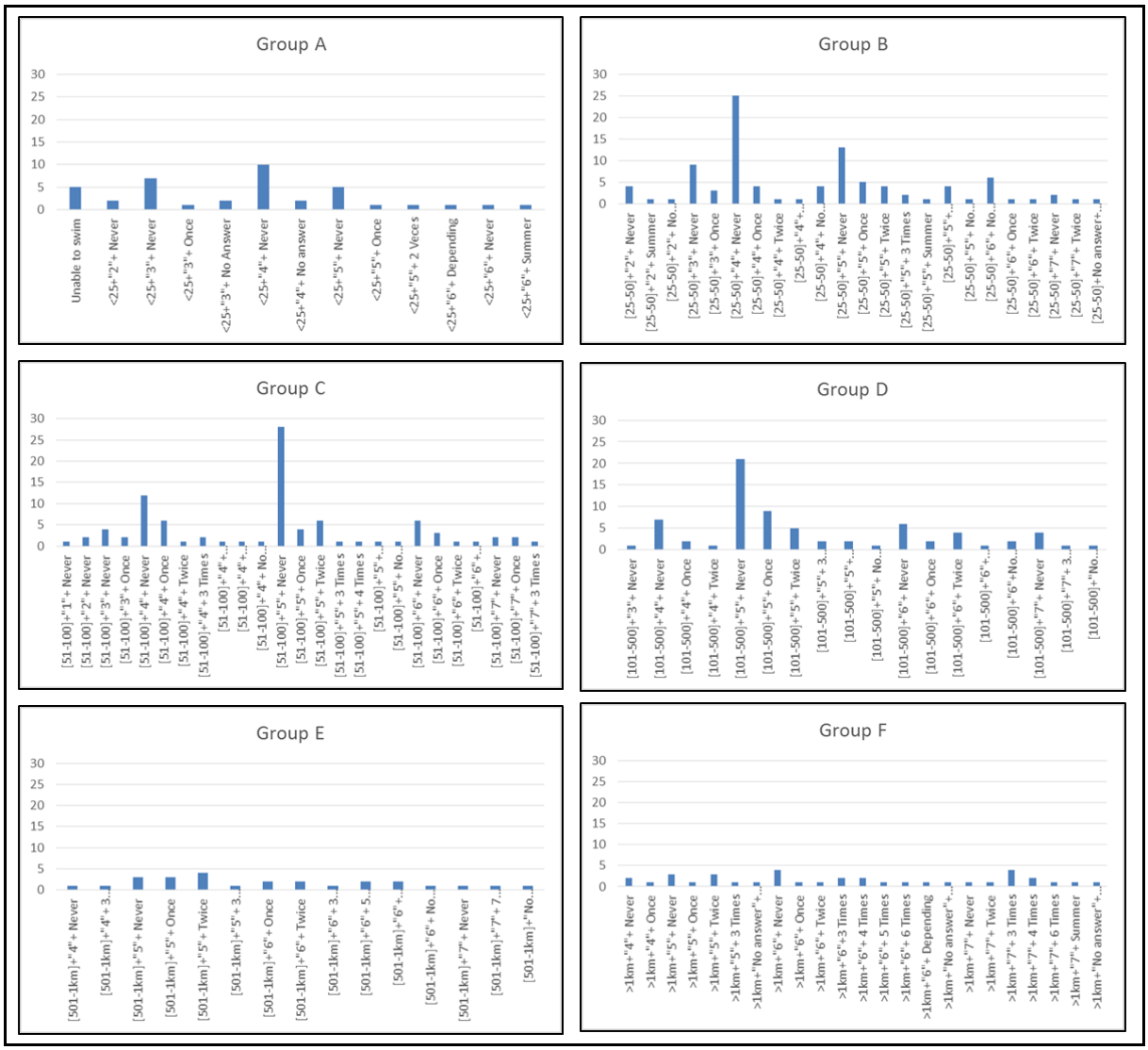



Figure 2-A.- Q2, Q3 and Q4 analyzed all together, group by group.

The statistical analysis for this questions is carried out jointly with the purpose of classifying the respondents according to their ability and their subjective degree of self-esteem, and with the aim of quantifying their distribution in the group. To do this, a code number is given to every question. The groups are identified with the modes as well as with the different sub-distributions surrounding the modes, which are the particulars of each group and the central tendency chosen for their classification. The mode of every group is directly related to the value Q4 which is the most important one and, consequently, what defines the group from which the associated values of Q2 and Q3 are determined. The value Q2 is objective even though the analysis shows that the respondent is giving the average number of times he/she swims per week since the possible reply may be under the influence of other factors. The value Q3 is absolutely subjective and shows the respondent's degree of self-esteem.

The results reflect that 51% of the all respondents swim between 25 and 100 meters. The peculiar groups concentrate in the modes are the following:

- Group A [< 25] with a mark of 4 in Q3 is formed by people who can swim but do not do it. It is a group with low dispersion and its own valuation is medium or low.
- Group B [25-50] with a mark between 4 and 5 in Q3 is formed by people who do not tend to swim. It is a group with high dispersion that presents sub-groups (bimodal). Its own valuation is higher than the mean despite the fact that they do not swim regularly.
- Group C [51-100] with a mark of 5 in Q3 is formed by people who do not tend to swim. This group has a high dispersion and presents sub-groups (bimodal). Its own valuation is clearly of 5 and other groups where the frequency per week is 1 start to be present. It is important to give relevance to those who answer a frequency different to zero, since they are more aware on their current physical status.
- Group D [101-500] with a mark of 5 in Q3 is formed by people who do not tend to swim; it is followed by sub-groups formed by people who tend to swim 1 and 2 times per week. This group presents less dispersion in sub-groups.
- Group E [501-1000] with a mark of 5 in Q3 is formed by people who tend to swim at least once a week. The mode is focused in a group with a frequency of twice per week. Its dispersion is low.
- Group F [>1000] has the largest dispersion and lower modes. Its own valuation, as particular group, is between 6 and 7. People who form this group tend to swim between 2 and 4 times per week.

The respondents who answer 0 times to question Q2 are answering in an optimistic way to questions Q3 and Q4, what shows their high self-esteem, especially for marks higher than 5 and swimming more than 500 meters.

The respondents who answer more than 0 times to question Q2 are very likely aware of their own swimming ability according to what they swim weekly.

Most respondents who answer more than 5 to question Q3 swim more than once per week.

Figure 2-B shows the groups A and B on non-technical centers and the groups D, E and F on technical centers. Differences between technical and non-technical centers are visible.

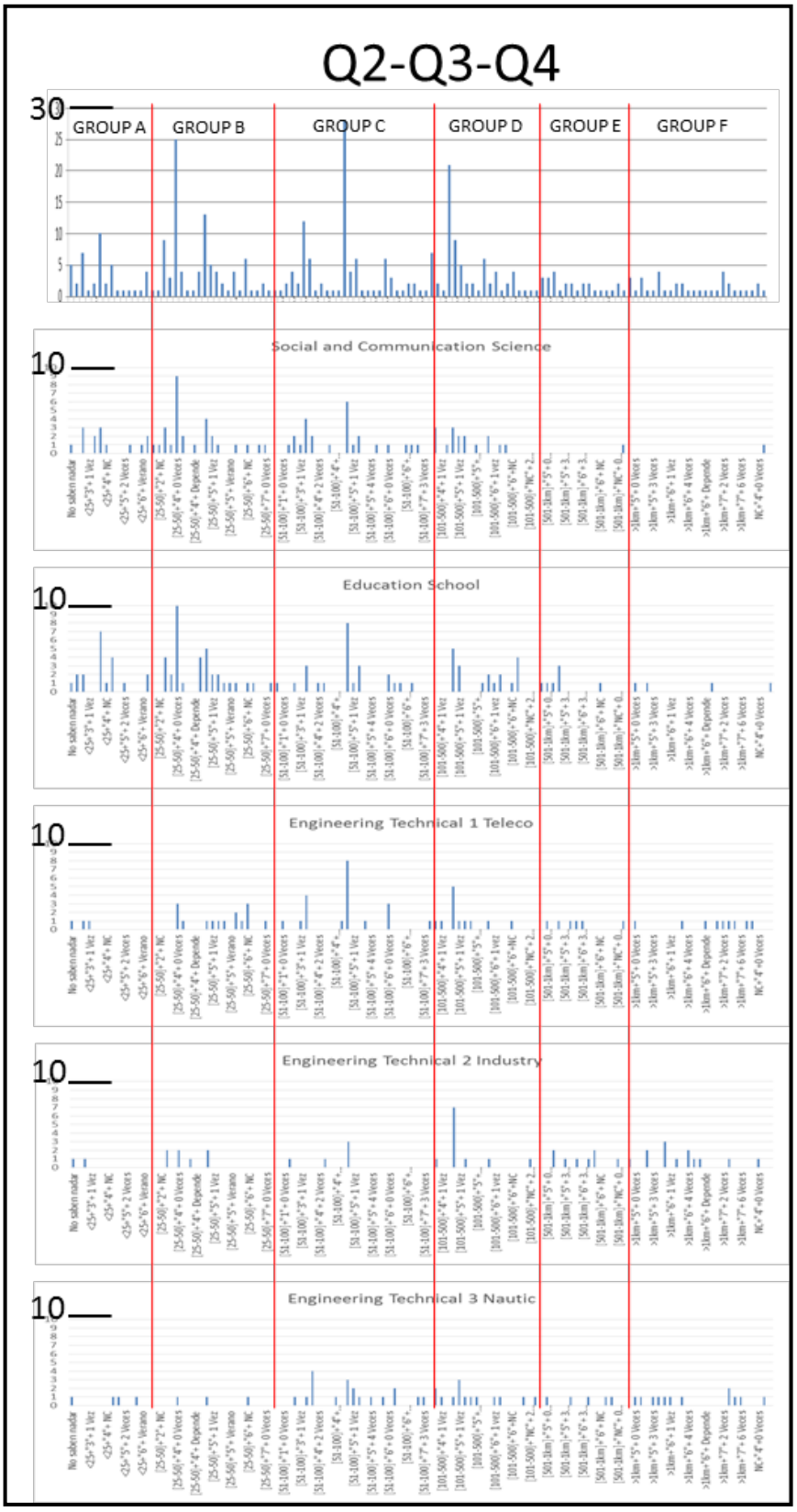



Figure 2-B.- Analysis of Q2, Q3 and Q4 with regard to the university centers surveyed. There are two non-technical centers (Social and Communication Science and Education of Bilbao) and three technical canters (Engineering Industry, Tele Communications and Nautical and Marine Engineering) .

**Q5. How did you learn to swim?**

46% of respondents have learnt to swim in short courses (extracurricular), 11.3% in the primary school at physical education hours, 13.7% were taught by friends or relatives and 7.7% have learnt alone. The rest (19.5%) had combined various ways of learning. The extracurricular short courses and the physical education in primary school are the main ways of learning. Sometimes there is a contractual relationship between the school and the firm offering short courses.

**Q6. Where (place) have you learnt to swim?**

In general the question seems to be confusing given that the respondents were mixing up the questions where and how they learnt to swim. Nevertheless, most of respondents learnt to swim in the pool, as opposed to those who did it in other places as the sea, the rivers or even the reservoirs.

**II. Beach visit frequency**

In this section the beachgoers' profile is complemented by indentifying their habits on the beach. Moreover, the periods of lifeguard vigilance will be taken into account in the interpretation of the results.

One of the objectives of the research is to find out if the beachgoers are aware of the dangers and especially of rip currents. The aim of this section is to analyze their exposure to danger and to know the type of activities they do. The purpose of this analysis is to carry out a classification between "risky activities" (bathing[1], aquatic sports, etcetera) and "non-risky activities" (walking, sunbathing, etcetera).

**Q7. Q8. Q9. How many times have you gone to the beach during the examined year? (Figure 3)**

97.5% of respondents have gone to the beach more than one day during the examined year.

45% of respondents tend to go to the beach only in the summer, of them, 45% cannot swim more than 50 meters without stops, and additionally, 76% of those summery beachgoers answer 'never' to question Q2 (How many times per week do you swim?).

44.5% of respondents go to the beach some day in May. This percentage seems to be interesting taking into account that there is no lifeguard vigilance in this month. 77.7% of beachgoers in May are not surfers, divers or swimmers and 23.4% of them cannot swim more than 50 meters without stops.

[1] In this work, we will use the term "swimming" to refer to the sport activity and "bathing" to refer to the leisurely activity of going into the sea water.

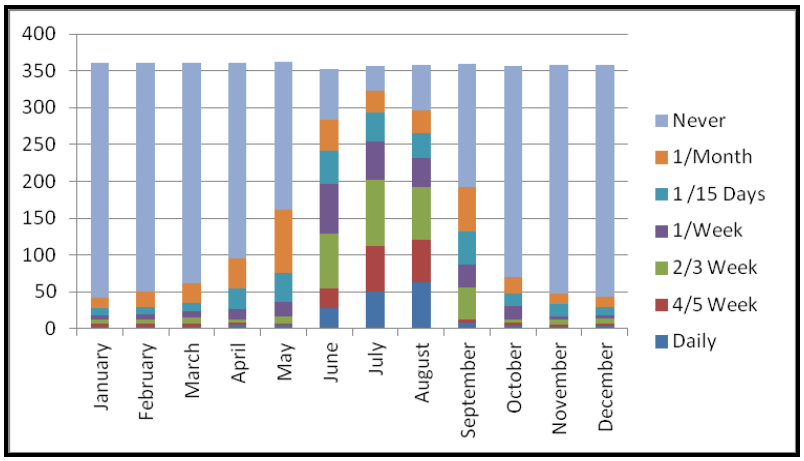
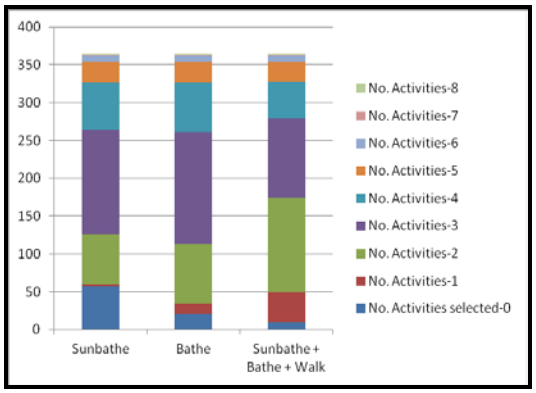



Figure 3.- Q7, Q8 and Q9 analyzed all together.

More than 50% (54,1%) of respondents go to the beach more than once a week in the months of June, July and August, vis-à-vis 23.9% who do so in September. Maximum daily frequency takes place in August whereas the frequency of more than one day per month is higher in July.

**Q10. Which are your activities on the beach? (Figure 4)**

This question permits a multiple answer: on one hand, closed answers related to usual activities and, on the other hand, open answer where the respondent may specify other less common activities.




| | | N_Activities | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Activities | Sunbath+Bath+Walk | 0 | 0 | 105 | 49 | 26 | 8 | 1 | 1 |
| | Sunbath+Bath | 0 | 61 | **136** | 63 | 27 | 8 | 1 | 1 |
| | Sunbath | 3 | 66 | 138 | 63 | 27 | 8 | 1 | 1 |
| | Bath | 13 | 79 | 148 | 66 | 27 | 8 | 1 | 1 |
| | Walk | 1 | 11 | 110 | 50 | 26 | 8 | 1 | 1 |
| | Surf | 6 | 5 | 11 | 10 | 5 | 2 | 0 | 0 |
| | Swim | 1 | 0 | 5 | 3 | 0 | 0 | 1 | 0 |
| | Fish | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | Buceo | 1 | 0 | 1 | 1 | 6 | 0 | 0 | 0 |
| | Waves | 0 | 2 | 9 | 26 | 11 | 7 | 1 | 1 |
| | Volley | 1 | 0 | 5 | 12 | 12 | 6 | 1 | 1 |
| | Run | 0 | 3 | 3 | 5 | 2 | 0 | 0 | 1 |
| | Futbol | 1 | 1 | 20 | 21 | 14 | 8 | 1 | 1 |
| | TenisBadmi | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 |
| | Play_Sand | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Play_Cards | 0 | 0 | 0 | 3 | 2 | 1 | 0 | 1 |
| | Castels | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | Read | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

Figure 4.- Q10 analyzed.

Considering all the activities shown in the closed answers, the most popular one is bathing (31%), followed by sunbathing (28%) and walking (19%). The sports were selected by a very low percentage of respondents. The answers were analyzed both individually and in a joint way. In the joint analysis the beachgoers carry out all three activities (sunbathing, walking and bathing) and, like that, their profile is indentifying with the free time. Therefore, the analysis has been remade to find out which is the use of the beach in minority cases according to the number of activities.

The user profile is associated with three activities and is considered the profile of leisure formed by bathing-sunbathing-walking that means 74% of respondents. The rest is divided as follows: 23% of respondents do other activities in addition to those ones and 3% do not.

Figure 4 shows the relevance of the bathing and sunbathing as single activities selected by the respondents where sunbathing is higher than bathing. Nevertheless, there are not many people who go to the beach only to sunbathe or to bathe as single activity. As mentioned before, most beachgoers (74%) do the following three activities: bathing, sunbathing and walking. Particularly, up to eight activities have been summed up in some answers. Surfing is the aquatic sport activity preferred by the respondents and football the non-aquatic sport.

**Q11. Q12. How often do you bathe in the seawater during the examined year? (Figure 5)**

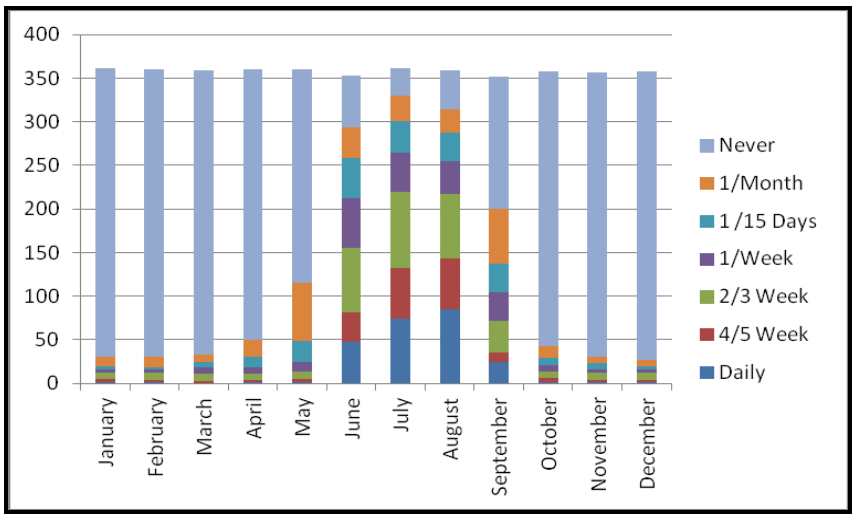



Figure 5.- Q11 and Q12 analyzed together.

The high attendance and bathing takes place during June, July and August. The highest frequency occurs in August when the beachgoers go daily or 4/5 times weekly. Although the lifeguard vigilance is mantained in September, this is the month where bathing occurs least frequently due to the beginning of the academic year and other factors as low air and seawater temperatures, increase of wave height, less sunlight etcetera.

The comparative analysis (Figure 6) of the results of questions Q7-Q8-Q9 (frequency of attendance) and Q11-Q12 (frequency of bathing) shows that the respondents change their beach activities from the summer time to the non-summer period. There are more people who go to the beach without bathing during the non-summer time (negative associated to “not go any day”). It is associated with people who go to the beach exclusively for bathing without staying on the beach sand. That it is interpreted from the differences graphic (positive associated to “not go any day”), taking into account that respondents may find themselves close to the beach, without actually lying on the beach.

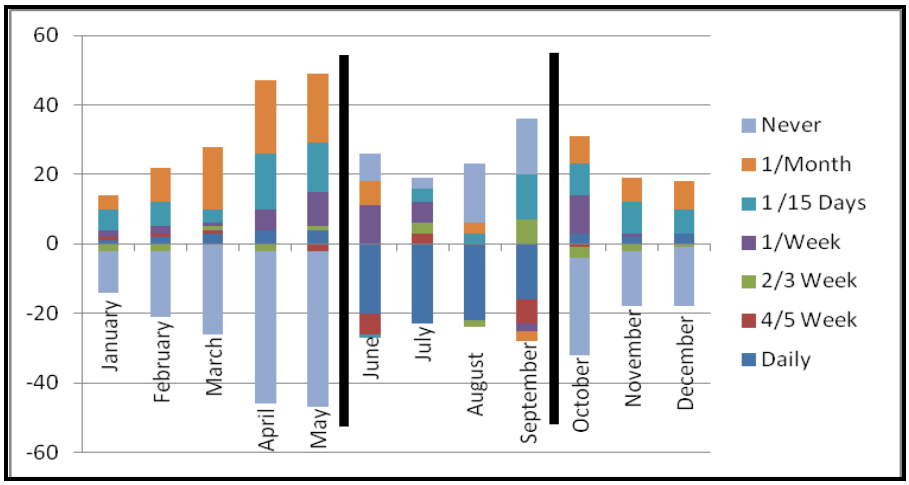



Figure 6.- Q7, Q8, Q9, Q11 and Q12 analyzed together

**Q13. What have you taken into account to choose a beach to go to? (Figure 7)**

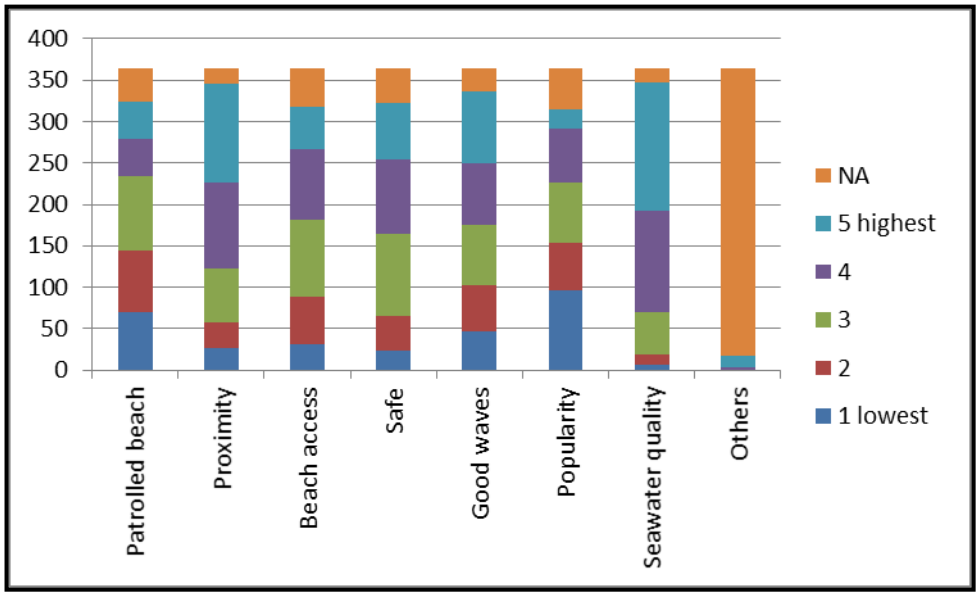



Figure 7.- Q13 analyzed.

As shown in figure 7, seawater quality is the most important factor to choose the beach, and it receives the highest marks (4-5). The second one would be the proximity of the beach and, on the other hand, lifeguard vigilance seems not to be relevant by the respondents since the marks are the lowest ones.

## III. RIP CURRENTS

**Q14. Have you ever heard about the existence of rip currents on the beach?**
**Q15. How are the currents?**

Only 49% of respondents have heard of the existence of rip currents and can recognize them.

**Q16. How is a current?**

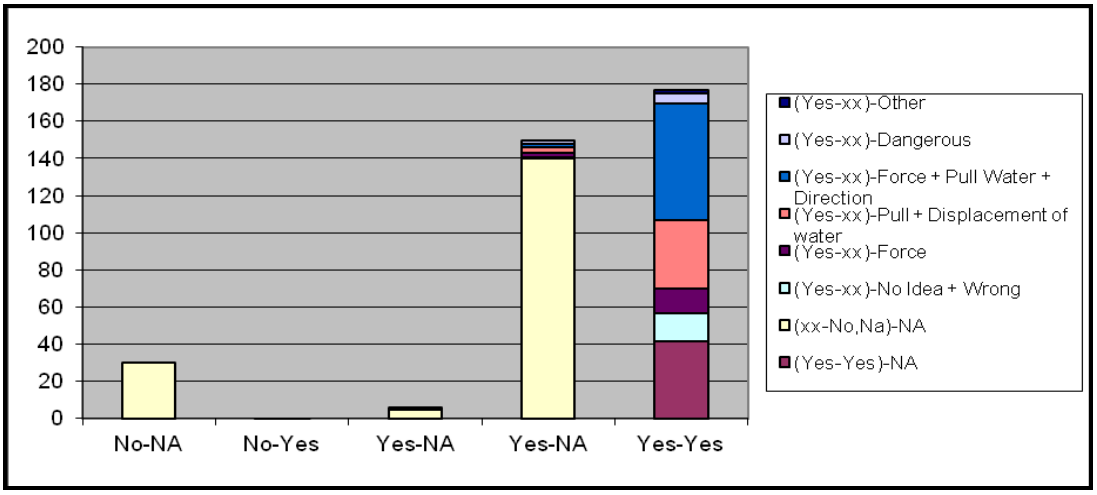



Figure 8.- Q14, Q15 and Q16 analyzed together.

Figure 8 shows the answers to questions Q14, Q15 and Q16 together. The group who has answered "Yes-Q14 and Yes Q15=Yes-Yes" is highlighted, since they should know what a current is like. Even though this group is formed by 49% of respondents, only 17% can define the rip current as a water flow that carries a person to the sea. The rest use very confused definitions related to strength and displacement. The keywords that categorize the question are strength, undertow and direction (displacement).

**Q17. Why are the currents generated?**

There are two main groups who mention the waves in the generation of currents.

The respondents of the first group know how the currents are generated but they cannot identify them and probably they have never been involved into a current (1%). Then there are other two minority groups YES-YES, corresponding to 2.7% of the respondents who can recognize them and know how they are generated.

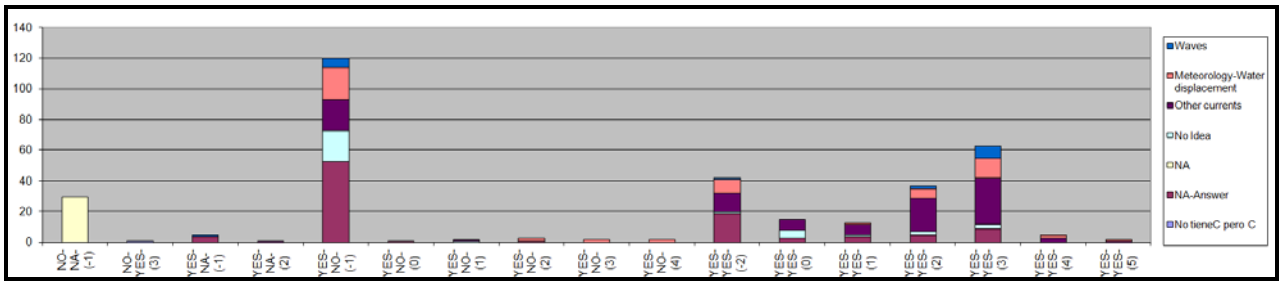



Figure 9.- .- Q14, Q15, Q16 and Q17 analyzed together

In Figure 9 we can see questions 14, 15, 16 and 17 analyzed together. Given that the question refers to currents in general, many respondents have in mind the oceanic currents when answering, due probably to what they have learnt in the geography lessons in primary school.

As Brander 2013 notes, Geography is an all-encompassing discipline but in the study of rip currents, "writing the earth" is still mostly achieved along highly demarcated lines (Brander, 2013).

**Q18. Where would you swim to in case you are moving away from the beach? (Figure 10)**

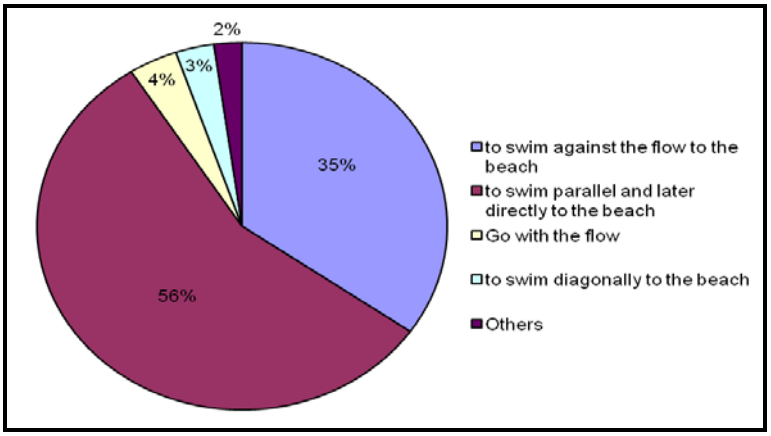



Figure 10.- Q18 analyzed.

The majority groups are 'swim directly to the beach' and 'swim parallel and then directly to the beach'; the latter being the option with the highest number of respondents (56%). This information has been crossed with the identification of the rip currents in the pictures showed to the respondents (Q19 and Q20).

Recent studies show that in most cases the solution to escape from a rip current is to "stay afloat" and then swim towards the beach, and mainly "not to panic" (Short, 2007; Austin et al., 2010; Sherker et al., 2010; MacMahanet al., 2010; Brander et al., 2011; Drozdzewski et al., 2012, 2015; McCarroll et al., 2014a; McCarroll et al., 2014b; Scott et al., 2014).

**Q19. (PHOTO A) Q.20 (PHOTO B) Which is the safest place to bathe? (Figure 11, 12, 13 and 14)**

The analysis takes into account that the breakers area (scum area) is the safest area to bathe in the beach (Wright and Short, 1984; Short, 2007; Brander, 2010; Hatfield et al., 2012; Hammerton et al., 2013; Caldwell et al., 2013; Brannstrom et al., 2014). Similar questions to Q19 and Q20 have been used in other research and the results showed the difficulties for beachgoers to recognize the rip currents (Ballantyne et al., 2005; Sherker et al., 2010; Brannstrom et al., 2015; Bradstreet et al., 2014). According to a survey carried out at Queensland in 2002, 62% of the sample admit knowledge of what a rip was, however the majority of this group (64%) were unable to explain how they would recognize one (Ballantyne et al., 2005). The same happened at Florida in 2010 where 57% claimed to have the ability to recognize a rip current and, contrary to this, only less than 20% could do it (Caldwell et al., 2013). So much the worse at Texas in 2012 where only 12% could recognize the rip current (Brannstrom et al., 2015).

Both photos in Q19 and Q20 were taken in Barinatxe beach belonging to Sopela and Getxo towns adjoining Portugalete (57 respondents) and Leioa (196 respondents). It should be taken

into account in the analysis of the results that many of respondents were users of that beach. The rip tends to stay in the C area where the current direction is towards the sea as well as in the right part of the B area where the lateral current prevails.

Photo A was taken on 16th August 2015 at noon when the tide was low and close to springs, prevailing Northeasterly wind force 2-3 and northwest swell height 1-1.5. Photo B was taken on 23th August 2015 at noon one hour after the high tide and near to neaps, prevailing westerly wind force 4-5 and northwest swell height 1.5.

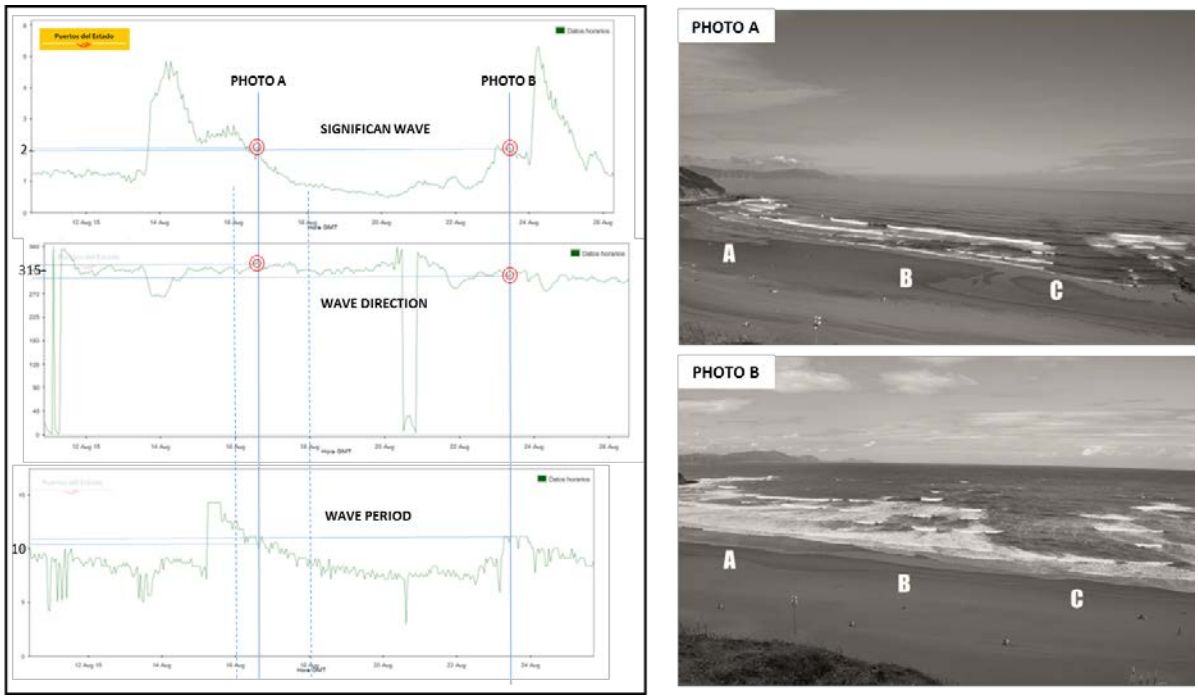



Figure 11 and 12.- Sea conditions Bilbao buoy, Photo A and Photo B (Fuente: Sea conditions graphs taken from puertos del estado web cite. Photo A and B are own)

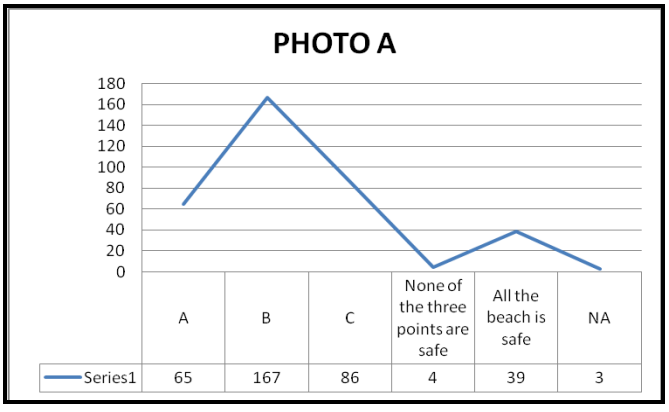



Figure 13.- Q19 analyzed.

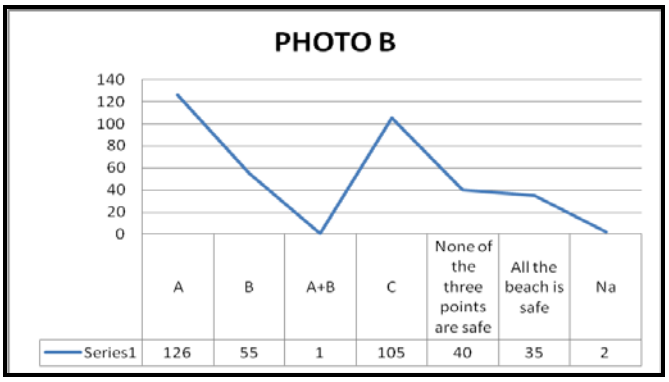



Figure 14.- Q20 analyzed.

Respondents seem to agree in the photo A where the B area is considered the safest and the C area (where the rip current is) would be safer than the A area (where there is no current). However they do not agree in photo B where the A area is the safest but very close to the C area. This seems to be due to the fact that there are more visual differences in the B area of photo B.

In this paragraph the figures are given without counting the respondents who think that the whole beach is safe. In this way, 87 persons would bathe in the C area of photo A, of which 45 would do the same in the photo B and, on the other hand, 105 would bathe in the C area of photo B of which 60 would do the same in photo A.

The A area has been selected as safe zone in both photos at the time of analyzing the results. The dangerous zone may be visible in both photos. The danger exposed beachgoer who does not recognize the rip is the one who selects the area C as safer or who does not differentiate between the zones.

The safer area is C (where the rip is) for 34 respondents of whom 11 would swim directly towards the beach.

The whole of the beach is safe for 6 persons of whom 4 would swim directly towards the beach.

25 respondents recognize correctly the dangerous area of whom 18 would choose the correct response to escape from the current.

The key is the recognition of the rip, since the beachgoers who can recognize it tend to avoid swimming there (Sherker et al. 2010).

## IV. BEACH SAFETY

**Q21. Have you ever had any problem when bathing in the beach? (Figure 15)**

118 respondents had problems sometime when bathing in the beach. In this respect, figure 15 show the global percentages.

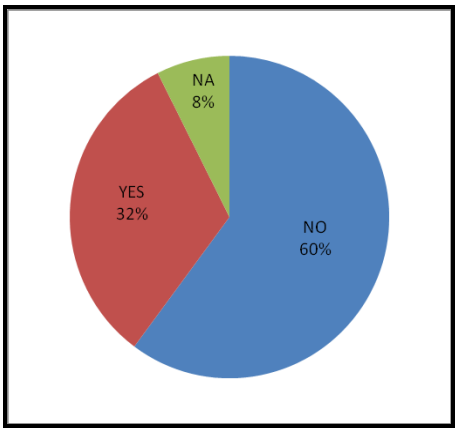



Figure 15.- Q21 analyzed.

**Q22. What kind of problems? (Figure 16)**

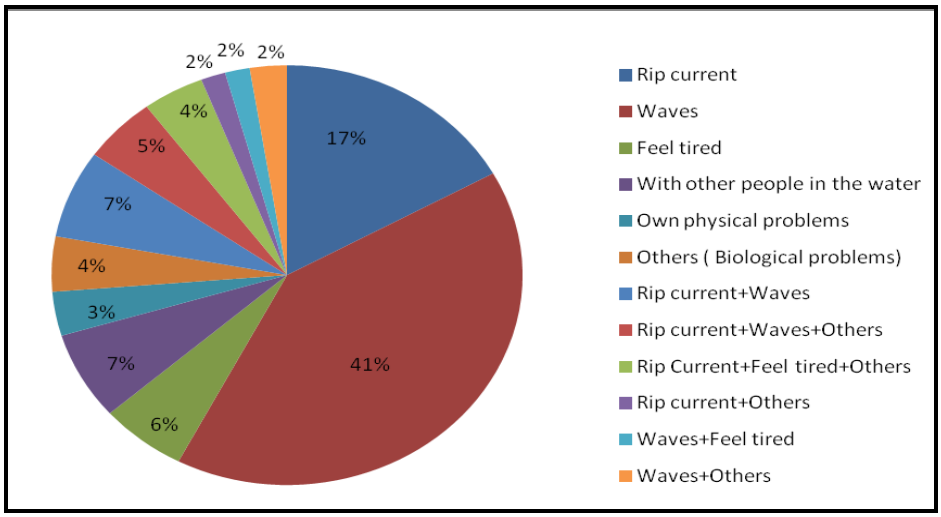



Figure 16.- Q22 analyzed.

As shown in figure 16 the main problems are related to waves and rip currents.

**Q23. Have you ever been rescued? (Table 2)**

The results are shown in table 1.

Table 2.- Q23 analyzed.

| | |
|---|---|
| Q 23 | 26 have been rescued |
| YES | 23 (of whom 2 have answered NO in Q21) |
| NO | 339 (of whom 3 have been rescued by a bather, a life guard and a surfer) |
| CANNOT REMEMBER | 0 |
| NO ANSWER | 2 |
| | 364 |

**Q24. Who was the rescuer? (Figure 17)**

It is interesting to note that most rescues have been achieved by surfers, even more than by lifeguard. The reason is based on the good physical condition of surfers, their knowledge of the beach, their nearness to dangerous areas and the use of a surfboard. Obviously, the higher percentage in rescues correspond to surfers who have been trained in aquatic safety, even over experienced surfers, whereas non-experienced surfers are a hindrance more than a help (Attard et al., 2015).

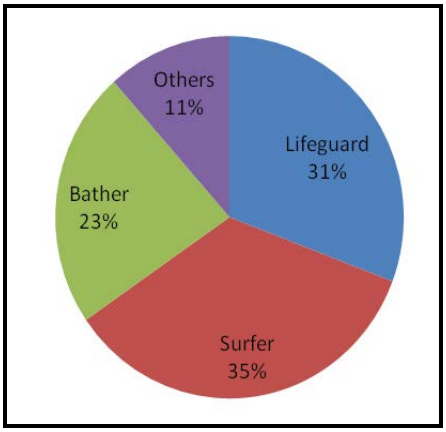
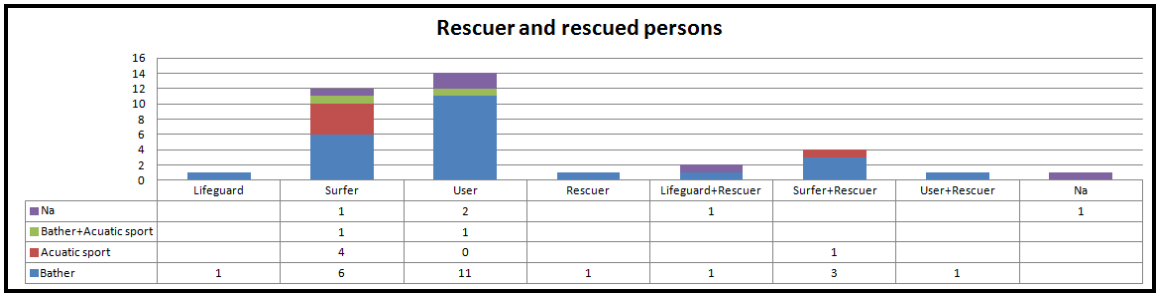



Figure 17.- Q24 analyzed.

69% of rescues were made by "bystanders". That implies a high risk since the rescuers may overestimate themselves and may act without enough calm what means a risky situation for both of them (Franklin et al., 2010; Franklin and Pearn, 2011; Pearn and Franklin, 2012; Moran and Stanley, 2013).

**Q25. Have you ever rescued somebody? (Figure 18)**

Although there are not many lifeguards and surfers among the respondents, it should be noted that surfers rescue people who are doing aquatic sports, as well as bathers, whereas the bathers recue only other bathers. In total, there are 36 rescuers of whom 14 are bathers (they are neither lifeguards nor surfers) without knowledge on aquatic safety.




| | Lifeguard | Surfer | User | Rescuer | Lifeguard+Rescuer | Surfer+Rescuer | User+Rescuer | Na |
|---|---|---|---|---|---|---|---|---|
| Na | | 1 | 2 | | 1 | | | 1 |
| Bather+Acuatic sport | | 1 | 1 | | | | | |
| Acuatic sport | | 4 | 0 | | | 1 | | |
| Bather | 1 | 6 | 11 | 1 | 1 | 3 | 1 | |

Figure 18.- Q25 analyzed.

**Q24-25 (joint analysis) (Figure 19)**

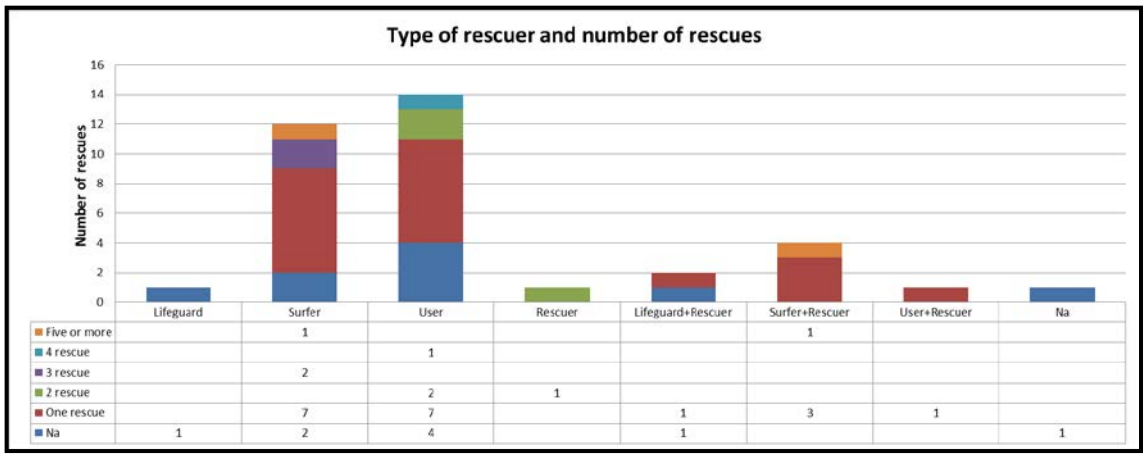



Figure 19.- Q24 and Q25 analyzed together.

According to the analysis, the number of rescuers exceedes the number of people rescued. According to a four-year research carried out in Turkey, 88 rescuers were drowned from which the average age was 26.2 and 42.1% were underage (less than 18) (Turgut, A. and Turgut, T., 2012).

**Q26. Do you think necessary an Aquatic Safety Educational Plan?**

Despite the fact that 83% of beachgoers agree with the educational plan, the 16% that are not interested in this plan should make us to wonder why. Respondents are young people who have received other educational plans (i.e. Road Safety Educational Plan) and they may not rely on them.

In fact, people continue to drown in rip currents at high rates, despite community education and awareness strategies. Due to this, in 2013-14 a powerful visual-based risk communication approach involving imagery and footage of colored dye released into rip currents was used as an outreach tool with success (Brander et al., 2013; 36_Brander et al., 2014). Nevertheless, the key to reduce the deaths along the coast is the education in safety (Moran et al., 2011).

In this respect, the awareness of the rip should be as when we have a look to both sides in a cross road (Sherker et al. 2010).

Other authors think that geography and social sciences should be combined as a whole so that people may understand better the problem of the rips (Shaw et al., 2014).

## V. BEACH SIGNALS

**Q27. What kind of warning signals do you consider necessary on the beach during the non-vigilance periods? (Figure 20)**

Despite the fact that the signals that beachgoers may find on the Byscaine beaches provide different information for each risk, the respondents seem to answer the same for all of them. As shown in figure 20, there are not differences in the reply for three of the main risks.

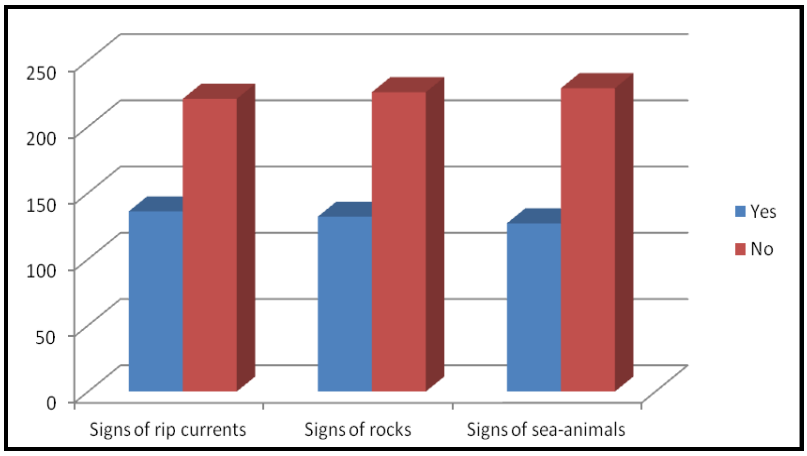



Figure 20.- Q27 analyzed.

Despite the fact that question Q27 refers to a period (non-vigilance) during which there is not any signal related to rip currents, the respondents have answered as if there was some sort of signal. It is usual that the rips currents tend to change their position and direction throughout the year and that is the reason why rips are not highlighted in a permanent way (Woodrofe, C.D., 2002).

Nevertheless, permanent signals are necessary for other type of risks during non-vigilance periods. For example, in Australia only 45% of respondents report not to see warning signals on the beaches (Hatfield et al., 2012). A similar percentage (48%) is the result of a research carried out in the USA (Brannstrom et al. , 2015).

**Q28. Do you include an additional warning signal to improve the users' safety on the beaches? (Figure 21)**

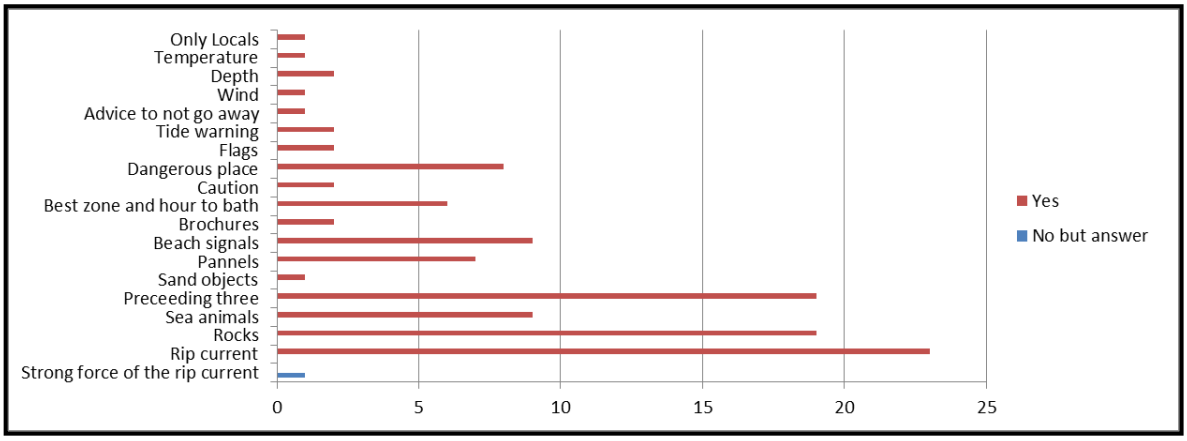



Figure 21.- Q28 analyzed.

Warning signs related to rips and rocks are the most demanded. As for the way to warn, users are interested in brochures, posters and even boards. Some respondents prefer general warnings without indicating information on specific hazards. However, Australian beachgoers have in mind the risk of the rips as the foremost in the warning signage. In any case, it seems to be complicated to warn of the rips by means of sings when it is difficult for lifeguards to

recognize those (Fletemeyer and Leatherman, 2010). Therefore, multiple risk management strategies should be considered (Matthews et al., 2014).

**IV. IDENTIFYING VARIABLES** (Table 3)

Table 3.- Q29, Q30, Q31, Q32, Q33, Q34 and Q35 analyzed.

| Respondents: 364 | | Identifying variables | |
|---|---|---|---|
| Sex % | | Female: 49,2% | Male : 50,8% |
| Age=18 years | | 47,8% | |
| Age <22 years | | 90,9% | |
| Respondents living in a town with beach | Details | 65 | 3 have not heard from rips ever<br>34 are unable to recognize a rip<br>31 are able to recognize a rip, of whom 11 are surfers<br>56 are in favour of aquatic safety education plan |
| Respondents living at Biscay | | 292 | |
| Respondents living at inland province | | 35 | |
| No answer | | 10 | |

## 4. CONCLUSION

The aquatic education responsibility seems to lie with the family rather than the school. Most respondents can swim and learnt how to do it in short courses out of the school. Adult age is reached with a basic level of swimming according to the results (51% of respondents swim between 25 and 100 metres).

Most beachgoers (74%) go to the beach during summer to do three main leisure activities: sunbathing, walking and bathing. Only 3% of respondents have not selected any of these three activities and prefer aquatic sports. It should be noted that some respondents combine leisure activities with sports. Although sports and other activities on the beach sand may be observed during non-summery time, weather permitting, beach activities are usually not related to this period. Nevertheless, a minority group of respondents do aquatic activities during the whole year. The summer season starts in May and finishes in September. It may be concluded that beachgoers' profile is adapted to the season and the weather. Bathing frequency is very reduced outside the summer season time and limited to surf and other aquatic sports. The proximity and quality are the most appreciated elements to choose a beach. Patrol services of the beach are not so recognized.

As for safety, beach users do not recognize the hazards although they would wish to have further information about them. An improvement between the Administration and the users appears to be necessary. The surveyed group lacks basic knowledge with regard to rip currents. In particular, only 2.7% of respondents have proved to know them. In this respect,

49% of respondents answer that they know and can recognize a rip current, however the percentage goes down below 20% when they have to identifying it in a photo. Waves and currents are the most usual hazards. Currents are the most cited by the respondents together with bathers' fatigue and waves related to the current itself. Moreover, respondents give importance to the indirect effects coming from the current but cannot recognize the current itself. Safety is always considered positive by the respondents, however they evaluated several hazards (currents, rocks, fauna, ...) in a different way from what they are shown in the beach signs which leads us to think that there is a general lack of knowledge about beach information. Therefore, beach information should be improved by means of proper signs and even mobile applications. According to the own authors' experience and the bibliography analysis, the education on how to identify and overcome the hazards helps in their prevention and improves the way to face them.

A small group of respondents had to rescue somebody in some occasion (the number of rescuers being higher than the rescued ones). The survey shows that most rescuers are bathers and surfers. Bather rescue other bather and surfers rescue bather and people playing aquatic sports. Proximity to the rescued person is another factor reflected in the survey answers.

Regarding possible steps to reduce the beach risks, education is fundamental. Beachgoers' vulnerability may be reduced by swimming and first aids courses in primary and secondary education. Training on knowing how to face the risks and how to be psychologically strong in a dangerous situation should also be taken into account in the education. The slogan "investing in education is investing in safety" should always be present as demanded by the respondents since the hazard exposure might be reduced. Nevertheless, education must be complemented with a proper hazard information "in situ" and a higher safety perception to reinforce the psychological aspects. In this way, accidents and deaths on the beaches may be reduced to zero as desirable.

## FUTURE WORKS:

Está clara la primera línea de investigación que surge de este estudio y es la necesidad de trabajar en la formación de los individuos como mejora a evitar el riesgo en las playas. Las formaciones que se proponen son tres. La primera se trataría de trabajar con una formación a pie de playa tanto de forma activa, por medio de voluntarios, y de forma pasiva, por medio de folletos que pueden ser entregados en las oficinas de turismo ya existentes. La segunda sería una formación a colegios, se puede realizar bien en el propio centro o bien por medio de una visita a una playa. Y por último se propone la formación que se podría llevar a cabo por la propia universidad con universitarios preparados por medio de cursos que puedan formar a otros universitarios y puedan dar formación en el exterior. También se deberán de tener en cuenta las propias escuelas de surf que son las que están a pie de playa y son las que están formando a futuros surfistas que podrían verse involucrados en casos de salvamento.

## ETHICAL STATEMENT:

This research has been carried out in accordance with the ethical guidelines of the respective author´s instructions. The research is original having not been previously published and is the result of the author´s intellectual thought.


## ACKNOWLEDGEMENTS:

The authors appreciate very much the cooperation of the Biscay Regional Council and the company INGURE, and the non-stop support of general coordinator Koldo Larrazabal from the Biscay Red Cross.


## REFERENCES:


Aggar, B., 2014. The Rip Buoy: Evaluating the Effectiveness of a Potential Lifesaving Aid (Honours Thesis) (BSc). Hons, University of New South Wales, Sydney.

Arozarena, I., Houser, C., Echeverria, A.G., Brannstrom, C., 2015. The rip current hazard in Costa Rica. Nat. Hazards 77 (2), 753e768. http://dx.doi.org/10.1007/s11069-015-1626-9.

Arun Kumar, S.V.V., Prasad, K.V.S.R., 2014. Rip current-related fatalities in India: a new predictive risk scale for forecasting rip currents. Nat. Hazards 71 (1), 313e335. http://dx.doi.org/10.1007/s11069-013-0812-x.

Ashbullby,Katherine J.; Pahl,Sabine; Webley,Paul; White,Mathew P., 2013. The beach as a setting for families' health promotion: A qualitative study with parents and children living in coastal regions in Southwest England.Health Place, 2013, 23, 138-147.

Attard, A.; Brander, R. W.; Shaw, W. S., 2015. Rescues conducted by surfers on Australian beaches. Accident Analysis & Prevention, 2015, 82, 70-78

Austin, M., Scott, T., Brown, J., Brown, J., MacMahan, J., Masselink, G., Russell, P., 2010. Temporal observations of rip current circulation on a macro-tidal beach. Cont. Shelf Res. 30 (9), 1149e1165. http://dx.doi.org/10.1016/j.csr.2010.03.005 .

Ballantyne, R., Carr, N., Hughes, K., 2005. Between the flags: an assessment of domestic and international university students' knowledge of beach safety in Australia. Tour. Manag. 26 (4), 617e622. http://dx.doi.org/10.1016/j.tourman.2004.02.016 .

Bradstreet, A.J., Brander, R.W., McCarroll, J.R., Brighton, B., Dominey Howes, D., Drozdzewski, D., Sherker, S., Turner, I., Roberts, A., MacMahan, J., 2014. Rip current survival principles: towards consistency. J. Coast. Res. 72 (Special issue), 85e92. http://dx.doi.org/10.2112/SI72-016.1.

Branche, C.M. ; Stewart, S., 2001. Lifeguard effectiveness: A report of the working group, Centers for Disease Control and Prevention, Atlanta (2001)

Brander, R.W., 1999. Field observations on the morphodynamic evolution of a low-energy rip current system. Marine Geology, 157 (1999), pp. 199–217

Brander, R., 2013. Thinking space: can a synthesis of geography save lives in the surf?. Australian Geographer, 44 (2) (2013), pp. 123–127
http://dx.doi.org/a0.1080/00049182.2013.799053

Brander, R.W., 2010. Dr Rip's Essential Beach Book: Everything You Need to Know about Surf, Sand and Rips. University of New South Wales Press Ltd, Sydney, NSW.

Brander, R.W., Bradstreet, A., Sherker, S., MacMahan, J., 2011. Responses of swimmers caught in rip currents: perspectives on mitigating the global rip currenthazard. Int. J. Aquatic Res. Educ. 5, 476e482.

Brander, R.W., Drozdzewski, D., Dominey-Howes, D., 2014. "Dye in the water": a visual approach to communicating the rip current hazard. Sci. Commun. 36 (6), 802e810. http://dx.doi.org/10.1177/1075547014543026.

Brander, R.W., Dominey-Howes, D., Champion, C., Del Vecchio, O., Brighton, B., 2013. Brief Communication: a new perspective on the Australian rip current hazard. Nat. Hazard Earth Sys. 13, 1687e1690. http://dx.doi.org/10.5194/nhess-13-1687-2013.

Brannstrom, C.; Lee Brown,H.; Houser, C.; Trimble, S.; Santos, A., 2015. "You can't see them from sitting here": Evaluating beach user understanding of a rip current warning sign. Appl.Geogr., 2015, 56, 61-70

Brannstrom, C., Trimble, S., Santos, A., Brown, H.L., Houser, C., 2014. Perception of the rip current hazard on Galverston Island and North Padre Island, Texas, USA. Nat. Hazards 72 (2), 1123e1138. http://dx.doi.org/10.1007/s11069-014-1061-3 .

Breton, F., Clapés, J., Marquès, A., Priestley, G. K., (1996). "The recreational use of beaches and consequences for the development of new trends in management: the case of the beaches of the Metropolitan Region of Barcelona (Catalonia, Spain). Ocean & Coastal Management, Vol. 32, Nº 3, pp. 153-180

Bernadette M., Robert A., Austin A., 2013. Warning signs at beaches: Do they work?. Safety Science 62:312–318

Caldwell, N., Houser, C., Meyer-Arendt, K., 2013. Ability of beach users to identify rip currents at Pensacola Beach, Florida. Nat. Hazards 68 (2), 1041e1056. http://dx.doi.org/10.1007/s11069-013-0673-3.

Cervantes, O.; Verduzco-Zapata, G.; Botero, C.; Olivos-Ortiz, A; Chávez-Comparan, J. C.; Galicia-Pérez, M., 2015. Determination of risk to users by the spatial and temporal variation of rip currents on the beach of Santiago Bay, Manzanillo, Mexico: Beach hazards and safety strategy as tool for coastal zone management. Ocean Coast.Manage., 2015, 118, Part B, 205-214

Costill DL, Kovaleski J, Porter DA, Kirwan J, Fielding R, King DS, 1985. Energy expenditure during front crawl swimming: predicting success in middle- distance events. Int J Sports Med; 6: 266–270

Cowell, P.J., Thom, B.G., 1994. Morphodynamics of coastal evolution. In: Carter, R.W.G., Woodroffe, C.D. (Eds.), Coastaln Evolution: Late Quaternary Shoreline Morphodynamics. Cambridge University Press, Cambridge, pp. 33–86.

Czaja, R. and Blair, J., 1996. Designing Surveys: A Guide to Decisions and Procedures. Thousand Oaks, CA: Pine Forge.

Dalrymple, R.; MacMahan J.; Reniers, A.; Nelko, V.., 2011 Rip currents. Annu. Rev. Fluid Mech., 43 (2011), pp. 551–581

Davies, J.L., 1972. Geographical Variation in Coastal Development. Oliver & Boyd, Edinburgh (1972)

Drozdzewski, D., Roberts, A., Dominey-Howes, D., Brander, R., 2015. The experiences of weak and non-swimmers caught in rip currents at Australian beaches. Aust. Geogr. 46 (1), 15e32. http://dx.doi.org/10.1080/00049182.2014.953735 .

Drozdzewski, D., Shaw, W., Dominey-Howes, D., Brander, R., Walton, T., Gero, A., Sherker, S., Goff, J., Edwick, B., 2012. Surveying rip current survivors: preliminary insights into the experiences of being caught in rip currents. Nat. Hazard Earth Sys. 12, 1201e1211. http://dx.doi.org/10.5194/nhess-12-1201-2012.

Fletemeyer, J.; Leatherman, S., 2010. Rip currents and beach safety education. Journal of Coastal Research, 26 (1) (2010), pp. 1–3

Franklin, R.C., Scarr, J.P., Pearn, J.H., 2010. Reducing drowning deaths: the continued challenge of immersion fatalities in Australia. Med. J. Aust.192 (3), 123–126

Franklin, R.C.; Pearn, J.H., 2010. Drowning for love: the aquatic victim-instead-of-rescuer syndrome: drowning fatalities involving those attempting to rescue a child. Journal of Paediatrics and Child Health, 47 (1–2) (2010), pp. 44–47 http://dx.doi.org/10.1111

Franklin, R., Pearn, J., 2011. Drowning for love: the aquatic victim-instead of rescuer syndrome: drowning fatalities involving those attempting to rescue a child. J. Paediatr. Child Health 47, 44–47

Gallop, S.L., Woodward, E., Brander, R.W., Pitman, S.J., (2016). ”Perceptions of rip current myths from the central south coast of England” Ocean & Coastal Management 119, 14-20.

Gensini, V.A., Ashley, W.S., 2010. An examination of rip current fatalities in the United States. Nat. Hazards 54 (1), 159e175. http://dx.doi.org/10.1007/s11069-009-9458-0.

Hammerton, C.E.; Brander, R.; Dawe, N.; Riddington, C.; Engel, R., 2013. Approaches for beach safety and education in Ghana: a case study for developing countries with a surf coast. International Journal of Aquatic Research and Education, 7 (2013), pp. 254–265

Hartmann, D., 2006. Drowning and beach-safety management (BSM) along the Mediterranean beaches of Israel along term perspective. J. Coast. Res. 22 (6), 1505e1514. http://dx.doi.org/10.2112/05-0497.1.

Hatfield, J., Williamson, A., Sherker, S., Brander, R., Hayen, A., 2012. Development and evaluation of an intervention to reduce rip current related beach drowning. Accid. Anal. Prev. 46, 45e51. http://dx.doi.org/10.1016/j.aap.2011.10.003 .

Holden, A., 2000. Environment and tourism. London: Routledge.

IPCC, 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen,M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

James, R.J., 2000. From beaches to beach environments: linking the ecology, human-use and management of beaches in Australia. Ocean and Coastal Management, 43 (2000), pp. 495–514

Kennedy,D. M.; Sherker,S.; Brighton, B.; Weir, A.; Woodroffe, C. D., 2013. Rocky coast hazards and public safety: Moving beyond the beach in coastal risk management. Ocean Coast.Manage., 2013, 82, 85-94

Klein, A. H. da F., Santana, G.G., Diehl, F.L., de Menezes, J.T., 2003. Analysis of hazards associated with sea bathing: results of five years work in oceanic beaches of Santa Catarina state, southern Brazil. J. Coast. Res. 35, 107e116.

MacMahan, J., Brown, J., Brown, J., Thornton, E., Reniers, A., Stanton, T., Henriquez, M., Gallager, E., Morrison, J., Austin, M.J., Scott, T.M., Senechal, N., 2010. Mean lagrangian flow behaviour on an open coast rip-channeled beach: a new perspective. Mar. Geol. 268 (1e4), 1e15. http://dx.doi.org/10.1016/ j.margeo.2009.09.011.

MacMahan, J., Reniers, A., Brown, J., Brander, R., Thornton, E., Stanton, T., Brown, J.,Carey, W., 2011. An introduction to rip currents based on field observations. J. Coast. Res. 27 (1), iiieivi. http://dx.doi.org/10.2112/JCOASTRES-D-11-00024.1.

MacMahan, J.H., Thornton, E.B., Reniers, J.H.M., 2006. Rip current review. Coast. Eng. 53 (2e3), 191e208. http://dx.doi.org/10.1016/j.coastaleng.2005.10.009.

Marin, V., Palmisani, F., Ivaldi, R., Dursi, R., Fabiano, M., 2009. “User´s perception analysis for sustainable beack management in Italy”. Ocean & Coastal Management 52, 268-277.

Martín Prieto, J. A., Rodríguez-Perea, A., 1998. Participación vegetal en la construcción de los sistemas dunares litorales de Mallorca. In: Grandal d'Angade, A.(Ed.), IV Reunion de Geomorfología. Sociedad Española de Geomorfología O Castro, A Coruña, pp. 785 e798.

Matthews,Bernadette; Andronaco,Robert; Adams,Austin, 2014. Warning signs at beaches: Do they work?. Saf.Sci., 2014, 62, 312-318

McCarroll, R.J., Brander, R.W., MacMahan, J.H., Turner, I.L., Reniers, A.J.H.M., Brown, J.A., Bradstreet, A., Sherker, S., 2014a. Evaluation of swimmer-based rip current escape strategies. Nat. Hazards 71, 1821e1846. http://dx.doi.org/10.1007/s11069-013-0979-1 .

McCarroll, R.J.; Brander, R.W.; Turner, I.L.; Power, H. E.; Mortlock, T.E., 2014b. Lagrangian observations and circulation on an embayed beach with headland rip currents. Marine Geology, 355 (2014), pp. 173–188

McCarroll, R.J., Castelle, B., Brander, R.W., Scott, T., 2015. Modelling rip current flow and bather escape strategies over a transverse bar and rip channel morphology. Geomorphology 246, 502e518. http://dx.doi.org/10.1016/j.geomorph. 2015.06.041.

McCool, J.; Moran, K.; Ameratunga, S.; Robinson, E., 2008. New Zealand beachgoers swimming behaviours, swimming abilities, and perception of drowning risk. International Journal of Aquatic Research and Education, 1 (2008), pp. 7–15

Moran, K., 2006. Water safety knowledge, attitudes and behaviours of Asian youth in New Zealand. Proceedings of the 2nd International Asian Health and Wellbeing Conference, Auckland, New Zealand (2006), pp. 91–101

Moran, K.; 2008. Will they sink or swim? New Zealand youth water safety knowledge and skills. International Journal of Aquatic Research and Education, 2 (2008), pp. 114–127

Moran, K.; Quan, L.; Franklin, R.; Bennett, E., 2011. Where the evidence and expert opinion meet: a review of open-water recreational safety messages. International Journal of Aquatic Research and Education, 5 (3) (2011), pp. 257–270

Moran, K., Stanley, T., 2013. Readiness to rescue: bystander perceptions of their capacity to respond in a drowning emergency. Int. J. Aquat. Res. Educ.7, 290–300

Pearn, J., Franklin, R., 2012. The impulse to rescue: rescue altruism and the challenge of saving the rescuer. Int. J. Aquat. Res. Educ. 6, 325–335.

Puertos del estado web cite. http://www.puertos.es/es-es/oceanografia/Paginas/portus.aspx Last visit on 28/04/2017.

Pye, K., 1982. Morphological and desenvolpment of coastal dunes in a sumid tropical environment, Cape Bedford and cape Flattery. N. Qld. Geogr. Ann. 64-A, 213 e 227.

Red Cross Bizkaia, 2015. Memoria playas 2015. Cruz Roja Bizkaia.

RFESS, 2015. Real Federación Española de Salvamento y Socorrismo. Informe Nacional de Ahogamientos.
http://www.rfess.es/DOCUMENTOS/Prevenci%C3%B3n/Informeahogamientos2015.pdf Last consult: 6 October 2016.

Reilly TR,Wooler A, TiptonMJ. 2005. Occupational fitness standards for beach lifeguards phase 1: the physiological demands of beach lifeguarding. Occup Med; 56: 6–11

Scott, T., Masselink, G., Austin, A.J., Russell, P., 2014. Controls on macrotidal rip current circulation and hazard. Geomorphology 214, 198e215. http:// dx.doi.org/10.1016/j.geomorph.2014.02.005.

Scott, T., Russell, P., Masselink, G., Wooler, A., Short, A., 2007. Beach rescue statistics and their relation to nearshore morphology and hazards: a case study for southwest England. J. Coast. Res. 50 (Special issue), 1e6.

Scott, T., Russell, P., Masselink, G.,Wooler, A., Short, A., 2008. High volume sediment transport and its implications for recreational beach risk. In: Proceedings of the 31st International Conference on Coastal Engineering, pp. 4250e4262. http://dx.doi.org/10.1142/9789814277426_0353. Hamburg.

Shaw,W. S.; Goff,J.; Brander,R.; Walton,T.; Roberts,A.; Sherker,S., 2014. Surviving the surf zone: Towards more integrated rip current geographies. Appl.Geogr., 2014, 54, 54-62

Sherker, S.; Brander,R.; Finch, C.; Hatfield, J., 2008. Why Australia needs an effective national campaign to reduce coastal drowning. Journal of Science and Medicine in Sport, 2008, 11, 2, 81-83

Sherker, S., Williamson, A., Hatfield, J., Brander, R., Hayen, A., 2010. Beachgoers' beliefs and behaviours in relation to beach flags and rip currents. Accid. Anal. Prev. 42 (6), 1785e1804. http://dx.doi.org/10.1016/j.aap.2010.04.020 .

Short, A.D., 1985. Rip current type, spacing and persistence, Narrabeen beach, Australia. Mar. Geol. 65 (1e2), 47e71. http://dx.doi.org/10.1016/0025-3227(85) 90046-5 .

Short, A.D., 2007. Australian rip systemsdfriend or foe? J. Coast. Res. 50 (Special issue), 7e11.

Short AD, Hogan CL., 1994. Rip currents and beach hazards: their impact on public safety and implications for coastal management. J Coast Res 1994;12:197-209 [Special issue: Coastal Hazards].

SLSA, 2010. Surf Lifesaving Australia. Annual Report 2009–2010 Surf Life Saving Association of Australia, Sydney (2010)

Tipton MJ, Reilly TR, Iggleden C, Rees A; 2002. Fitness and Medical Standards for Beach Lifeguards. Portsmouth: University of Portsmouth Report to the RNLI.

Tipton, M., Reilly, T., Rees, A., Spray, G., Golden, F., 2008. Swimming performance in surf: the influence of experience. Int. J. Sports Med. 29 (11), 895–898.

Turgut,A.; Turgut,T., 2012. A study on rescuer drowning and multiple drowning incidents. J.Saf.Res., 2012, 43, 2, 129-132

Williamson,A., Hatfield,J., Brander, R. et al. 2008. Improving beach safety: the Science of the Surf research project. Proceedings of 2008 Australian Safety Conference, Sydney, pp. 102-103.

World Health Organization (2008). World Report on Child Injury Prevention. Geneva, Switzerland. World Health Organization and UNICEF. ISBN 978 92 4 156357 4.

World Health Organization (2014). Global report on drowning: preventing a leading killer . Geneva, Switzerland. WHO Press, World Health Organization Wilks, J.; Dawes, P.; Pendergast,

D.; Williamson, B., 2005. Tourists and beach safety in Queensland, Australia. Tourism in Marine Environments, 1 (2005), pp. 121–128

Wilks, J.; De Nardi,M.; Wodarski, R., 2007. Close is not close enough: drowning and rescues outside flagged beach patrol areas in Australia. Tourism in Marine Environments, 4 (2007), pp. 57–62

Woodrofe, C.D., 2002. Coasts, Forms and Evolution. Cambridge University Press, UK (2002) 498

Woodward, E.M., Beaumont, E., Russell, P.E., Wooler, A., Macleod, R., 2013. Analysis of rip current incidents and victim demographics in the UK. J. Coast. Res. 65 (Special issue), 850e855.

Woodward, E., Beaumont, E., Russell, P., Macleod, R., 2015. Public understanding and knowledge of rip currents and beach safety in the UK. Int. J. Aquatic Res. Educ. 9, 49e69. http://dx.doi.org/10.1123/ijare.2014-0067.

Wright, L.D., Thom, B.G., 1977. Coastal depositional landforms: a morphodynamic approach. Prog. Phys. Geogr. 1, 412–459.

Wright, L.D., Short, A.D., 1984. Morphodynamic variability of surf zones and beaches: a synthesis. Mar. Geol. 56 (1e4), 93e118. http://dx.doi.org/10.1016/0025- 3227(84)90008-2.