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Do red and yellow flags indicate a danger zone?: Exploring Japanese university students' beach safety behaviour and their perceptions of Australian beach safety signage

Masaki Shibata [a,b,*], Amy E Peden [b,c], Hideo Watanabe [f], Jasmin C Lawes [b,d,e]

[a] School of Languages, Literature, Cultures, and Linguistics, Monash University, Clayton, VIC 3800, Australia
[b] UNSW Beach Safety Research Group, UNSW Sydney, Kensington, NSW 2052, Australia
[c] School of Population Health, Faculty of Medicine and Health, UNSW Sydney, Kensington, NSW 2052, Australia
[d] Surf Life Saving Australia, Bondi Beach, NSW 2026, Australia
[e] School of Biological, Earth and Environmental Sciences, UNSW Sydney, Kensington, NSW 2052, Australia
[f] Faculty of Education, Musashino University, Tokyo, Japan

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ABSTRACT

Background: Coastal drowning is a tragic regular occurrence in Australia, and in the decade 2012–2022, 455 overseas-born beachgoers drowned. Being one of the top five countries of international visitors who drown, Japanese tourists are an at-risk group. This study investigates Japanese university students' knowledge of beach safety and their perceptions of Australian beach safety signage.
Methods: The present study conducted an online survey with 152 university students in Japan, comprising both closed and open questions. Although the survey was in Japanese, the signage terms used in the survey were in English as used in Australia. Descriptive analysis was conducted on the statistical data via SPSS and deductive thematic analysis was conducted on the open responses using Nvivo.
Results: 90 % of them planned to visit beaches and 64 % would enter the water when or if visiting Australia. However, 60 % interpreted the safer supervised zone denoted by red and yellow flags as signifying a danger zone. Regardless of their English proficiency, almost none fully understood terms commonly used on safety and warning signs such as *submerged objects, shore dump, shore break* and *rip currents*, and 60 % of them didn't know the Japanese term of rip currents, *riganryuu.* Visual icons were understood much better than these English terms.
So what?: This study explored a specific (i.e. Japanese) cultural perception and understanding of Australian beach signs beyond the scope of CALD communities. Future studies should continue exploring those of other cultures so Australian beach signs can be revised and improved based on scientific evidence.

1. Introduction

Japanese visitors have traditionally made up one of the biggest groups of international tourists to Australia (Tourism Research Australia, 2023; Tourism Western Australia, 2022). In 2018/2019, prior to the COVID-19 pandemic, about 500,000 Japanese tourists visited Australia (Tourism Research Australia, 2019). Japanese tourists' visits to Australia in the same period had a significant impact on the Australian economy, contributing 2.1 billion Australian dollars to Australian tourist revenue (Tourism Research Australia, 2019). Although this figure has since declined due to the border closures in response to the COVID-19 pandemic, this number is expected to recover to pre-pandemic levels by 2026 (Tourism Research Australia, 2023). Japanese tourists are most likely to visit coastal destinations such as Sydney in New South Wales and the Gold Coast in Queensland where they can visit beaches and enjoy water-based activities (De Nardi and Wilks, 2007; Toyama, 1991; Tourism WA, 2022).

However, the Australian coastal environment features a number of dangerous characteristics that have claimed many human lives (Koon et al., 2023). Australia has over 11,000 mainland beaches with 17,500 rip currents, i.e., seaward flowing that can take beachgoers away from the shore (Brander, 2015). These currents can reach speeds of 2 m per

* Corresponding author at: School of Languages, Literature, Cultures, and Linguistics, Monash University Level 5, 20 Chancellors Walk, Clayton campus, VIC 3800, Australia.
E-mail address: masaki.shibata@monash.edu (M. Shibata).

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second, faster than Olympic swimmers (Brander & Macmahan, 2011). The dangers of the coastal environment including rip currents cause an average of 122 coastal drownings every year, including of international visitors (Peden et al., 2016; SLSA, 2022; Willcox-Pidgeon et al., 2023) Almost half of coastal drowning deaths are associated with beachgoers born outside of Australia, and among these, Japanese represent the tenth largest ethnicity of victims (SLSA, 2022). In the data of 2008–2018, Japanese visitors were the fourth largest group of drowning victims (Willcox-Pidgeon et al., 2023). They were also the fifth largest group of drowning among international short-term visitors in the 15 years of 2005–2019 (Koon, 2024). These data suggest that Japanese tourists are considered high risk for coastal drownings compared to most nationalities, and some preventative interventions for them need to be considered.

Given the high risk for coastal drownings in accordance with the popularity of visiting coastal areas among Japanese tourists, Surf Life Saving Queensland (SLSQ) took the initiative to promote beach safety to Japanese tourists in Australia. In 1998, SLSQ launched a campaign called "meet and greet" where surf lifesavers talked in person to visitors about beach safety, and in 2002 an advancement of this program, where the tour was given by Japanese-speaking surf lifesavers, was implemented specifically for Japanese tourists (De Nardi and Wilks, 2007). In 2018, a technology company, Romeo Digital, in collaboration with Surf Life Saving Queensland, developed and implemented a free internet service known as "Life-Fi". In order to access this free WIFI service, beachgoers are required to read beach safety information that is available in a number of foreign languages, including Japanese (Romeo Digital, 2023).

While these campaigns and programs have been made available for Japanese tourists, detailed information on Japanese tourists' beachgoing behaviour and perceptions of beach safety signage are still lacking. In fact, there are almost no studies that examined a specific cultural group and showed how a particular cultural and linguistic background affected beachgoers' behaviours and perceptions of beach warning messages. For example, previous studies have found certain differences between Australians and international visitors (Shibata, 2023; Shibata et al., 2024): for example, international visitors are more likely to enter the water outside the red and yellow safety flags (Williamson et al., 2012), which in Australia are safer designated swimming areas supervised by professional lifeguards and/or volunteer surf lifesavers. Regarding the longstanding core beach safety message in Australia, 'always swim between the red and yellow flags', Clifford et al. (2018) found that a majority of international students are not fully aware of the meaning of the red and yellow flags before they arrive in Australia. Ballantyne et al. (2005) found that 13 % of international students interviewed in their study thought that they indicated a danger zone.

From a linguistic point of view, Shibata (2023) discusses intercultural communication issues involved in understanding Australian beach safety signage, and shows that about 30 % of overseas-born beachgoers take the meaning of *swim between the flags* literally, understanding it to mean that visitors, who don't or can't swim, need to stay *outside* the flags. Some terms found on signage such as *bluebottle*, referring to a marine stinger, can be understood only by seeing them or hearing about them (Shibata, 2023). A popular translation application, Google Translate, also currently mistranslates some terms on beach signs in foreign languages, which is a serious concern for people like tourists who rely on the application due to a lack of English proficiency (Shibata et al., 2024). Because of such cultural and linguistic issues involved in safety signage, there is an additional barrier preventing international visitors from appropriately understanding important warning messages.

While these studies identify differences between Australian and international visitors regarding the beachgoing behaviour and the perception of warning messages, the groups, referred to by terms such as "international" "overseas-born", or "Culturally And Linguistically Diverse (CALD)", requires a further investigation. In fact, these terms feature multiple nationalities, cultures and linguistic varieties and it is difficult to address the issues without understanding specific cultural and linguistic factors. Therefore, narrowing the scope of such terms to investigate a specific language group, nationality or ethnicity has the potential to contribute to a better understanding of these communities and improving Australian beach signage with scientific evidence. That said, the primary aim of this study is to explore Japanese beachgoing behaviour and perceptions of Australian beach signs. The second aim of this study is to provide future studies guidance and a survey tool to examine other cultural perceptions of Australian beach safety signs.

This study selects university students as a sample, a majority of whom are typically at the age of 18–25 years old in Japan. This is because many Japanese young adults are attracted to Australia as a holiday destination: for example, over 50 % of Japanese tourists in Australia are between the ages of 15–34 (Tourism WA, 2019). Secondly, in relation to trends among coastal drownings in Australia, male young adults (15–34) are considered one of the groups most at risk, accounting for almost half of rip current drownings in Australia (RLSSA, 2023). This is a particular concern for Japanese tourists since the proportion of male Japanese visitors to Australia is relatively higher than those to other foreign nations (Toyama, 1991).

2. Research method

2.1. Recruitment and participants

Recruitment was carried out via online announcements and in classrooms. For the online announcements, the purpose and summary of the project, guidelines for potential participants, and a link to the survey were sent out. For the classroom recruitment, the lecturer explained the same content to the students during the classes, and on the same day, a link to the survey was sent out to students. It is noted that the students were informed that participation in this study would have no affect on their course grades. The first page of the anonymous survey set out the relevant participant information and a form for indicating consent. Once consent was obtained, the survey was launched, and participant responses were recorded. The total number of recorded responses was 177; of these, 25 unfinished responses were removed, leaving a total of 152 responses for analysis. The design of this study was reviewed and approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2023-040).

2.2. Survey

The survey for this study was developed using *Qualtrics* (Provo, UT). The survey comprised 29 closed and open questions. The survey questions were classified into four categories; demographics, expected safety behaviour when visiting Australian beaches, usual safety behaviour at Japanese beaches, and interpretations of safety messages on common Australian beach signage (see Appendix for the complete survey). To narrow down the focus on beach safety in Australia, this study excluded usual safety behaviour at Japanese beaches from the analysis and discussion. Although most questions called for closed responses, a number of open responses were also incorporated for clarification of respondent interpretations of terms on signs. Regarding the interpretation of the graphics on signs, only open responses were requested, as the perceptions of icons, graphics, images can be influenced by cultural and personal experiences (Forceville, 2022; Pettersson, 1982) and, hence, highly unpredictable. The interpretation of the icons is particularly important for those who do not understand the verbal text; hence, rely on the icons on the signs to interpret the relevant warning message. The survey was given in Japanese language, considering that all the participants were studying university courses with Japanese as the language of instruction. The signage terms in the questionnaire were, however, kept as the original Australian signage – that is, the terms were presented in English. Therefore, the multiple response options for signage term-related questions were carefully chosen considering the Japanese

students' likely knowledge of English. Hence, the options were set as "Yes, absolutely", "I know both words, and I think I understood, but I'm not entirely sure", "I know both words, but I don't understand what they mean together", "I don't know either word, so I don't know what it means." Those who chose the first two options were asked to clarify their interpretations in a written response.

'The content validity of the survey was ensured through two processes: a comprehensive literature review and a review carried out by experts in the field of beach safety (authors JL, and AP) (Taherdoost, 2016; Zamanzadeh et al., 2014; Koon et al., 2022). Face validity, that is, the appropriateness and clarity of the instrument for respondents, was enhanced by having a Japanese sociologist and a qualified Japanese swimming instructor review the survey and provide feedback. Based on this feedback, modifications were made to the survey before it was disseminated. Table 1 shows a list of the images and photographs used in the survey. Table 3 shows a list of the terms used on Australia beach signs included in the survey, with a brief explanation of each.

2.3. Analysis

This study used SPSS version 28.0.1.0 for descriptive analyses, and Nvivo 20 to conduct deductive code analysis for the open responses. The code analysis for the open responses is particularly important as it allows the investigators to understand *how* the participants interpret the warning messages delivered by the signs. It also shows how many responses of those indicating their understanding of the sign have an appropriate interpretation of the warning message (see, Shibata,et al., 2024). To add further rigour to the analysis, the investigators (MS, JL, AP) discussed the individual codes as a team in the course of processing and finalising the analysis.

3. Results

3.1. Demographics

All participants in this study were aged between 18 and 24 years; the gender breakdown of participants was 62.5 % female, 35.5 % male, 1.3 % non-binary, and 0.7 % preferred not to mention (Table 3). The longest place of residency of most participants (97.0 %) was Japan. Over 80.0 % of participants reported their English proficiency as intermediate or above, with more than 90 % of participants reporting a minimum of four years of English language education (Table 3).

3.2. Expected safety behaviour when visiting Australian beaches

In regard to visiting Australia, only 12 (7.9 %) of the Japanese students had previously visited Australia, for stays of less than three months (Table 4). Two out of the 12 had been exposed to knowledge of Australian beach safety while staying in Australia; one from the people they lived with and one from an educational institution. Most participants (90.1 %) expressed a wish to visit a beach if travelling in Australia, with 64.2 % of them indicating they would like to enter the water, while 11.7 % had no intention of doing so, and 24.1 % were unsure whether they would enter the water or not (Table 4).

The survey used a picture of Bondi Beach, Sydney divided into four areas featuring a rip current (see Q11 in Table 2) and asked respondents where they would enter the water to swim at this beach. Option 1 has a sandbank to enter without any rip currents, and Option 2 could include the currents feeding into the mainstream of the rip current shown in Option 3. Option 3 of the picture shows the presence of a wide rip current, and Option 4 is close to rocks. Almost half the respondents (48.7 %) chose Option 1, while close to half (44.1 %) of the others chose Option 2; only 7 (4.6 %) chose Option 3, and only 3 (2 %) chose Option 4. Interpreting these figures, we can see that almost no Japanese students chose the area featuring a mainstream of a rip current (i.e. Option 3).

3.3. Interpretations of Australian beach flags and beach safety signage

This section illustrates whether and how Japanese university students understand the red and yellow flags and the terms and graphics used on Australian beach safety signs.

3.3.1. Red and yellow flags

The questions about perceptions of the red and yellow flags were accompanied by pictures of the red and yellow flags (see Q23 and Q24 in Table 1). Firstly, the survey asked whether or not respondents learned what was meant by the red and yellow flags on Australian beaches, to which only four (2.6 %) responded "yes". Follow-up questions were asked about their interpretations of the red and yellow flags. Over half of the respondents (60.6 %, n = 92) indicated that the red and yellow flags signify a danger zone, where swimming and bathing were not allowed. 25.6 % (n = 39) responded that the red and yellow flags signified a safe zone, and of these 9.2 % (n = 14) believed that surfers should also be between the flags. A few (11.2 %, n = 17) thought that the flags informed beachgoers that the area was currently being used for some type of competition.

3.3.2. Descriptive safety terms used on signage

As Table 5 shows, *high surf* had only a few students (16.4 %, n = 25) who were fully confident in their understanding of the term, and 36.8 % (n = 56) believed they understood it but were not entirely sure. Almost half of them (46.7 %, n = 71) did not understand the term at all, and of these, 28.3 % (n = 43) recognized the individual component words but did not understand them together as a warning message. Regarding *bluebottle,* 94.8 % indicated that they weren't familiar with the term at all, with only one person confident of understanding it and the combinations *submerged objects, shore dump,* and *shore break* showed similar results (Table 5). In relation to *submerged objects,* no respondents were fully understood the term, and almost none reported full comprehension of *shore dump* and *shore break*. A slightly higher proportion of respondents believed they understood *shore dump* and *shore break* than *submerged objects,* but in all cases this proportion was less than 10 % (8.6 %, 7.9 %, and 4.6 % respectively). About 65 % of the students simply did not know either or both of the English words used in *submerged objects* (65.8 %, n = 100)*, shore dump* (66.4 %, n = 101)*,* and *shore break* (63.8 %, n = 97) and so were unable to interpret the terms at all. As for *rip currents,* only a very few (6.5 %, n = 10) fully understood or believed they understood the term, while the majority of respondents (93.4 %, n = 142) did not understand the meaning of *rip currents* (Table 5). In order to understand whether this result is associated with their interpretation of the words or rather real-world knowledge of rip currents, the survey also asked if respondents knew the standard Japanese equivalent of "rip currents", *riganryuu.* Only 21.7 % (n = 33) of respondents were confident they knew what *ringaryuu* meant, 18.4 % (n = 28) believed they knew, but more than half (59.9 %, n = 91) of them did not know or had never heard of the term before (Table 5).

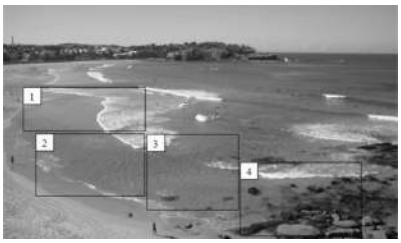
3.3.3. The graphics used on signs

This section explores how the graphic icons used on signs were understood by Japanese university students. The icons for *slippery floor, submerged objects, high surf, dangerous currents,* and (floating) *stingers* are shown in Table 1. Participants were asked to write down their understanding of these icons.

As Table 6 shows, regarding the icon for *slippery area,* of those who clarified their interpretations in open questions, while the largest number of responses (38.6 %, n = 59)[1] referred to the risk of falling potentially caused by slippery ocean floors. However, quite a few students misinterpreted the icon to refer to danger underwater. For example, 16.8 % (n = 26) of responses mentioned a sudden drop in the

[1] Some participants referred to multiple themes.

Table 1
Photographs and images on the beach safety signs featured in the survey.

Question	Photographs and signage	Message
Q.11Where would you enter the water to swim or bathe at this beach?	 Four entry points at Bondi Beach. At the further area of option 1 and 2 there are some people in the water; option 1 is the safest place to enter due to the sand bar. Option 2 is a safety option, but could be dangerous due to a rip feeder, a current feeding into the mainstream of the rip shown in option 3. Option 3 has a seaward flowing rip current (the calm area without any white forms); option 4 is near a rock platform (Photograph: Robert W. Brander).	N/A
Q23. Have you learned what the Australian red and yellow flags mean?	 Red and yellow flags as used on an Australian beach. (Photograph: Surf Life Saving Australia)	Stay/Swim between the flags
Q24. What do you think these flags mean? Or what were you told about these flags?	 Red and yellow flags in use on a beach of NSW. (Photograph: Robert W. Brander)	Stay/Swim between the flags
Q25. What do you think this sign is warning about?	 Graphic used on standing board signage at Bondi beach, Sydney (Photograph: author MS)	Slippery area
Q26. What do you think this sign is warning about?	 Graphic used on standing board signage at Bondi beach, Sydney (Photograph: author MS)	Submerged objects
Q27. What do you think this sign is warning about?	 Graphic used on standing board signage at Bondi beach, Sydney (Photograph: author MS)	High surf

(*continued on next page*)

Table 1 (*continued*)

Question	Photographs and signage	Message
Q28. What do you think this sign is warning about?	 Graphic used on standing board signage at Bondi beach, Sydney (Photograph: author MS)	Dangerous current
Q29. What do you think this sign is warning about?	 Graphic warning of marine stingers or bluebottles (National Aquatic & Recreational Signage Style Manual, 2006)	Stingers (floating) – e.g. *bluebottles*

Table 2
Terms signage commonly used on Australian beach signs as featured in the survey.

Signage terms	A brief explanation of the term
High surf	Surf conditions are powerful and dangerous
Bluebottle	A marine hydrozoan with a tentacle that causes painful stinging
Submerged objects	The presence of objects such as reefs and rocks under the surface of the water
Shore dump	Plunging waves alternatively called *dumping waves* break suddenly onto the shore with great force.
Shore break	Plunging waves alternatively called *dumping waves* break suddenly onto the shore with great force.
Rip currents	Strong seaward currents that can take swimmers away from the shore

Table 3
Participants' demographic characteristics and experience in relation to Australian beaches and beach safety education.

Characteristic/experience	Number (percentage)
The country they currently live in Japan	152 (100 %)
The country they lived in for the longest period	
Japan	150 (98.7 %)
Jordan	1 (0.7 %)
Malaysia	1 (0.7 %)
Age	
<18	0 (0 %)
18–24	152 (100 %)
25–34	0 (0 %)
35–44	0 (0 %)
45–54	0 (0 %)
55–64	0 (0 %)
<65	0 (0 %)
Gender	
Male	54 (35.5 %)
Female	95 (62.5 %)
Non-binary or X gender	2 (1.3 %)
Prefer not to mention	1 (0.7 %)
Length of time studying English	
<1 year	3 (2.0 %)
1–3 years	12 (7.9 %)
4–6 years	55 (36.2 %)
7–9 years	62 (40.8 %)
<10 years	20 (13.2 %)
English Proficiency (self-assessed)	
Beginner	15 (9.9 %)
Advanced beginner	14 (9.2 %)
Intermediate	31 (20.4 %)
Advanced intermediate	73 (48.0 %)
Advanced	19 (12.5 %)

sea floor or deep water, 14 (9.0 %) responses referred to the risk of drowning, and 10 (6.5 %) responses mentioned the risk of high surf. The icon for *submerged objects* was generally well understood as indicating either submerged objects including reefs or rocks (36.4 %, n = 67), as advice against diving (32.6 %, n = 60), or as indicating shallow water (27.1 %, n = 50). The icon for *high surf* was consistently understood correctly (97.4 %, n = 148), with very few alternative responses (Table 6). As for the icon for *dangerous currents,* most responses referred to some dangerous characteristics of the waves/water such as strong or rough currents (58.3 %, n = 88) or rip currents (18.5 %, n = 28), although six (4.1 %) responses pointed to the danger of marine creatures such as sharks and jellyfish. The icon for stingers (floating jellyfish) was understood by a majority (48.0 %, n = 72) as a warning about jellyfish and of these 9 (6.0 %) responses referred to the equivalent Japanese term, *katsuo no eboshi,* 'bluebottle'. 26 (17.3 %) responses referred to dangerous creatures without further specification. Other marine creatures were also mentioned; for example, sharks (2 %, n = 3), shells/clams (2 %, n = 3), birds (0.7 %, n = 1), dead fish (0.7 %, n = 1), giant squid (0.7 %, n = 1), sea cucumbers (0.7 %, n = 1), and stingrays (0.7 %, n = 1). It is also notable that the response "unsure" was recorded more commonly (12.7 %, n = 19) for *stingers* than for the other icons.

3.4. Interpretations of the terms by those who believed they understood them

Section 3.3.2 described the number of students who understood, or believed they understood, the terms used on the signage. These participants were asked to further clarify their interpretations (Table 7). For *high surf,* which recorded the highest proportion of respondents who believed they understood the term, the majority (97.0 %, n = 65) described it as *takanami* meaning 'high surf' in Japanese, although one student thought that the warning message of this icon was only for surfers. Regarding *bluebottle,* only three students believed they fully understood what it referred to, two of these three mentioned certain characteristics of *bluebottle* or used a Japanese equivalent, but one

Table 4
Japanese students' experience of visiting Australia and predicted behaviour on Australian beaches.

Have you been to Australia?	
Yes	12 (7.9 %)
No	140 (92.1 %)
Would you intend to visit a beach when visiting Australia?	
Yes	137 (90.1 %)
No	15 (9.9 %)
Would you intend to enter the water at Australian beaches	
Yes	88 (64.2 %)
No	16 (11.7 %)
Unsure	33 (24.1 %)
Which area would you choose to enter the water from at this beach? (Table 2:Q11)	
1	74 (48.7 %)
2	67 (44.1 %)
3	7 (4.6 %)
4	3 (2.0 %)
I would not swim at this beach	1 (0.7 %)

Table 5
Understanding the terms used in signs and the meaning of the red and yellow flags.

Response options	n (%)
Do you understand what "high surf" means?	
Yes, absolutely.	25 (16.4 %)
I know both words, and I think I understood, but I'm not entirely sure.	56 (36.8 %)
I don't know either word, so I don't know what it means.	28 (18.4 %)
I know both words, but I don't understand what they mean together.	43 (28.3 %)
Do you understand what "bluebottle" means?	
Yes, absolutely.	1 (0.7 %)
I know both words, and I think I understood, but I'm not entirely sure.	7 (4.6 %)
I don't know either word, so I don't know what it means.	79 (52.0 %)
I know both words, but I don't understand what they mean together.	65 (42.8 %)
Do you understand what "submerged objects" means?	
Yes, absolutely.	0 (0 %)
I know both words, and I think I understood, but I'm not entirely sure.	7 (4.6 %)
I don't know either word, so I don't know what it means.	100 (65.8 %)
I know both words but I don't understand what they mean together.	45 (29.6 %)
Do you understand what "shore dump" means?	
Yes, absolutely.	2 (1.3 %)
I know both words, and I think I understood, but I'm not entirely sure.	13 (8.6 %)
I don't know either word, so I don't know what it means.	101 (66.4 %)
I know both words, but I don't understand what they mean together.	36 (23.7 %)
Do you understand what "shore break" means?	
Yes, absolutely.	2 (1.3 %)
I know both words, and I think I understood, but I'm not entirely sure.	12 (7.9 %)
I don't know either word, so I don't know what it means.	97 (63.8 %)
I know both words, but I don't understand what they mean together.	41 (27.0 %)
Do you understand what "rip currents" means?	
Yes, absolutely.	4 (2.6 %)
I know both words, and I think I understood, but I'm not entirely sure.	6 (3.9 %)
I don't know either word, so I don't know what it means.	97 (63.8 %)
I know both words, but I don't understand what they mean together.	45 (29.6 %)
Do you understand what riganryuu 'rip currents' means?	
Yes, absolutely.	33 (21.7 %)
I think I know, but I'm not entirely sure.	28 (18.4 %)
I don't know or have never heard the term.	91 (59.9 %)
Do you know what the red and yellow flags on Australian beaches mean?	
Yes	4 (2.6 %)
No	148 (97.4 %)
What do you think these flags mean? Or what were you told about these flags?	
Safe Zone (Swimming, walking, and playing are okay, but not surfing)	25 (16.4 %)
Safe Zone (Swimming, walking, playing, and surfing are all okay)	14 (9.2 %)
Danger Zone (swimming, playing, and surfing are prohibited)	72 (47.4 %)
Danger Zone (swimming and playing are prohibited, but surfing is okay)	20 (13.2 %)
Racing Zone (there is some competition going on)	17 (11.2 %)
Private Zone (staff/members only)	4 (2.6 %)

believed *bluebottle* to be a type of fly[2]. Regarding *submerged objects*, all responses, except for those referring jellyfish, referred to unspecified objects underwater (Table 7). As for *shore dump,* only three students interpreted the term as a warning about waves or currents, but six students thought that the term was used to warn about an area where waste or rubbish was dumped/discarded. *Shore* as in *shore dump* and *shore break,* seemed to be misunderstood as *shower* by two students; hence, one student thought *shore dump* as meaning "broken shower" and another interpreted *shore break* as meaning the same. Three interpreted *shore break* as referring to breaking or rough waves, but another three associated the word *break* with erosion or cliff collapse. Regarding both *rip currents* and *riganryuu,* a majority of responses referred to currents with an outbound direction, but one student thought that *rip currents* signified a possible need for an oxygen cylinder. This interpretation may be motivated by the abbreviation for Rest in Peace, *RIP,* implying a death.

4. Discussion

Results of this survey have described general knowledge of beach safety among Japanese university students and their perceptions of Australian beach safety signs. The previous studies on beach safety, knowledge among beachgoers, and their signage perceptions often divide their participants into Australian or non-Australian, alternatively called "overseas-born beachgoers", "CaLD communities", and "international visitors and students" (Clifford et al., 2018; Shibata, 2023; Shibata et al., 2024; Williamson et al., 2012). A few studies such as Woods et al., (2022) and Mitchell and Haddrill (2004) focus on a specific ethnic community or nationality and discuss their findings from a more specific cultural point of view. Like their studies, this study examined a particular cultural and linguistic group of Japanese and demonstrated what they know about beach safety and how they interpret Australian beach signs. The findings discussed below contribute to a targeted drowning prevention strategy for Japanese visitors while allowing future studies to compare their knowledge and cultural perceptions of the signs to other nationality groups.

4.1. Misinterpretation of the signage and tourism advice

Previous literature (De Nardi and Wilks, 2007; Toyama, 1991; Tourism WA, 2022) has noted that Japanese tourists often visit coastal areas such as Sydney (within the state of New South Wales) and the Gold Coast (within the state of Queensland), which is supported by the present study with over 90 % of respondents expressing a wish to visit

[2] There is a species of fly known in English as the "blue bottle" (note the slightly different spelling).

Table 6
Interpretations of the icons.

Question (n = The total number of the themes recorded)	Descriptions
What do you think this sign (slippery area) means? $n = 155$	risk of falling (59), a sudden drop in the seafloor or a point that gets deeper or deep water (26), slippery area (19), risk of drowning (14), high surf (10), no diving (5), dangerous currents or rip currents (4), no swimming (3), falling over underwater (2), blown away (1), dangerous (1), dehydration (1), no suicide (1), sandbank (1), advice to stay in the water (1), flotsam (1), violence (1), unsure (5).
What do you think this sign (submerged objects) means? $n = 184$	objects, rocks, or reefs underwater (67), no diving (60), shallow water (50), dangerous creatures (1), fisheries area (1), advice to face forward while swimming (1), no swimming (1), unsure (3).
What do you think this sign (high surf) means? $n = 152$	high or dangerous waves (148), no swimming permitted (1), risk of falling (1), tsunami (1), unsure (1)
What do you think this sign (dangerous currents) means? $n = 151$	dangerous, fast, or strong currents (88), rip currents (28), risk of drowning (11), advice on the direction of currents (4), dangerous creatures (3), deep water (3), no swimming, playing, or rampaging (2), sharks (2), no touching ocean floor (1), electric current running (1), jellyfish (1), shallow area (1), advice on calling for help (1), unsure (5)
What do you think this sign (stingers, bluebottles) means? $n = 150$	jellyfish (72), dangerous creatures (26), bluebottle (9), dangerous weather (3), sharks (3), shells (3), watch out for surfers (3), birds (1), dangerous cliff (1), dangerous currents (1), erosion (1), dead fish (1), lightning (1), giant squid (1), area with no jellyfish (1), no surfing allowed (1), sea cucumber (1), stingray (1) not comprehensive response (1), unsure (19)

coastal destinations if, or when, visiting Australia. New South Wales and Queensland also represent the top two states for coastal drowning deaths in Australia, with their combined proportion of drowning deaths accounting for over half of the total coastal drowning burden in Australia since 2013 (SLSA, 2022). Considering the majority of Japanese students intending to travel to Australia expressed an intention to visit beaches there, having knowledge of beach safety prior to visiting Australia is essential. Authorities and tourism companies need to ensure that Japanese tourists are well informed about the danger of Australian beaches and provide appropriate safety advice. The current website of the Ministry of Foreign Affairs of Japan provides safety advice to Japanese visitors to Australia (Minister of Foreign Affairs of Japan [MOFA], 2023). All the safety information relating to travelling to Australia is provided under the heading, *taizaiji no ryuuijikou* 'Things to keep in mind during your stay'; with information about beach safety is given under the subheading, *shizen taiken, autodoa taiken,* "Nature experience, outdoor sports experience'. The advisory statement starts with the following statement:

> *Yūei suru sai wa, yūei kinshi no hyōshiki ga dete inai koto o kanarazu kakunin shi, ōku no hito ga yūei shite ite, kaigan no kanshi-in ga iru basho o erande kudasai.*
> When swimming, be sure to check that there are no no-swimming signs posted, and choose an area where there are many people swimming and where there are beach lifeguards.

This statement advises Japanese tourists that they should not swim in areas with no professional lifeguards or surf lifesaving services, and to stay in the area where many beachgoers are. In this statement, highlighting the importance of reading signs is a crucial message, given that many beachgoers ignore beach signs or only read them without much attention in Australia (Matthews et al., 2014; Shibata, 2023). While the statement refers to reading beach safety signs and explains the red and

Table 7
Interpretations of the terms by those who believed they understand them[1] (multiple items mentioned by the same speaker).

	Response rate	Instances of coded response (n)
Yes (n) I know both words, and I think I understood, but I'm not entirely sure (n) Total (n)	n (%)	
Do you know what *high surf* means?		high surf (65), deep water (1), a warning for surfers (1)
Yes (25)	17 (68 %)	
I know both words, and I think I understood, but I'm not entirely sure (56)	49 (87.5 %)	
Total (81)	66 (81.5 %)	
Do you know what *bluebottle* means?		bluebottle (1), jellyfish (1), fly (1)
Yes (1)	1 (100.0 %)	
I know both words, and I think I understood, but I'm not entirely sure (7)	2 (28.6 %)	
Total (8)	3 (37.5 %)	
Do you know what *submerged objects* means?		flotsam (1), jellyfish (1), some obstacles underwater (1), submerged objects(1), sunken objects (1)
Yes (0)	N/A	
I know both words, and I think I understood, but I'm not entirely sure (7)	5 (71.4 %)	
Total (7)	5 (71.4 %)	
Do you know what *shore dump* means?		breaking waves (2), rip currents (1), dumped rubbish area (6), risk of falling (1), broken shower (1)
Yes (2)	2 (100.0 %)	
I know both words, and I think I understood, but I'm not entirely sure (13)	9 (69.2 %)	
Total (15)	11 (73.3 %)	
Do you know what *shore break* means?		breaking waves (2), risk for rock or cliff collapse (3) rough waves (1), broken shower (1), advice to take a break (1)
Yes (2)	1 (50.0 %)	
I know both words, and I think I understood, but I'm not entirely sure (12)	8 (66.7 %)	
Total (14)	9 (64.3 %)	
Do you know what *rip currents* mean?		strong currents moving away from the shore (5), oxygen cylinder needed (1)
Yes (4)	4 (100.0 %)	
I know both words, and I think I understood, but I'm not entirely sure (6)	6 (100.0 %)	
Total (10)	10 (100.0 %)	
Do you know what *riganryuu* mean?		Strong currents moving away from the shore (40), currents moving backwards from crashing reefs (2), currents not letting swimmers come back (4), currents with no breaks, currents moving parallel to the shore (1)
Yes (33)	27 (81.8 %)	
I know both words, and I think I understood, but I'm not entirely sure (28)	20 (71.4 %)	
Total (61)	47 (77.0 %)	

[1] This data does not include any responses from those who did not understand the terms.

yellow safety flags in the following statement, it does not show visual examples of Australian beach safety signs or flags. Readers, therefore, may not fully understand from this advice what kind of signs and flags indicate permission, warning, or prohibition against swimming, respectively. This is a concern given that this study found that about 60 % of Japanese university students believe that the red and yellow flags indicate a danger zone as opposed to the correct meaning. The MOFA's advisory statement provides further specific advice for three states; Queensland, Northern Territory, and Western Australia. The advice for Northern Territory and Western Australia mainly refers to animals such as crocodiles and sharks, and the advice for Queensland refers to the danger of Australian beaches and informs that even strong swimmers have drowned there. They also refer to "calm water" which despite its appearance, may conceal strong and fast currents. However, what needs to be added here is that the direction of the current can be outbound rather than inbound, and calm water can be a sign of rip currents (Short, 2007). Such information is crucial for Japanese tourists, given that about 60 % of Japanese university students do not know the meaning of, or have never heard of, *riganryuu* 'rip currents'. A recent study by Endo et al. (2021) also showed similar results, with 58.9 % of their survey participants in Japan not knowing about rip currents. This study showed that the English term, *rip current,* was not understood by most respondents, which indicates that advice needs to better communicate about what rip currents are, including their characteristics and strategies to identify them, and escape from rip currents. This, along with explaining the correct English term as well as the Japanese term, is an important first step to raise safety knowledge so Japanese tourists can be aware of dangerous outbound currents and its preventative strategies.

4.2. Interpretation and perceptions of terms and icons on the signs

This study also demonstrated that Japanese university students understand the icons on the signs much better than the terms on the signs. For example, in relation to "high surf", 46.7 % of the respondents did not understand the written term, whereas almost all participants correctly interpreted the icon as referring to *high* or *dangerous waves.* Regarding *bluebottle,* almost none understood what the term meant, whereas participants (semi-)correctly interpreted the icon as indicating jellyfish (48.0 %, n = 72), dangerous creatures (17.3 %, n = 26), or bluebottles (6.0 %, n = 9). It is notable that only one respondent fully understood the English term *bluebottle* while 9 described its icon using the Japanese equivalent*, katsuo no eboshi.* The icon for *bluebottle* also showed a wide variety of interpretations from respondents, with 19 (12.7 %) unsure as to what it referred to. Similarly, the icon for *slippery floor* was interpreted in many ways, since some respondents incorrectly took the pictorial information to be referring to the situation underwater, with some thinking the sign warned of a sudden drop of the seafloor, deep water, and drowning. The "semantic distance" in this case between the icon *slippery floor* and its intended meaning, that is, the distance between what is depicted and what is intended to mean (Chan and Ng, 2012) seems to be greater for *slippery floor* than for *submerged objects.* The semantic distance can be increased by a higher level of abstraction in the image. As the result for *slippery floor* shows, the delivery of the warning message can fail if the pictorial information is too abstract for readers (Murray et al., 1998). In order to reduce the level of abstraction, the pictorial information for *slippery floor* may need to include clearer information about relevant locations such as cliffs or rocks in order to avoid misinterpretation. The addition or revision process, however, needs to be carefully approached, since over-delivery of information can also confuse users as to the intended message (Bruyas et al., 1998). Measuring the effectiveness of the signs before implementing them on location is key to ensuring the effectiveness of the message (Wogalter et al., 2002).

Regarding interpretations of terms, although quite a few respondents proved not to know a number of the words used on the signs, over 80 % (n = 123) assessed their English proficiency as intermediate or higher. The participants were also university students who would have received a sound secondary education. This implies that regardless of their English proficiency, understanding the terms was incomprehensive for the Japanese university students. However, the outcome may worsen among Japanese young adults with lower English proficiency or less experience of education in English. To more precisely measure any correlations between English proficiency and interpretation of the signage terms, future studies could use a formal language assessment instead of self-assessment.

4.3. Safety behaviour on Australian beaches

The present study asked the participants where to swim in the picture of Bondi beach (Table 1; Question 11). 92.5 % (n = 141) of the participants chose the areas without a mainstream of a rip current (Options 1 and 2) or near a reef (Option 4). This data, however, does not imply that Japanese students would regularly "avoid rip currents" since about 60 % of them did not know about rip currents. In the picture, the areas (Options 1 and 2) with no mainstream of a rip current have other swimmers and it is most likely that the participants chose this area by following these swimmers. This is, in fact, a common practice for beachgoers to follow other swimmers rather than making their own decisions independently (Ménard et al., 2018).

Previous studies exploring knowledge of rip currents among Australians show that about half of respondents were able to identify rip currents correctly (Williamson et al., 2012): compared to this study, in which far fewer participants (21.7 %, n = 33) fully understood the meaning of *riganryuu* 'rip currents'. About one in three respondents also interpreted the red and yellow flags as indicating a danger zone, and only 16.4 % understood the meaning of red and yellow flags appropriately. Given the dynamic nature of many Australian beaches and considering these findings, Japanese university students can be considered beachgoers at much greater risk than Australian beachgoers if they visit such Australian beaches. This overwhelmingly low proportion of understanding of rip currents and the significance of safety flags among Japanese university students is also a serious concern for Japan. The Japan Lifesaving Association [JLA], which aligns with the standards of the International Lifesaving Federation, uses red and yellow flags in Japan in similar contexts (JLA, n.d.), which raises the question for future studies: do Japanese beachgoers properly understand the function of red and yellow flags in Japan?

It is notable the educational program set by the Ministry of Education, Culture, Sports, Science and Technology, Japan [MEXT] (2016) prioritises swimming education and the majority of primary schools in Japan have their own swimming pools. Such advanced swimming education in Japan provides children with swimming practice and enables them to obtain at least a minimum level of swimming skills. It can also develop them some "confidence" toward the water. While it's important to develop confidence with a decent level of swimming skills, "overconfidence" can be a causal factor for young male drowning deaths, especially if they don't have appropriate knowledge of beach safety (Cornell et al., 2023; Lawes et al., 2021). Therefore, it is important to provide water safety education, while training them on aquatic survival skills including swimming ability.

4.4. Water safety education

Like Australia, coastal drownings are a serious problem in Japan, given that 367 unfatal and 212 fatal incidents were reported, along with 2000–3000 rescue reports in 2022 (Japan Coastal Guard [JCG], 2023; Sawagashira et al., 2021). Some beaches in Japan have difficulty in establishing safety management for various reasons. For example, one beach with multiple rip currents has approximately 70,000 visitors per day in the summer (Ishikawa et al., 2014). These visitors are taken care of by only 26 surf lifesavers each day, which means that one lifesaver supervises 2,700 visitors on their patrol per day (Ishikawa et al., 2014).

On top of this, some swimming areas, regardless of the presence of rip currents, are decided based on the location of beach bars and shops (Ishikawa et al., 2014). In such cases, the JLA, even if aware of the presence of rip currents, does not have the authority to decide on swimming areas (Ishikawa et al., 2014). Considering the difficult situation of safety management on Japanese beaches, beachgoers should have adequate knowledge of beach safety so as to be fully responsible for their own lives. Given this situation, the previous studies were conducted for the assessment of potential educational and preventative approaches in Japan (Endo et al., 2021; Nishi et al., 2005; Toguchi et al., 2023). This study additionally found that over half of Japanese young adults do not understand Australian beach safety signage, some of which (i.e. red and yellow flags) are also used globally including Japan (Japan Lifesaving Association, n.d.). Both the high number of coastal drownings and the participants' lack of beach safety knowledge imply that Japan urgently needs to promote water safety education so as to reduce the number of coastal drownings in both Japan and Australia.

Regarding beach safety education, one of the most effective pedagogies has been found to be beach safety workshops held by water safety experts (Brander et al., 2022; Clifford et al., 2018; Kamstra et al., 2023; Wilks et al., 2016). Experts can introduce important information about water safety while confirming or correcting learners' prior knowledge. These processes are especially important for beach safety knowledge, since prior knowledge, regardless of whether it's correct or not, inevitably influences how people behave at the beach (Ménard et al., 2018). Such workshops can be more beneficial if workshop organisers ask learners in advance what they know and what they want to know (Koon et al., 2022). Encouraging self-reflection and analysis of their own previous behaviour is another effective pedagogical method for potential beachgoers to consider their own future risks (Kamstra et al., 2022). This method is particularly important for Japanese beachgoers who often see other beachgoers as in greater risk than themselves of coastal drowning (Endo et al., 2021).

To educate Japanese people on "Australian" beach safety, a popular Australian reality TV show, *Bondi Rescue*, has proven to have had a positive impact on international visitors' perceptions of Australian beaches (Warton and Brander, 2017). This TV show demonstrates fatal and non-fatal drowning incidents and serious rescue scenes carried out at Bondi beach, Sydney. Warton and Brander (2017) show that international viewers recognise how dangerous Australian beaches are and are able to learn some surf lifesaving skills from the rescue scenes. A notable drawback of the show as an educational tool is that the show does not provide much of an explanation of rip currents; hence, many viewers still could not point out the appropriate explanation of rip currents after watching the show (Warton and Brander, 2017). Although *Bondi Rescue* is not accessible through the current TV programs in Japan, Japanese residents can still watch episodes via the website, YouTube.[3]

Having beach safety knowledge is also important for locals in understanding English signs. Numerous applied linguistic studies have shown that high familiarity with relevant content helps users to process and remember information in a second language (Horiba and Fukaya, 2015). According to Cook and Gueraud (2005), learners are more likely to use their prior knowledge to understand new information, so having beach safety knowledge helps Japanese tourists to understand Australian beach safety signage. In addition, Endo et al. (2021) examined a new kind of digital signage in Japan that uses the Internet of Things (IoT) to display rip currents captured by a camera. With this new technology, beachgoers can identify and see the current movement of rip currents on the signs, something that is difficult for many beachgoers to do in a real situation (Brannstrom et al., 2015; Fallon et al., 2018; Sherker et al., 2010). Such technology can also assist lifeguards and surf lifesavers to spot drowning swimmers and can encourage visitors to avoid rip currents (Endo et al., 2021). Most importantly, Endo et al. (2021) found that beachgoers who knew about rip currents were more likely to avoid the area after seeing the signs than those who did not. On the other hand, a few participants who saw the signs, still thought that they could not see any "danger" since the water appeared to be calm. Even with new technologies being developed to prevent beachgoers from drowning, knowledge of rip currents is still a crucial education component in the primary prevention of drowning in Australia, Japan and overseas.

4.5. Future studies

While this study demonstrates Japanese beachgoing behaviour and their perceptions of Australian beach safety, it also provides a survey tool to investigate other nationalities, especially those who do not use English as the official or first language. For example, the questions about the signage terms include ones associated with the knowledge of the English language rather than of beach safety. As Table 5 shows, some terms such as shore dump were not understood because many did not know a word (shore or dump) or both (shore and dump) of the English language. In this case, Australia can be aware of that shore dump requires a translation or simpler words (e.g. crushing waves) for Japanese tourists (Shibata et al., 2024). In light of Spair-Whorf's Linguistic Relativity (Lucy, 1997); that is, people's views of the world are formed by the language they speak, it is important to examine each cultural perception of Australian beach safety signage and compare them to understand similarities and differences. In this way, Australia can improve their signage for the "CALD" communities and their multicultural society.

4.6. Limitations of the present study

Despite the novelty and multiple strengths of this study, there remain a few limitations that need to be acknowledged. Firstly, this study measured the English proficiency of the participants by their self-assessment so a formal assessment may have a different outcome regarding their English proficiency. Secondly, questions regarding understanding of terms on Australian beach signs may have been affected by a lack of confidence simply due to their second or foreign language. It is overwhelmingly common to lose confidence in communication in a second or foreign language (MacIntyre and Gardner, 1991; Onwuegbuzie et al., 1999). Although the proportion of these two yes-options (i.e. "Yes, absolutely", and "I know both words, and I think I understood, but I'm not entirely sure") may have been affected by their lack of confidence in the foreign language, the proportion of no-responses should not be affected. Lastly, the survey could have been taken at any locations and at any time during the collection period so participants may have used a translation application or dictionary, although the current search in Google Translate is unable to translate the signage terms tested in this study into Japanese (Shibata et al., 2024).

5. Conclusion

This novel study investigates Japanese university students' perceptions of Australian beach safety signs and their potential safety behaviours in Australia. Although many of the respondents indicated that they wished to visit coastal destinations in Australia, almost none fully understood common terms used on Australian beach safety signs. Not only the English term *rip currents* but its Japanese equivalent *riganryuu* was an unfamiliar word for about 60 % of participants. A lack of understanding of Australian beach safety signs seems more related to respondents' lack of familiarity with beach safety in general rather than due to any other reasons. Since both Australia and Japan experience regular drowning incidents, it is time for Japan to not only provide Japanese children and residents swimming lessons, but also educate them on beach safety and rip currents, including for those planning to travel outside of Japan. Knowledge is the primary means of drowning prevention that can be

[3] https://www.youtube.com/channel/UCxEct2HUBYj_mt4t7qR9UYg.

applicable when travelling to idyllic coastal destinations such as Australia, and this study has highlighted opportunities to improve this knowledge and awareness needed to save lives in the future.

CRediT authorship contribution statement

Masaki Shibata: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Amy E Peden:** Writing – review & editing, Visualization, Validation, Resources, Methodology, Investigation, Conceptualization. **Hideo Watanabe:** Writing – review & editing, Visualization, Validation, Resources. **Jasmin C Lawes:** Writing – review & editing, Visualization, Validation, Resources, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Full list of survey questions translated in English (The original survey was in Japanese. The terms on beach signs were presented in English)

Demographics

Q1. Which country do you currently live in?
Q2. Which country were you born in?
Q3. Which country have you lived in for the longest amount of time?
Q4. What gender do you identify yourself as?
Q5. How old are you?
Q6. How old are you?
Q7. How many years have you studied English?
Q8. How well do you understand English?
Q9. Have you been to Australia before? (If yes, how long have you stayed in Australia?)

Expected beachgoing activity in Australia

Q10. If/when you go to Australia, do you intend to go to the beach? (If yes, at the beach do you intend to go into the water?)
Q11. What purpose do you usually go to the beach for?
Q12. Where would you enter the water to swim or bathe at this beach?
Q13. If you went to/have visited a beach in Australia, did you read the public safety signage? (a question to only those who visited Australia)
Q14. Have you learned anything about beach safety in Australia? (a question to only those who visited Australia) (If yes, who did you learn beach safety information from?)
Q15. Have you been in a situation when you felt you needed to be rescued in the water on Australian beaches?
Q16. If you are caught in strong currents that carry you to the deeper area, and there is not one to help, what do you think you would do first?

Behaviour on the beach in their country

Q17. When you go to a beach **in your country**, how often do you read the public safety signage?
Q18. How do you decide where to swim at a beach?
Q19. How often do you use inflatable toys when you go to the beach?
Q20. How often do you wear clothes (e.g. T-shirt) in the water when you go to the beach (the clothes do NOT include wetsuits, swim bathers, rash, and lycra)?

Interpretation and perceptions of Australian beach safety signs (Term)

Q21. Do you know "high surf" means? If you know the term, please specify what it means.
Q22. Do you know "bluebottle" means? If you know the term, please specify what it means.
Q23. Do you know "submerged objects" means? If you know the term, please specify what it means.
Q24. Do you know "shore dump" means? If you know the term, please specify what it means.
Q25. Do you know "shore break" means? If you know the term, please specify what it means.
Q26. Do you know "rip or rip currents" means? If you know the term, please specify what it means.
Q27. Do you know what "離岸流(*riganryuu*)" means? If you know the term, please specify what it means.

Interpretation and perceptions of Australian beach safety signs (flags and iconology)

Q28. Have you learned what the Australian red and yellow flags mean?
Q29. What do you think these flags mean? Or what were you told about these flags?
Q30. Do you understand the warning message of this sign? If yes, please explain what this signage means? (a picture of the slippery area icon without text)
Q31. Do you understand the warning message of this sign? If yes, please explain what this signage means? (a picture of the submerged objects icon without text)
Q32. Do you understand the warning message of this sign? If yes, please explain what this signage means? (a picture of the high surf icon without text)
Q33. Do you understand the warning message of this sign? If yes, please explain what this signage means? (a picture of the dangerous current icon without text)
Q34. Do you understand the warning message of this sign? If yes, please explain what this signage means? (a picture of stingers (bluebottle) without text)

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