

SNORKEL SAFETY STUDY

FINAL REPORT

PRESENTED TO

THE HAWAII TOURISM AUTHORITY

BY THE

HAWAIIAN LIFEGUARD ASSOCIATION

MAY 2021



EXECUTIVE SUMMARY

The Snorkel Safety Study was conducted from August 2017 through April 2021 under the administration of the Hawaiian Lifeguard Association (HLA), a 501 ©(3) non profit organization incorporated in the State of Hawaii to promote ocean safety and drowning prevention efforts in the Hawaiian Islands.

The Study was funded by a grant from the Hawaii Tourism Authority (HTA) that enabled researchers and interested parties to investigate possible causes of the number of snorkel related incidents, including fatal and non-fatal drownings, occurring in Hawaii's ocean environment.

Although there were many opinions and theories about the phenomenon, there had been no formal, evidence-based studies that could explain why residents and visitors were experienced problems while snorkeling.

The goals of the Snorkel Safety Study were to 1) determine causal factors associated with snorkeling distress; and 2) based on these findings, to craft and recommend public service messaging aimed at reducing the number of snorkel related incidents.

PARTICIPANTS

CORE GROUP / STEERING COMMITTEE

Philip T. Foti, M.D., Principal Investigator
Carol Wilcox, Project Manager
Ralph S. Goto, Project Administrator

ORGANIZATIONS

State of Hawaii Department of Health
State Department of Land and Natural Resources
City and County of Honolulu Ocean Safety Division
County of Kauai Ocean Safety Bureau
County of Maui Fire Department
Hawaii County Ocean Safety Division
City and County Medical Examiner
United States Coast Guard
Hawaiian Lifeguard Association
Kauai Lifeguard Association
Hawaii Tourism Authority
Straub Medical Center
Friends of Hanauma Bay

INDIVIDUALS

Daniel Galanis, Ph.D., DOH Epidemiologist
Bruce Anderson, Ph.D., Director of Health
Alvin Bronstein, M.D., DOH Branch Chief
Bridget Velasco, PT, MPH, DOH Public Health Educator
Tammie Smith, MPH, DOH Public Health Educator
Jim Howe, Director, Honolulu Emergency Services Department
Patrick Fujimoto, M.D. Anesthesiologist, Straub Medical Center
Christopher Happy, M.D., Medical Examiner
Elizabeth A. Char, M.D., Department of Health
Jan Prins, Ph.D., University of Hawaii Aquatics Research Lab
Ron Bregman, Lt., Ocean Safety Division, City and County of Honolulu
Kawika Ekhart, Lt., Oceans Safety Division
Alan Hong, Retired Manager, Hanauma Bay
Alex Stachel, Lt. Cmdr. U.S. Coast Guard
Coliin Yamamoto, Retired Batallion Chief, Maui Fire Department
Gerald Kosaki, Retired Fire Batallion Chief, Hawaii Fire Department
Raymond Sanborn, CEO, Kama'aina Kids
Duane DeSoto, CEO, Na Kama Kai

MEETINGS AND WORKSHOPS

Monthly meetings were conducted by the Core Steering Group to keep abreast of developments and to plan areas and methods of investigation. Meetings were also conducted via zoom with web developers, contracted public relations firms, and others as necessary.

Two Snorkel Safety Workshops were conducted to gather and disseminate data, research findings, and recommendations. The first workshop was held on March 28, 2018 at the Hilton Hawaiian Village, and the second conducted at the Hawaii Convention Center on February 29, 2020. Both workshops were well-attended and relevant information was exchanged. The workshops featured expert presentations and opportunities for networking with representatives from government and non-profit agencies, dive industry companies, and equipment manufacturers. Agendas and selected presentations from the workshops are attached,

RESEARCH METHODS

Extensive data and information collection strategies were implemented, with valuable assistance from DOH Epidemiologist Daniel Galanis. Data analysis was extremely important in the development of the study findings and recommendations. Examples of these reports and analyses are attached.

Another very effective and useful data gathering tool was the Snorkel Study Survey. Interviews with survivors and those who experienced difficulty while snorkeling were conducted to determine underlying causes and/or events which may have led up to distress. These surveys provided first-hand accounts of cases and were important in determining

AREAS OF STUDY / INVESTIGATION

- Equipment, including full-face masks
- Pre-existing / underlying medical conditions
- Human factors; swimming ability and aquatic experience
- Environmental factors; ocean conditions
- Possible effects of altitude/pressure changes, i.e., long airline flights

FINDINGS

1. EQUIPMENT

Snorkels were tested using SARA, a device designed to measure air flow and resistance in various types and sizes of snorkels to determine the effects of reduced / restricted air flow. Researchers on Maui conducted an informal analysis of the "full face" mask to determine design and/or functional effects on those using the mask. Results of the study were inconclusive. (A letter was sent to Consumer Reports requesting a test/analysis of snorkel equipment by the organization. Copies of the communication and response are attached.)

2. PRE-EXISTING MEDICAL CONDITIONS

With assistance from the Honolulu Medical Examiner's Office, a review of autopsy reports was conducted to determine to what extent pre-existing medical conditions (cardiac and/or respiratory) may have contributed to problems while snorkeling. Once again,

determining a causal relationship between pre-existing medical conditions and increased risk of experiencing a cardio-pulmonary event while snorkeling was extremely difficult to establish.

3. HUMAN FACTORS

It has been assumed that swimming competence is directly related to surviving an aquatic incident, i.e., strong swimmers have the ability to swim and or stay afloat more effectively than poor or non-swimmers. Although this concept is intuitively accepted, measuring the swimming competence of those involved in aquatic events is difficult and subjective at best. Responses to the Snorkel Safety Survey suggest that many 'victims' were 'strong' or 'good' swimmers who had past snorkeling experience, suggesting that other factors (equipment, ocean conditions, etc.) may have contributed to their distress.

4. ENVIRONMENTAL FACTORS:

Challenging ocean conditions including waves, surf, currents, winds and poor visibility could all contribute to a snorkeler's distress. These conditions commonly exist throughout all areas of aquatic safety and cannot be put forward as unique causes of snorkeling incidents. Education, awareness, and respect of the ocean's potential power must play an important role in the messaging strategy of the project.

5. EFFECTS OF ALTITUDE / AIR TRAVEL

Changes in air pressure during ascent and descent in airplanes has been an area of concern since the beginning of man's adventures in flight. Effects of long-distance air travel and pressure changes have long been studied by military and commercial experts. Although the specific effects related to snorkeling or swimming immediately following air travel have not been conducted, there is some concern regarding the effect of these pressure changes on the body while snorkeling.

The study found no evidence to support this theory and would suggest it as a potential area for further study.

SNORKEL SAFETY STUDY

OVERVIEW

October 2019

The Hawaiian Lifeguard Association (HLA), is a 501(c)3 non-profit organization incorporated in the State of Hawai'i. It is the only Statewide lifeguard association in Hawai'i. The HLA is conducting a Snorkel Safety Study.

BACKGROUND:

- Drowning is the leading cause of injury-related death among Hawai'i visitors.
- Snorkeling is the most common activity associated with visitor drownings.
- These types of incidents are increasing. There were 84 deaths in 2017 alone.
- There has been no formal investigation into the causes for these incidents

It has long been assumed that visitors are at increased risk while snorkeling because of inexperience, panic, ocean conditions, or preexisting health conditions. Yet these do not explain the wide disparity between resident and visitor deaths, why it often happens in benign ocean conditions, or why it isn't happening during other visitor activities, such as surfing. What is it that is peculiar to snorkeling?

In 2017, the Hawai'i State Department of Health (DOH) Injury Prevention and Control Branch formed the Snorkel Safety Subcommittee (Subcommittee) to consider the causes of these unexplained mysterious drowning and near drowning events. During more than a year of meeting, the Subcommittee has gathered convincing evidence that other pathophysiologic mechanisms, and specifically Rapid Onset Pulmonary Edema (ROPE), may be a significant factor in these unexplained mysterious fatalities. This possibility has not been previously considered.

The Subcommittee has identified a number of risk factors that may be involved in ROPE. Specifically:

- Snorkel gear design
- Preexisting health conditions
- Exposure to reduced pressure

PURPOSE OF STUDY:

The purpose of this Study is to formally assess the causes and risk factors of snorkel related fatal and non fatal drownings. The Study will collect and analyze data, conduct scientific research, conduct surveys and interviews, and consult with experts in the appropriate fields. It will keep in communication with interested parties, such as emergency responders, medical personnel, and its partners in the Department of Health, Medical Examiners Office, and County Ocean Safety Personnel.

STUDY METHODS:

Snorkel Safety Survey: Designed to identify the causes of drowning and near drowning while snorkeling and suggest effective means of prevention of these incidents. The survey collects information on the experience of the snorkeler both as a swimmer and as a snorkeler, the health of the snorkeler both historically and more recently prior to the incident, the history of air travel prior to the incident and the precise length of time between arriving in Hawaii and the incident. It examines the incident itself in some detail to see if there is consistency in early symptoms of a developing problem, the time lapse of events, and the severity of the incident for those that survive. The survey is applicable to a fatal incident if there is someone who can answer at least some of the questions.

Data: The data will be analyzed within the study and in collaboration with the DOH epidemiology department.

Clinical Studies: The Principal Investigator will be conducting clinical studies to assess the relative importance of the risk factors identified in the Study. He will conduct individual follow up with some of the respondents as deemed.

The Project Administrator will keep Participants, Interested Parties, and the public informed as appropriate.

DESIRED OUTCOMES:

The desired outcomes of this Study are to:

- Identify significant factors in snorkel-related fatal and non-fatal drownings
- Recommend public service messaging to promote enhanced safety while snorkeling.

STUDY TIMING:

The Study is projected to be 24-months from approval and receipt of funding of for this proposal.

STUDY TEAM:

- Project Administrator (Ralph Goto)
- Principal Investigator (Dr. Philip Foti, MD)
- Research Associate (Tina Hmayasu)
- Project Manager (Carol Wilcox)
- Communication Facilitator (TBD)
- State of Hawaii Department of Health (Bridget Velasco, Daniel Galinas)

STEERING COMMITTEE AND STUDY PARTICIPANTS:

State of Hawai'i

Department of Health (DOH) Injury Prevention and Control Branch

Snorkel Safety Sub-Committee
City and County of Honolulu
Office of the Medical Examiner
County Ocean Safety, EMS, First Responders
Oahu County Lifeguards

Medical Community

Physicians
Hospital personnel

INTERESTED PARTIES:

- All Emergency Responders
- Snorkel Equipment Manufacturers and Vendors
- Ocean Equipment Rental Companies
- Tour Operators
- Visitor Industry Organizations
 - Hawai'i Tourism Authority
 - Hawai'i Lodging and Tourism Association
 - Waikīkī Improvement Association
- Community Organizations
 - Friends of Hanauma Bay (FHB)
 - Kama'aina Kids
 - Visitor Aloha Society of Hawai'i (VASH)

PROGRESS TO DATE:

EQUIPMENT TESTING

S.A.R.A. – 50 snorkels have been tested to determine relationship between increased a flow and resistance. (Dr. Foti)

FULL FACE MASKS – Oxygen and CO2 sensors have been developed to measure gas levels in full face masks. (C. Yamamoto)

REVIEW OF MEDICAL EXAMINER'S AUTOPSY REPORTS – to identify pre-existing medical conditions and their possible relationship to fatal drownings involving snorkel use.

COLLABORATIION WITH FIRST RESPONDERS – lifeguards and ems personnel can gather and record important data re: equipment, activity, ocean condiitons and other pertinent factors.

SURVEY – Because first -hand accounts of persons who have experienced distress while snorkeling are a valuable source of information for the study. The survey has been developed by the study team, approved by the IRB, and is currently accessible on the SSS website. (C. Wilcox)

SNORKEL SAFETY STUDY INTERIM REPORT 9/13/2019

Members of the Snorkel Safety Study (SSS) core group are: Philip Foti, M.D., Principal Investigator, Carol Wilcox, Program Director, and Ralph Goto, Program Administrator. The core group meets regularly on the second Monday of the month to discuss progress, issues, and set priorities and action items to be addressed.

In addition to the regularly scheduled meetings, core group members have attended meetings with various government and NGO groups, including the Department of Health's Drowning and Aquatic Injury Prevention Advisory Committee (DAIPAC), Injury Prevention Advisory Committee (IPAC), State of Hawaii Ocean Safety Chiefs Association, Friends of Hanauma Bay, Hawaii Kai Neighborhood Board.

Accomplishments since July 2019:

- Snorkel Safety information included in HiOceanSafety.com website
- Snorkel Safety Brochure designed and printed
- Snorkel Safety Study Survey instrument completed
- Institutional Review Board (IRB) application and approval through DOH
- Meeting with Honolulu Medical Examiner to discuss co-morbidity issues
- Meetings with Hanauma Bay Ocean Safety Staff to develop reporting protocols
- Equipment testing: SARA / Dr.Foti has tested 50 snorkels for air flow resistance
Full face masks: CO2 and O2 measurements being tested
- Presentation made at State of Hawaii Ocean Safety and Drowning Prevention Conference, July 26, 2019

Ongoing Projects:

- Interview and hire replacement Clinical Coordinator
- Establish data collection protocols from first responders (Lifeguards, Fire, EMS)
- Design and implement specific study areas: Equipment, Pre-Existing Medical Conditions, Survey/Interview Results
- Reach out to Neighbor Island first responders and hospital personnel to expand survey and data collection efforts.
- Expand participation in Core Group planning efforts, establish physician advisory group.

The primary goals of the Snorkel Safety Study are to determine the causes and risk factors associated with snorkel related incidents occurring in the ocean environment. Because the great majority of these incidents involve visitors to Hawaii, it is important to study the issues with evidence-based protocols and sort out anecdotal reports and opinion-based theories. Once the data/information gathering has occurred, the study will begin to design and test meaningful prevention strategies to reduce the number of incidents.



Findings and Suggestions for Messaging

Findings

Snorkel Induced Rapid Onset Pulmonary Edema (SI-ROPE)

- Snorkel Induced Rapid Onset Pulmonary Edema (SI-ROPE) is a common factor in snorkel-related drowning and near-drowning events.
- Risk factors associated with the development of SI-ROPE are:
 1. Degree of the snorkel's resistance to inhalation
 2. Certain pre-existing medical conditions
 3. Age 50 years and older
 4. Increased exertion
- Among survey participants,
 - Aspiration (inhalation of water) was rarely the trigger or even a factor in near-drowning incidents while snorkeling
 - Lack of swimming or snorkeling experience was rarely a factor in snorkelers getting into trouble
 - Almost all events took place where the person could not touch bottom
 - 38% used a full-face mask. 90% of those who wore a full-face mask considered it a contributing factor to their trouble.

The typical sequence of a SI-ROPE drowning was:

1. Sudden shortness of breath, fatigue, loss of strength
2. Feeling of panic, doom, need for assistance
3. Diminishing consciousness

Next Steps

While able to identify with confidence the existence and process of SI-ROPE, the Study was unable to confirm a correlation between recent prolonged air travel and SI-ROPE. However, data and physiological functions strongly support that possibility. There is potential for additional studies to address this, and we encourage further research in this field.

Messaging

The Snorkel Safety Study was tasked with suggesting safety messaging. It was not tasked with implementation of suggested messages.

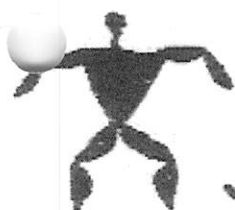
Because snorkel related incidents often occur without warning and/or obvious struggle, prevention efforts/recommendations have been difficult to develop. The responsibility for personal safety lies primarily with the snorkeler, and, therefore, on education. This educational effort needs to include collaboration with government, visitor industry (including HTA, dive shops, equipment manufacturers, hotels, etc.), and public health and safety providers.

Suggested actions

- Inform emergency responders of the SI-ROPE phenomenon and the likely involvement of pulmonary edema unrelated to aspiration in snorke-related cases.
- Develop a statewide public education program addressing snorkeling safety, with special emphasis at places commonly used for snorkeling, such as Hanauma Bay, O'ahu, and Black Rock, Maui.

Safety Messages might include the following cautions:

- Recreational snorkeling is not a benign low-risk activity. This is true both for inexperienced and experienced swimmers and snorkelers. The risk of drowning is higher among visitors.
- Swim with a buddy.
- If you can't swim, don't snorkel.
- Choose snorkel devices thoughtfully. Avoid constrictions in bore size or mouthpiece caliber, which may increase airway resistance to inhalation.
- Stay where you can touch the bottom comfortably.
- If in doubt about your cardiovascular health – don't go out.
- It may be prudent to wait several days after arrival in Hawai'i by air before snorkelling.
- Beware of drifting away from your base, check your location frequently.
- Shortness of breath can be a sign of danger. Stay calm, stand up, remove snorkel, get out of water immediately.



HAWAIIAN LIFEGUARD ASSOCIATION

FOR IMMEDIATE RELEASE: March 9, 2018

Honolulu, HI : The **Hawaiian Lifeguard Association** announced today that a **Snorkeling Safety Workshop** will be conducted at the Hilton Hawaiian Village Rainbow Suite on Wednesday, **March 28, 2018**, from 8:00 am until 4:30 pm.

During the past two months, 14 fatal and non-fatal drownings have occurred in ocean waters in Hawaii, with the majority of cases happening on Maui. The workshop is being convened by the Hawaiian Lifeguard Association to present information gathered by the Department of Health's Drowning and Aquatic Injury Prevention Advisory group comprised of physicians, public health, ocean safety and first responders. Presentations will address physiology, epidemiology, and ideas related to the causes of snorkeling drownings, and to provide a forum to discuss the risks associated with snorkeling related activities.

The primary goal of the workshop is to understand the risks that may contribute to these incidents, and to develop strategies and messages to mitigate these risks. Participants will have the opportunity to test different types of masks and snorkel equipment in the Duke Kahanamoku Lagoon adjacent to the Rainbow Suites.

The workshop is open to the public and is being supported by the Hawaii Tourism Authority and the State Department of Health's Injury Prevention and Control Program. Registration for the workshop is \$75.00 and includes continental breakfast and lunch. Validated parking will be available at the Hilton Hawaiian Village.

Tentative agenda and registration form are attached.

Contact: Ralph S. Goto ralphgoto@gmail.com (808) 479-1610

P.O. Box 283324 • Honolulu, Hawaii 96828 • (808) 922-3888
Facsimile (808) 922-0411 • Email: lifeguards@aloha.com



**SNORKELING SAFETY WORKSHOP
WEDNESDAY, MARCH 28, 2018, 8:00 AM – 4:30 PM**

**HILTON HAWAIIAN VILLAGE RAINBOW SUITE AND DUKE
KAHANAMOKU LAGOON**

AGENDA

8:00	Registration, Continental Breakfast	Rainbow Suite
9:00	Welcome, Introductions	Kaala Souza
9:15	Opening Remarks	R. Goto
9:25	DOH Advisory Task Force Update	B. Velasco
9:45	Epidemiology of Snorkel Related Drownings	Dan Galanis, PhD
10:15	Physiology of Drowning	Elizabeth Char, M.D.
10:30	Risk Factors and Possible Causes of Snorkel Related Drownings	Philip Foti, M.D.
11:00	Effect of Pre-Existing Medical Conditions	Chris Happy, M.D.
11:30	Report of Findings and Testing of Various Masks/Snorkels	

Dr. Foti
Colin Yamamoto

1200 – 1:00 LUNCH

1:00 - 2:00 Snorkeling Safety Best Practices

Alan Hong, Retired Hanauma Bay Manager
Captain Jenna Morris, Dolphin Excursions
Lt. Cmdr. Simone Mause, USCG

2:00 – 2:45 Breakout Groups:
Develop Strategies and Messaging to Mitigate Risks

2:45 – 3:00 BREAK

3:00 – 3:30 Reports from Breakouts
Call to Action

3:30 – 4:30 Demonstrations and Hands on With Equipment
in Duke Kahanamoku Lagoon

4:30 Adjourn

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MAHALO TO:

The Hawaiian Lifeguard Association

Department of Health EMS and Injury Prevention System Branch

Hawaii Tourism Authority

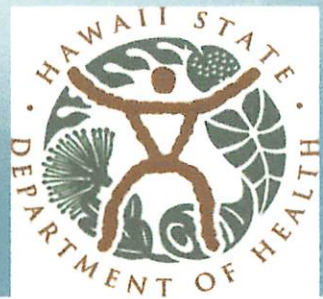
Waikiki Beach Activities

Hawaii Snorkeling Safety Workshop

March 28, 2018
Hilton Hawaiian Village

Bridget Kaumeheiwa Velasco
Public Health Educator
Emergency Medical Services and Injury
Prevention Systems Branch
Hawaii Department of Health
Bridget.velasco@doh.hawaii.gov







2020 HAWAII SNORKEL SAFETY WORKSHOP

Presented by the:
Hawaiian Lifeguard Association
State of Hawaii Department of Health

DATE: SATURDAY, FEBRUARY 29, 2020

TIME: 8:30 AM - 4:00 PM

LOCATION: HAWAII CONVENTION CENTER, ROOM 301 AB

The second Hawaii Snorkel Safety Workshop will be conducted to provide updates on the Snorkel Safety Study by members of the committee and to solicit input and recommendations regarding snorkeling safety in Hawaii from a variety of perspectives.

AGENDA

7:30 – 8:30	REGISTRATION	
8:30 – 8:45	WELCOME AND INTRODUCTIONS	K. Souza
8:45 – 9:15	SNORKEL RELATED INCIDENTS/FATALITIES	D. Galanis
9:15 – 10:00	SNORKEL TESTING AND FINDINGS (S.A.R.A.)	P. Foti
10:00 -10:30	SNORKEL SAFETY STUDY SURVEY	C. Wilcox
10:30 – 11:00	FULL FACE MASKS: EFFICACY OF SNORKEL EQUIPMENT DESIGN	C. Yamamoto

SNORKEL SAFETY WORKSHOP
PAGE 2

11:00 - 11:20	DEPT. OF HEALTH DROWNING PREVENTION INITIATIVES	T. Smith
11:20 – 11:40	VISITOR ALOHA SOCIETY OF HAWAII	J. Rich
11:40 - 12:00	U.S. COAST GUARD INVESTIGATIONS DIVISION	A. Statchel
12:00 - 1:00	LUNCH	
1:00 – 2:00	BREAKOUTS / WORK GROUPS SESSION 1	
	Equipment Testing: snorkels, full face masks	
	Medical Examiner Findings /Comorbidities	
	Aquatic Skills Competency	
	Environmental Factors	
	Dive Charters, Tour Boats	
	Data Collection / Surveys	
	Public Health / Prevention Strategies	
2:00 – 3:00	BREAKOUTS: SESSION 2	
3:00 - 4:00	RECOMMENDATIONS /ACTION ITEMS	K. Souza
4:00	ADJOURN	

2020 HAWAII SNORKEL SAFETY WORKSHOP

**HAWAII CONVENTION CENTER
SATURDAY, FEBRUARY 29, 2020**

REGISTRATION FORM

NAME: _____

AGENCY/ORGANIZATION: _____

TITLE/POSITION: _____

ADDRESS: _____

EMAIL: _____

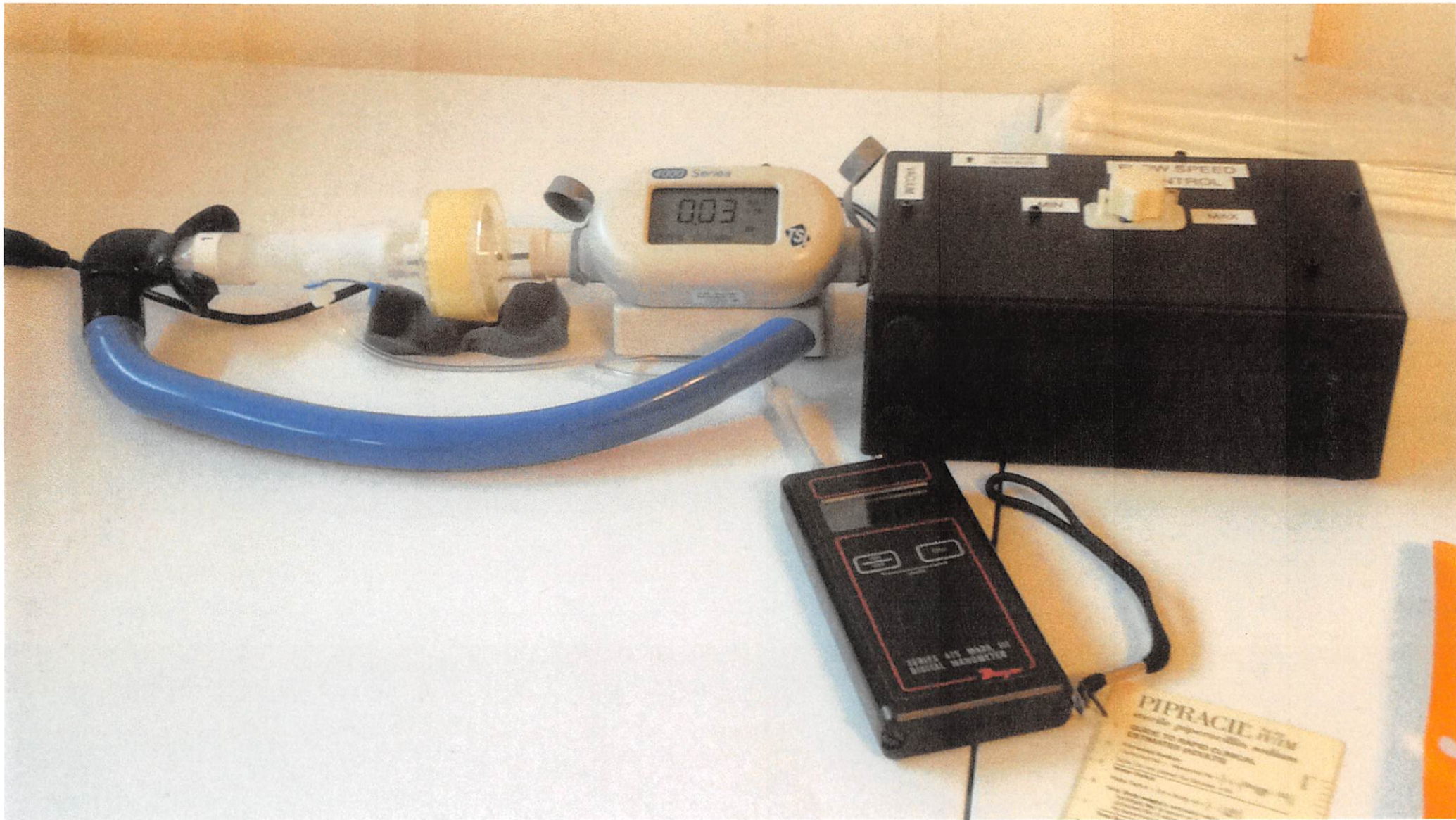
TELEPHONE: _____ **CELL PHONE:** _____

**REGISTRATION FEE: \$50.00 PAYABLE TO THE
HAWAIIAN LIFEGUARD ASSOCIATION**

CHECK, PURCHASE ORDER, OR CASH. NO CREDIT CARDS

**MAIL TO: HAWAIIAN LIFEGUARD ASSOCIATION
POST OFFICE BOX 283324
HONOLULU HI 96828**

EMAIL: ralphgoto@gmail.com





full face



basic with...



basic



basic wit...



dry wit...



basic with...



basic dry



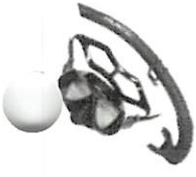
dry



pleats



basic with rig...



basic with right...



basic w c...



basic with...



extra wide bore

Cp
Set
by C
\$2
S



pinched tube



basic wit...



basic dry



basic wit...



full face



dry



dry



dry





Hawaii

Hawaii Struggling To Find Out If Full-Face Snorkel Masks Are Dangerous

The counties have been unable to collect enough data on the type of mask worn in drowning incidents to draw any conclusions yet.

 16

By Nathan Eagle    / October 8, 2019

 Reading time: 8 minutes.



In 2017, Hawaii lifeguards started [trying to track](#) what type of snorkeling equipment was worn in drowning incidents throughout the islands after stories emerged about the potential hazards of the increasingly popular full-face masks.

They remain committed to the effort, but collecting information has proven challenging, county officials said.

Ocean safety experts have been unable to draw any conclusions from the data that lifeguards and paramedics have provided over the past two-plus years, but they are optimistic that ongoing studies and future surveys will net clearer answers.



A man uses a full-face mask at Ahalanui Beach Park in 2017. Lifeguards said they've seen more people wearing this new type of mask.

“Everyone is really quick to indict these full face masks,” said Ralph Goto, who is on a snorkeling safety steering committee and co-chairs a multi-agency drowning prevention committee.

“Part of me wants to agree with them,” he said. “But the rational part says we don't have any evidence.”

Of 112 snorkeling-related drownings in Hawaii from 2014 to 2018, there was information on the type of mask worn in just 16% of the incidents. A full-face mask was worn in five drownings and a traditional two-piece mask and snorkel was worn in 11 drownings, according to state health department data.

Drownings have [continued to increase in Hawaii](#) as tourism has surged. The rate of visitor deaths far outpaces that of local residents, especially when it comes to snorkeling. More than 90% of snorkeling-related drownings are tourists.

Guy Cooper, whose wife drowned snorkeling in 2016 while visiting the Big Island, turned his focus immediately to the type of mask she was wearing. It was a blue Azorro full-face mask she purchased on Amazon before the trip.

He has raised his concerns with county and state officials, consumer protection sites, media outlets and others over the past few years as full-face masks have proliferated.

Cory Lum/Civil Beat

Beginner snorkelers in particular have gravitated to this new style for its highly touted ease of use.

Guy Cooper has pressed officials over safety concerns with full-face masks after his wife died wearing one while snorkeling on Hawaii island in 2016.

“I have been heartened by the increasing number of tours and retail outlets banning full-face masks and the social media cautions after every incident,” Cooper said. “And, to be fair, I’m encouraged by the industry nudging towards independent testing.”

But he said he remains frustrated by the lack of consistency in county reporting.

Cooper, who moved from California to Hawaii after his wife died, and others concerned about this issue say the design of full-face masks may

cause carbon dioxide to build up and lead to someone passing out. They add that it's inherently harder to remove the mask in case of emergency because of how the strap harness fits around the head.

Some snorkeling stores, tour companies and resorts — from Hawaii to Puerto Rico and beyond — have either refused to carry or stopped carrying full-face masks due to safety concerns. Those decisions have been based on their own experience with snorkeling equipment, their observations over time and individual stories.

Robert Wintner, who owns Snorkel Bob's rental stores on four of the Main Hawaiian Islands, said his employees tested the full-face masks and decided "no way."

Pride of Maui recently banned full-face masks from its snorkel tours, citing the potential dangers of carbon dioxide build-up leading to dizziness, headaches or unconsciousness. The company says on its website that this can also happen with poorly designed standard snorkel tubes.

Company manufacturers of the original full-face masks, like [Ninja](#) and [Head/Mares](#), have underscored that not all masks are created equal. They argue that there is nothing to worry about with their versions because they were designed to expel CO₂, but the knock-offs from China and elsewhere don't.

Ocean safety advocates in Hawaii have designed special instruments to start testing the equipment, but the results are not yet available.

"They're all dangerous if you don't know what you're doing," Goto said.

'It's Going To Take Awhile'

Dan Galanis, the state epidemiologist, said record collection improved

over time as more people became aware of possible issues with full-face masks. But he said the narrative text on death certificates specifies nothing about the type of equipment.

He has relied on EMS records instead, but those have been spotty at best.

Visitors drown at eight times the rate of locals. (Courtesy: Department of Health)

Galanis plans to review autopsy records next, but that requires filing an application with the Institutional Review Board, which ensures the rights of research subjects, and establishing a memorandum of agreement with the



HOUSE RESOLUTION

URGING THE COUNTY COUNCILS TO ENACT ORDINANCES TO BAN THE SALE
AND RENTAL OF FULL-FACE SNORKEL MASKS IN HAWAII.

1 WHEREAS, the State is a prime destination for ocean
2 activities because of the clear blue waters, year-round warm
3 waters, and unique ocean ecosystems; and
4

5 WHEREAS, the promotion of safe practices will ensure that
6 locals and non-locals enjoy ocean activities in the State; and
7

8 WHEREAS, 17 snorkeling-related deaths occur on average each
9 year in Hawaii; and
10

11 WHEREAS, in 2018, there were 14 such deaths in the first
12 three months; and
13

14 WHEREAS, between January 14 and 27, 2018, eight people,
15 including at least three tourists, drowned near several beaches
16 on Maui, bringing the death toll in the span of two weeks to
17 almost half of the 17 snorkeling deaths that Hawaii experiences
18 in a year; and
19

20 WHEREAS, two of those deaths involved visitors from
21 California who were wearing full-face snorkel masks and those
22 drownings have raised concerns about use of recently introduced
23 models of full-face snorkeling masks; and
24

25 WHEREAS, full-face snorkel masks are masks that seal around
26 a person's entire face and strap around the head with a tube for
27 breathing and the design of full-face snorkel masks makes it
28 difficult to remove the mask when an individual panics in the
29 ocean; and
30

31 WHEREAS, the design is also believed to retain more carbon
32 dioxide in the mask, which may lead to a person becoming
33 disoriented or lose consciousness; and



H.R. NO. 113

1 WHEREAS, critics of the full-face design, including
 2 experienced watermen and women on Maui say that there is carbon
 3 dioxide buildup in the mask, and the masks are prone to leaking
 4 and fogging easily; and

5
 6 WHEREAS, the full-face masks are popular because the new
 7 design advertises that people can breathe through their nose and
 8 mouth, unlike a traditional snorkel with only a mouthpiece; and

9
 10 WHEREAS, a Hawaii retailer field-tested the full-face
 11 snorkeling masks and now refuses to sell them, and an owner of
 12 one of Maui's and the State's largest snorkel companies said
 13 that he never will sell the "one piece" snorkel masks; and

14
 15 WHEREAS, some surviving relatives and friends of the
 16 deceased snorkelers have placed the blame on full-face snorkel
 17 masks; now, therefore,

18
 19 BE IT RESOLVED by the House of Representatives of the
 20 Thirtieth Legislature of the State of Hawaii, Regular Session of
 21 2019, that this body urges the county councils to enact
 22 ordinances to ban the sale and rental of full-face snorkel masks
 23 in Hawaii; and

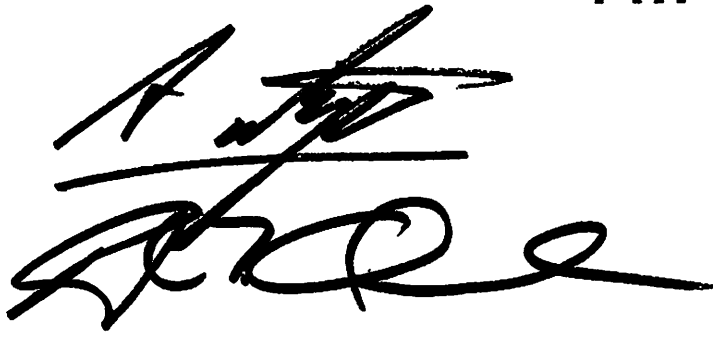
24
 25 BE IT FURTHER RESOLVED that certified copies of this
 26 Resolution be transmitted to the Council Chairs of the Honolulu
 27 City Council, Kaua'i County Council, Maui County Council, and
 28 Hawai'i County Council.

29
 30
 31

OFFERED BY:

[Handwritten signatures and names]
 S. Air
 R. A. Aho
 David Carnes
 Dettl
 Cynthia Thiel
 John H. ...
 ...
 ...



A handwritten signature in black ink, consisting of several stylized, overlapping strokes. The signature is positioned centrally on the page.

MAR 08 2019



Ralph S. Goto
44-547E Kaneohe Bay Dr.
Kaneohe HI 96744
(808) 479-1610

April 11, 2018

Consumer Reports
101 Truman Ave.
Yonkers NY 10703

Aloha,

I am writing to explore the possibility of Consumer Reports studying and reporting on the different types of snorkeling equipment available to the public, specifically, traditional two piece (masks and snorkels) and the newer, one piece, "full-face masks."

As you may be aware, there has been a heightened awareness of snorkeling and snorkeling related drownings over the past three months in the ocean surrounding the Hawaiian Islands. To date, there have been 16 snorkel related fatalities recorded this year, with 14 of the 16 occurring to visitors to Hawaii. There are many theories and hypotheses being put forth to explain the phenomenon, from inexperience to pre-existing medical conditions to the design and function of the snorkeling equipment. Although most of the theories may have some credence and credibility, there has been no definitive, objective study to determine the validity of any of them.

According to the U.S. Centers for Disease Control and Prevention (CDC), drowning is the 5th leading cause of unintentional injury death in the United States. In Hawaii, ocean drowning is the leading cause of fatal injury to non-residents, and of these fatalities, the most common activity associated with these incidents is snorkeling.

I am the retired Administrator of the City and County of Honolulu's Ocean Safety and Lifeguard Services Division (1981-2013) and the co-chair of the State of Hawaii's Department of Health's Drowning and Aquatic Injury Prevention Advisory Committee. We recently conducted a workshop to address the problem and to discuss the crafting of prevention messages that could be disseminated to visitors and residents. Workshop participants, including ocean safety and public health practitioners, concluded that there was a need for independent, objective testing of snorkeling equipment. As you are certainly aware, product manufacturers and those whose economic welfare is affected are quick to refer to their 'rigorous safety standards and testing.' However, there have been no objective, third party studies conducted to support these claims that we are aware of.

Although there are existing standards established for (and by) the SCUBA industry relative to equipment, we are not aware of any similar guidance for snorkeling and/or skin diving, and feel that there is a critical need to investigate this area.

The purpose of this letter is to obtain feedback from Consumer Reports regarding the appropriateness of such an undertaking. We have already initiated two projects to 1) measure air flow and resistance in various snorkels, and 2) to measure CO₂ and O₂ levels in the newer, full face masks. These projects, however, could not meet the objective testing criteria and standards of Consumer Reports as I understand them.

As co-chair of the Snorkeling Safety Advisory Subcommittee and as one who has devoted his professional career to ocean and water safety, I would appreciate a response from you to share with members of the group. I look forward to hearing from you and remain,

Sincerely yours,

Ralph S. Goto

attachments



April 21, 2018

Mr. Ralph Goto
44-547E Kaneohe Bay Dr
Kaneohe, HI 96744

Dear Ralph:

Thank you for contacting us. We value you as a member and are here to help quickly with your request.

We appreciate your writing us to suggest a future report on snorkeling equipment. As you might imagine, we get many suggestions for reports. Please be assured that our members' feedback plays a strong role in the work that we do. Because of this I have taken the liberty of sharing your suggestion with the appropriate members of our staff for their review and future consideration. While we can't guarantee we can publish every report suggested, we thank you for identifying a topic of interest.

We are the only nonprofit, independent product testing and ratings organization in the U.S., and we rely on consumers like you to fund and inform our work. Thank you again for your loyalty and support!

Much Appreciated,

Brenda
Representative
Member Services

003606078A

Similarly, Farah Morton invented the Baby Delight Snuggle Nest in-bed sleeper because she “realized the bassinet she was using prevented the closeness she desired with her newborn daughter,” says a Baby Delight spokesperson, who also says Morton no longer owns the company. According to what appears to be Morton’s LinkedIn page, she developed the product “in order to provide more protection for co-sleeping newborns, opening a category that previously did not exist.”

The spokesperson, when asked whether premarket testing was done to ensure that the product was safe for infant sleep, says Morton “engaged a seasoned safety consultant at the time of the first manufacturing.”

Though DockATot recently stopped explicitly promoting its product for bed-sharing, as of this April its marketing still showed images of babies sleeping in the product and pictures suggestive of bed-sharing. No details about premarket testing for sleep safety are provided on its website.

Consumers have responded to the products enthusiastically. The Snuggle Nest has become a best seller for Baby Delight, according to a company spokesperson. And the DockATot caught with celebrity influencers such as Molly Sims, Courtney Kardashian, and Hilary Duff, who raved about it on social media and in other outlets.

The product’s popularity is concerning, says Ben Hoffman, MD, chairperson of the AAP Council on Injury, Violence, and Poison Prevention. “If you go back to what we know is the safest way for an infant to sleep, in-bed sleepers missed the mark on virtually all accounts,” he says. It’s also unknown, he says, whether in-bed sleepers prevent adults from rolling over and smothering infants. “Basically, the products don’t do anything we would ever expect in a safe sleep space for a baby.”

Writing Their Own Rules

Despite Hoffman’s concerns, the makers of in-bed sleepers are now creating their own voluntary standard through ASTM. Whether the products should conform to the bassinet standard, or be sold as loungers instead of as sleep products, is among the concerns that regulators, safety advocates, and industry representatives are debating.

The discussions are taking place against the backdrop of the CPSC’s proposal of a mandatory

4 Products That Lack Safety Standards

We checked with five major standard-setting and accrediting organizations in the U.S. to see whether these consumer goods have an applicable safety standard. As of April 2021, they did not.

HOVERBOARDS



Until 2016, there was no standard covering hoverboards’ electrical systems, and some caught fire and were recalled. They’re still not subject to standards governing acceleration, braking, or durability, problems consumers have complained about, though such standards are being developed.

SNORKELS



At least one model was recalled because a piece broke off and was inhaled by a user. Recreational snorkels are not subject to specific standards, as some diving gear is.

E-SCOOTERS



Some adult and ride-sharing e-scooters have broken or caught fire, leading to injuries and recalls. While children’s e-scooters have some safety standards, a performance standard for adult versions is only now being created.

INFANT SLEEP HAMMOCKS



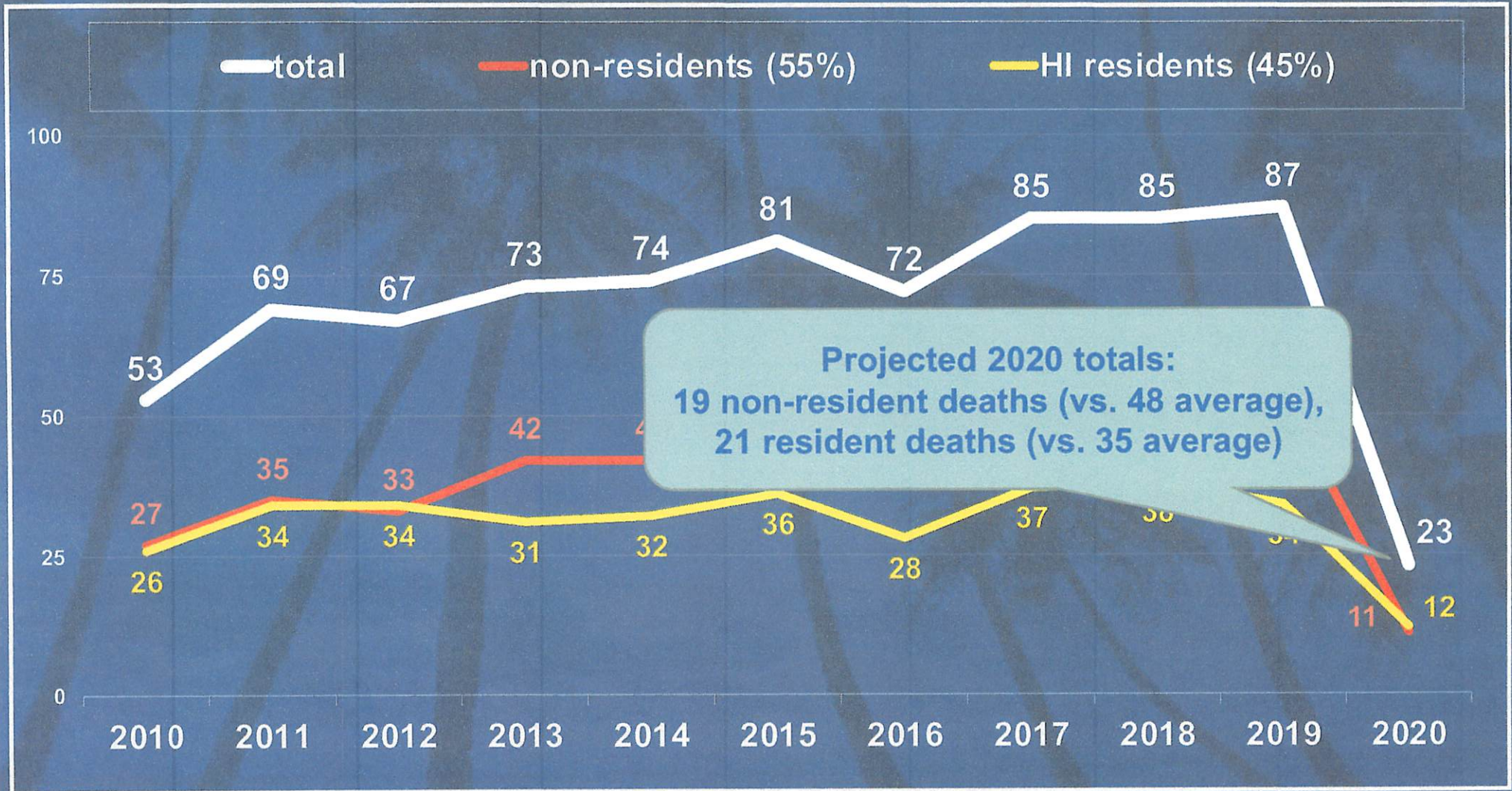
Some of these products have been linked to injuries and deaths and have been recalled. These products don’t conform to safety standards or follow safe-sleep advice that babies sleep on their back on a firm, flat surface.

Update on fatal ocean drownings, through July, 2020

*Dan Galanis, Ph.D.
Epidemiologist
Injury Prevention and Control Section
EMS & Injury Prevention System Branch
Hawaii Department of Health*

*Ph: 733-9236
E-mail: daniel.galanis@doh.hawaii.gov*

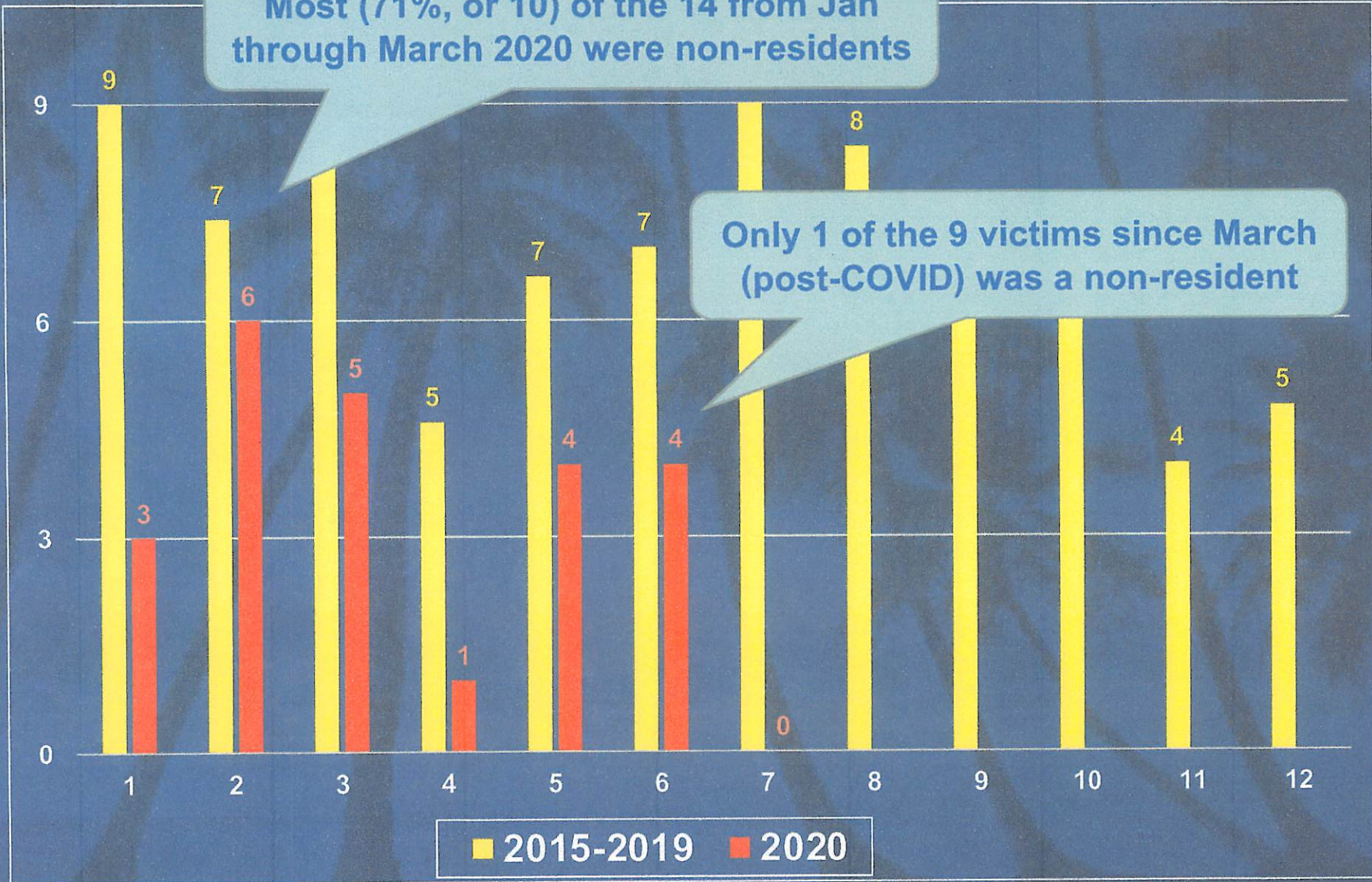
Ocean drownings in Hawaii, 2010- July 2020



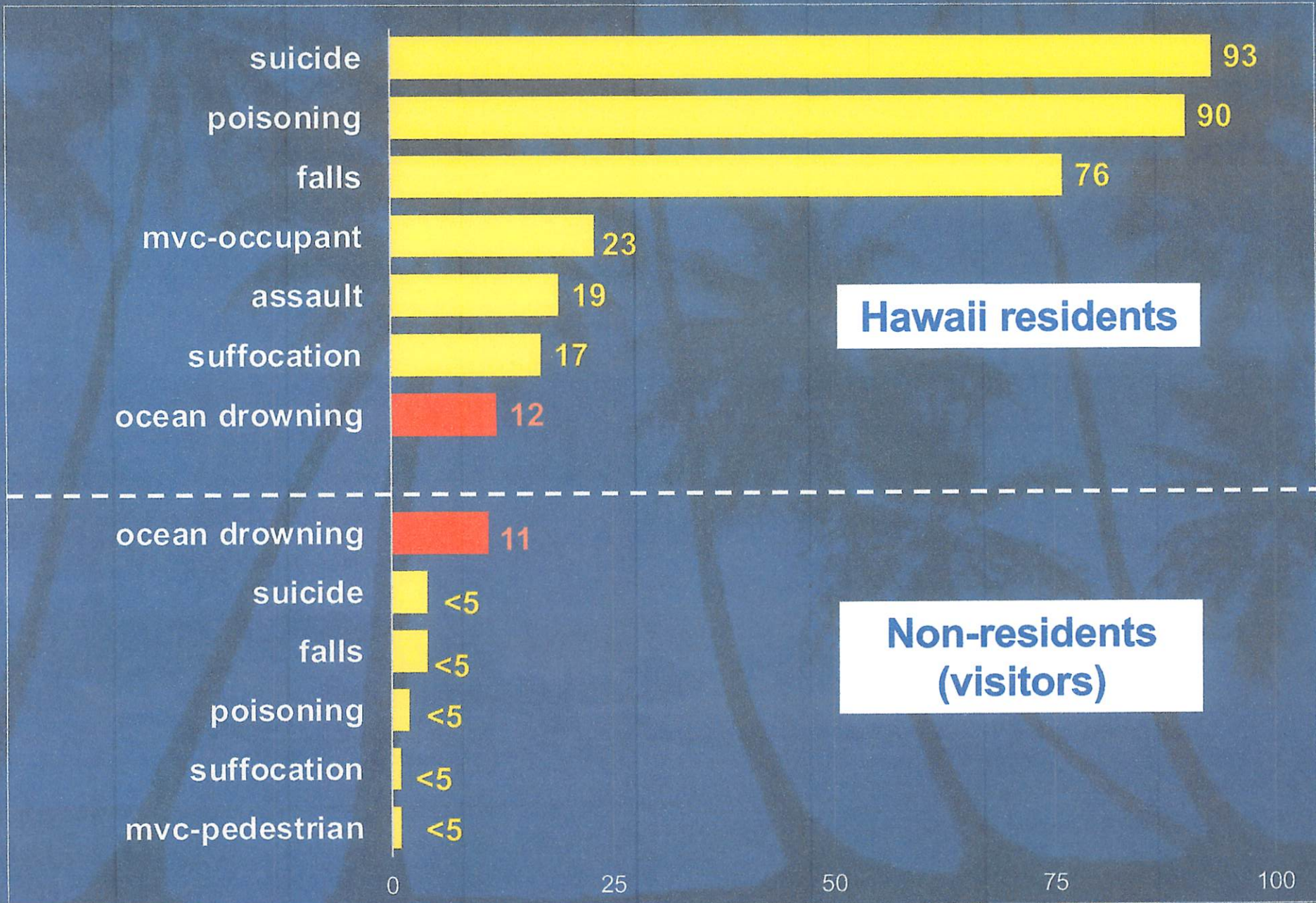
Monthly number of fatal ocean drownings in Hawaii, 2010-2019 vs. 2020 (through July)

Most (71%, or 10) of the 14 from Jan through March 2020 were non-residents

Only 1 of the 9 victims since March (post-COVID) was a non-resident



Leading causes of fatal injuries in Hawaii, by residence of victims, January through July, 2020



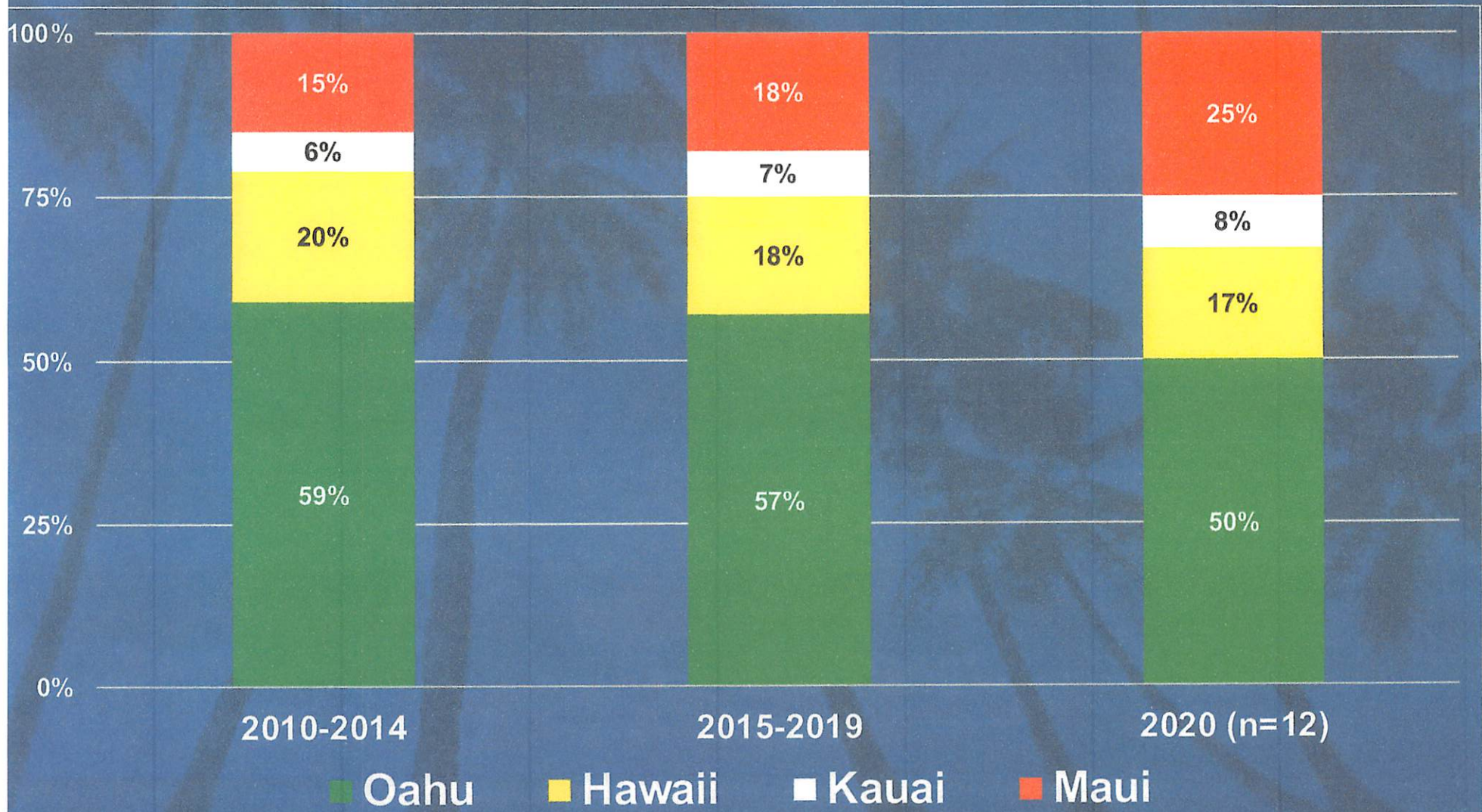
Ocean drownings in Hawaii, by residence and activity of victim, January through July 2020



Ocean drownings in Hawaii, by residence and activity of victim, 2010-2019

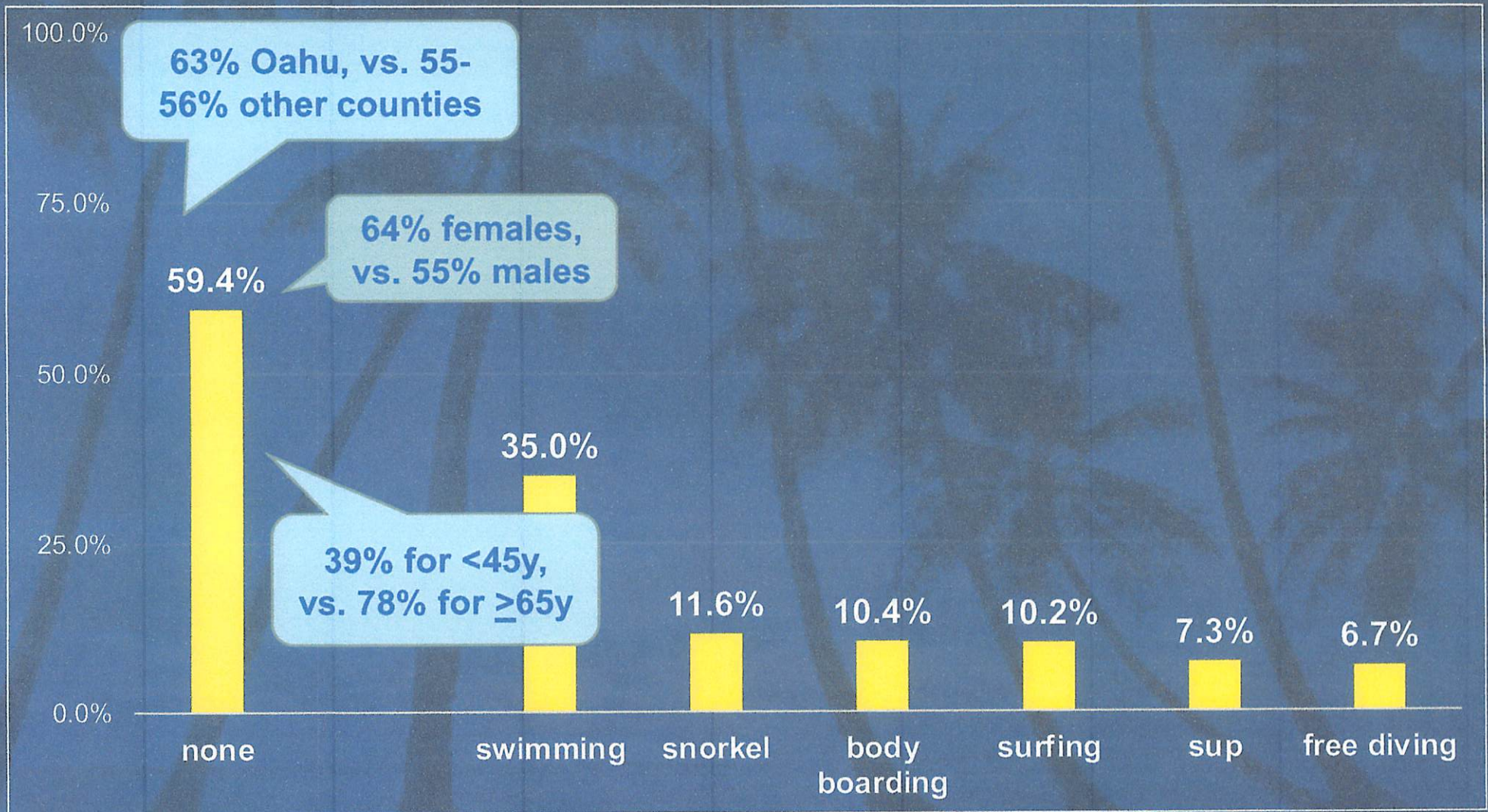


County distribution of fatal ocean drownings, by period, 2010 through July 2020



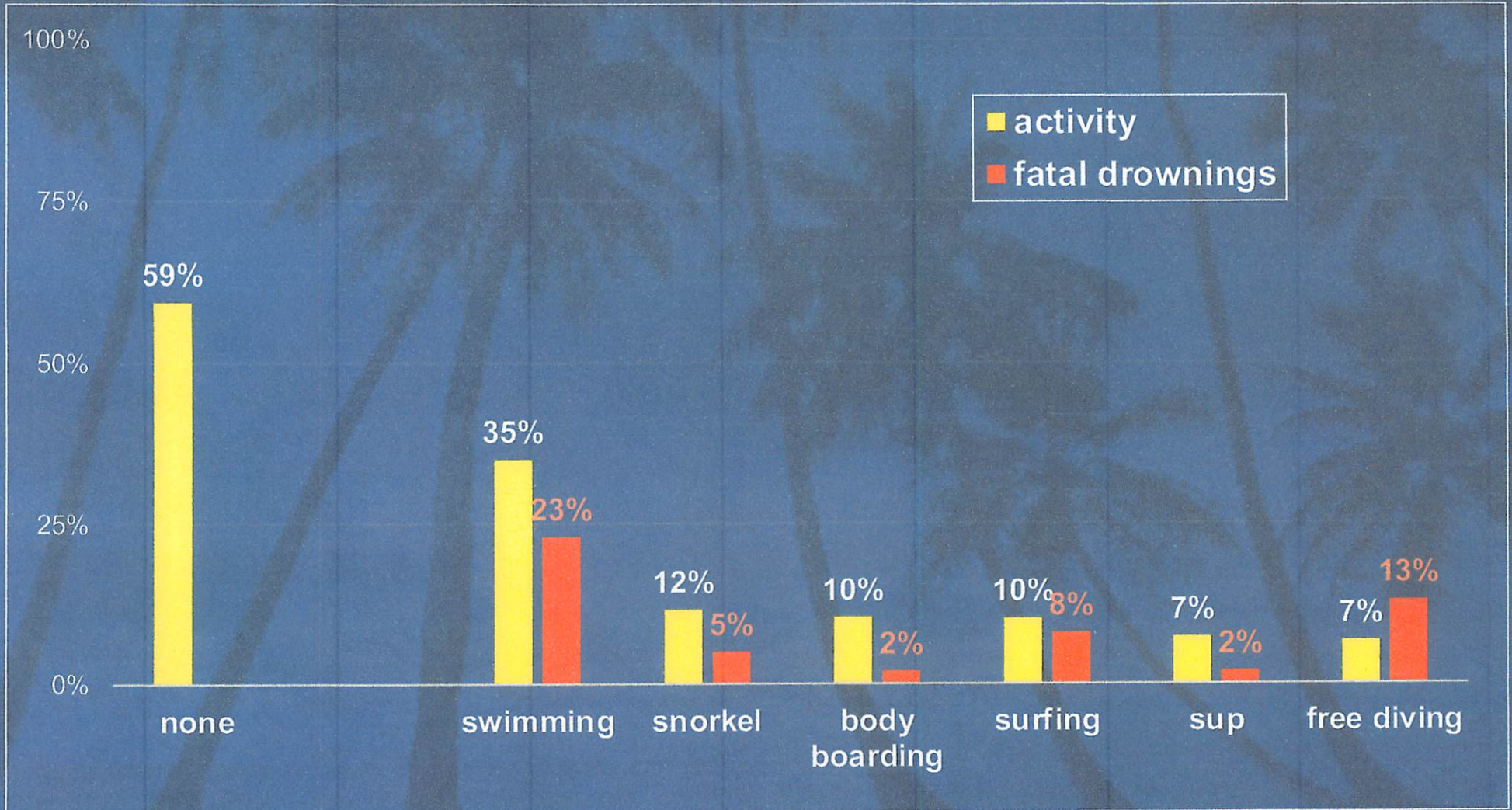
Question from the 2018 BRFSS survey (n=6,922):

“Did you go _____ in the ocean in Hawaii during the past 30 days?”



Question from the 2018 BRFSS survey (n=6,922):

“Did you go _____ in the ocean in Hawaii during the past 30 days?”



Summary

- **Fatal ocean drownings will probably be half the usual number in 2020**
 - *Projected total of ~40, vs. 80-85 in last 5 years*
 - *Only 1 non-resident victim in the 4-month post-COVID period of April through July*
- **To date, geography and activity distribution similar to previous years**
 - *Swimming and snorkeling among non-residents*
 - *Free diving, shoreline activities and swimming among residents*
- **Population survey of ocean activities among residents**
 - *59% report none in previous 30 days*
 - *Higher proportion for: Oahu residents, females, older residents*
 - *35% swimming, 12% snorkeling, 7-10% for other activities*
 - *Free diving is “over represented”: 7% report activity in the last 30 days, vs. 13% of drownings*



SNORKEL SAFETY SURVEY REPORT

April 28, 2021

SNORKEL SAFETY SURVEY SUMMARY

"I was snorkeling with Joe after a guided kayak trip. 15 minutes into the snorkeling, I noticed Joe was head up, treading water. I swam over and asked him if he was okay. He said "I'm having trouble breathing through this mask. I'd like to go closer to shore so I can stand up and breathe easier" I said "Okay, just slow your breathing and let's head back to shore slowly". He put the mask back on and we started swimming. Maybe a minute later I looked over, and Joe was swimming away from me, parallel to shore. I yelled for him, no response. I swam over to him, maybe 10 feet and he was unresponsive. I turned him over onto his back and waived to the shore for help. Several men came running out and helped me get Joe to shore. One man noticed the mask was flooded. They pulled it off and started CPR. 911 was called - they didn't arrive for 45 minutes. Paramedics worked on him for another half hour, then we were transported to the hospital where he was pronounced dead on arrival." (Narrative taken from the Snorkel Safety Survey, used with permission by Joe's fiancée.

Many snorkel drownings are mysterious. A snorkeler is often discovered motionless and unresponsive without any previous sign of distress. What is happening? While there are a lot of assumptions, no one really knows. The Snorkel Safety Study (Study) team felt that the best source of information is the individual who gets into trouble. The Snorkel Safety Survey (Survey) was designed to collect this information.

Survey questions explore the obvious risk factors such as: lack of swimming or snorkeling experience; ocean conditions (such as currents, waves or rocks); preexisting health conditions; trauma (such as heart attacks, stings or bites, injury); trouble with equipment (such as leaky masks or snorkel malfunction); inattention to location (such as drifting beyond a safe distance). Other questions explored the role and importance of lifeguards, "buddies," bystanders, friends and family.

A Study hypothesis was that the snorkel itself triggered pulmonary edema, something not previously considered. The hope was that the timing and sequence of events during a drowning incident would provide clues as to whether the person had experienced a process of drowning by *aspiration* (inhalation of water) or by *pulmonary edema*.

Hawaii Department of Health statistics show that far more visitors die while snorkeling than residents, and that snorkeling is the number-one cause of visitor deaths in Hawaii. While often attributed to a lack of swimming/snorkeling experience, a Study hypothesis was that this difference might be related to recent prolonged air travel.

The Snorkel Safety Survey was first disseminated in December, 2018, with a goal of getting two to three hundred responses with an emphasis on visitors. The project had hoped to but didn't get authorization to have a presence at Hanauma Bay, where there is a concentration of visitors. Then, In March of 2020, COVID-19 lockdown brought tourism to a halt. The opportunity to survey significant numbers of visitors was lost. By December, 2020, there were only 42 completed surveys.

The Study engaged Pang Communications, LLC, to develop a Survey awareness campaign to solicit more Survey responses. Within one week there were another 40 Survey responses. At the time of this report, March 2021, the total number of survey participants was 90.

Respondents were asked but not required to provide their names. Most did. Respondents showed a high degree of interest and trust and were generally eager to help unravel the mystery. Most of these also supplied their contact information and agreed to be available for follow up contact. Many also agreed to have their narratives published in order to help others.

The following section, *Snorkel Safety Survey Data*, summarizes the responses to each question. It does not interpret this data. Not all respondents answered all the questions, which accounts for the differing numbers in total respondents for each question.

Respondent Narratives, edited to exclude identifying information, is used with permission by the individuals, all of whom indicated a willingness to do what they could to help save lives.

The Snorkel Safety Survey will continue to collect data until the end of 2021. Further details can be found at www.snorkelsafetystudy.com



OCEAN SAFETY SURVEY

Prepared for the Drowning and Aquatic Injury
Prevention Advisory Committee

June 2016

Room for Improvement

Ocean Safety Information visitors wish they knew or had access to

Total

O'ahu

Maui

Kaua'i

What to do in case of **rip currents**

59.4% 60.5% 61.4% 56.5%

How to use the **public rescue tube** stations

59.3% 56.9% 61.7% 59.4%

Avoiding/what to do in case of **hazardous conditions**

51.2% 52.6% 52.0% 48.9%

Decreasing my risk to injury from **snorkeling**

32.9% 27.1% 32.1% 39.4%

Avoiding **danger** while watching waves from a **ledge**

23.5% 26.5% 17.8% 26.3%

Decreasing my risk to injury from **standup paddling**

15.2% 14.4% 16.5% 14.6%

HAVE YOU HAD A
PROBLEM WHILE SNORKELING?

PLEASE PARTICIPATE in the
SNORKEL SAFETY STUDY

**First-hand knowledge
from those who have experienced difficulty while snorkeling
is the most valuable source of information**

The HAWAIIAN LIFEGUARD ASSOCIATION, in cooperation with the State of Hawaii Department of Health, the four County First Responder and Emergency Medical Service agencies, the Honolulu Medical Examiner, and the Hawaii Tourism Authority, is conducting a **Snorkel Safety Study** to determine causes and risk factors associated with snorkel-related fatal and near-fatal ocean drownings in Hawaii

TAKE THE SURVEY

www.SnorkelSafetyStudy.com

QUESTIONS?

SnorkelSafetyStudy@gmail.com

SNORKEL SAFETY STUDY BUDGET PRO FORMA

INCOME:

Hawaii Tourism Authority (HTA):	April 2019:	50,000
	Sept. 2019:	50,000
	Final Payment Due:	<u>31,000</u>
TOTAL HTA FUNDING:		\$131,000

EXPENSES:

EXPENDED TO DATE (5/2021)*	=	\$118,025
PROJECTED FINAL EXPENSES**	=	<u>12,975</u>

\$131,000

*SEE ATTACHED PAGES FOR DETAILED EXPENDITURES

**FUNDS TO BE USED TO FORMALIZE AND DISEMINATE PUBLIC SERVICE AND PREVENTION MESSAGES

SNORKEL SAFETY STUDY FUNDS EXPENDED AS OF 7/7/20

<u>DATE</u>	<u>TO</u>	<u>FOR</u>	<u>NO.</u>	<u>AMOUNT</u>
1/16/18	USPS	Stamps	Card	130.00
1/29/18	Philip Foti	Snorkels	1231	279.00
4/ /18	Tiller Chi	Website	1237	33.00
1/15/19	Tiller Chi	Survey draft	1284	835.00
1/25/19	Social Marketing Hawaii	Website/survey	1285	8,586.38
2/7/19	Hawaii Physicians/Foti	SARA	1287	6,897.00
3/29/19	Tiller Chi LLC	Snorkel Study	1295	1,387.50
4/4/19	Seth Reis	Review contract	1296	376.00
4/6/19	Health Science Solutions	Don Pump	1297	2,000.00
4/14/19	Social Marketing Hawaii	Website update	1298	1,151.83
5/15/19	Don Pump	Research Assistant	1299	2,000.00
6/9/19	Don Pump	"	1308	2,000.00
6/10/19	Carol Wilcox	Projector and screen	1309	948.00
7/7/19	Don Pump	Research Assistant	1313	2,000.00
9/3/19	Sumiko Yamagishi	Translation	1323	150.00
10/7/19	Carol Wilcox	Printing	1329	185.00
10/14/19	Carol Wilcox	Reimbursement	1330	157.00
11/25/19	Tiller Chi	Website	101	1,050.00
11/25/19	Tina Hamayasu	Research Associate	103	595.00
12/5/19	Tina Hamayasu	"	104	58.00
12/9/19	Tina Hamayasu	Research Associate. (Dec 2019-Jan 2020)	105	560.00
2/5/20	Hawaii Convention Center	Workshop Deposit	106	548.00
2/5/20	Jerry Hay Insurance	Workshop	107	226.75
2/17/20	Tina Hamayasu	Research Associate	108	507.50
2/18/20	Philip Foti MD	Principal Investigator (April-Dec 2019)	109	18,000.00
2/20/20	Levy/Conv.Center	Workshop F&B	110	3,561.00
2/20/20	Colin Yamamoto	Airfare Conference	111	174.00
2/20/20	Bridget Velasco	Airfare Conference.	112	258.00
3/5/20	Colin Yamamoto	Fullface Mask Study	113	653.00
3/8/20	Gerald Kosaki	Airfare Conference	114	227.00
3/9/20	Carol Wilcox	Printing	115	336.91
??			116	
4/30/20	Philip Foti MD	Principal Investigator	117	6,000.00
5/7/20	Tiller Chi	Website / Survey	118	1,069.00
7/3/20	Pang Communications	PR Deposit	119	2,000.00
7/3/20	Philip Foti MD	4/20-6/20	120	<u>7,138.17</u>

Expended to date: \$72,074.17

UPDATE: 12/2/20

9/4/20	Pang Communications	August service fee	121	4,167.34
10/5/20	Pang Communications	Website, Sept fee	122	5,002.30
10/29/20	Kalani Films	Video	123	500.00
11/2/20	Pang Communications	October	124	4,779.06
11/24/20	Philip Foti	July - Sept	125	6,624.00
12/2/20	Pang Communications	Nov, QR codes	126	2,884.19
12/2/20	Tiller Chi	11/28 invoice (Carol)	127	<u>628.27</u>
				24,585.16

AS OF 12/2/2020: \$96,659.33

1/2/21	Pang Communications	December 2020 Invoice.	128	1,361.00
2/1/21	Pang Communications	for January 2021.	129	2,178.01
2/1/21	Philip R. Foti MD	October-December 2020	130	6,005.68
2/16/21	Tiller Chi	Carol	131	628.27
3/2/21	Pang Communications	Feb 21 Service fee	132	2,478.00
4/21/21	Pang Communications	Service fee, web update		916.23
4/21/21	Philip Foti MD	January – March. 2021		<u>6,000.00</u>
				19,566.00

TOTAL EXPENDED TO DATE (4/21/21) = \$ 116,225.00

4/29/21	Tiller Chi	Website / survey		1,800.00
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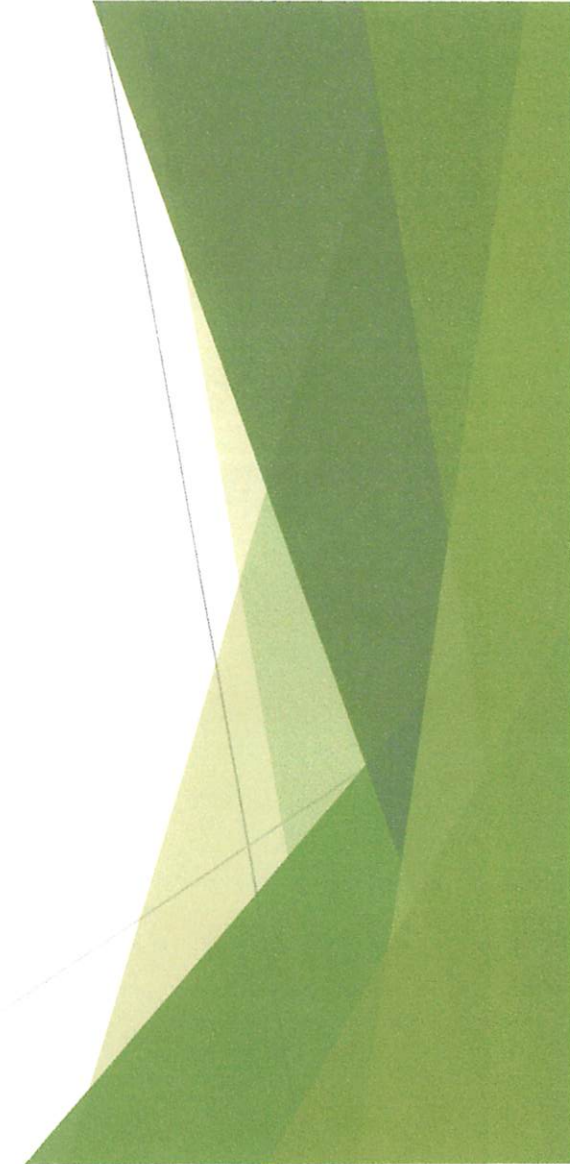


Snorkeling Related Drownings and their Relationship to Natural Disease - Oahu 2011-2018

Christopher Happy, MD
Chief Medical Examiner
City and County of Honolulu

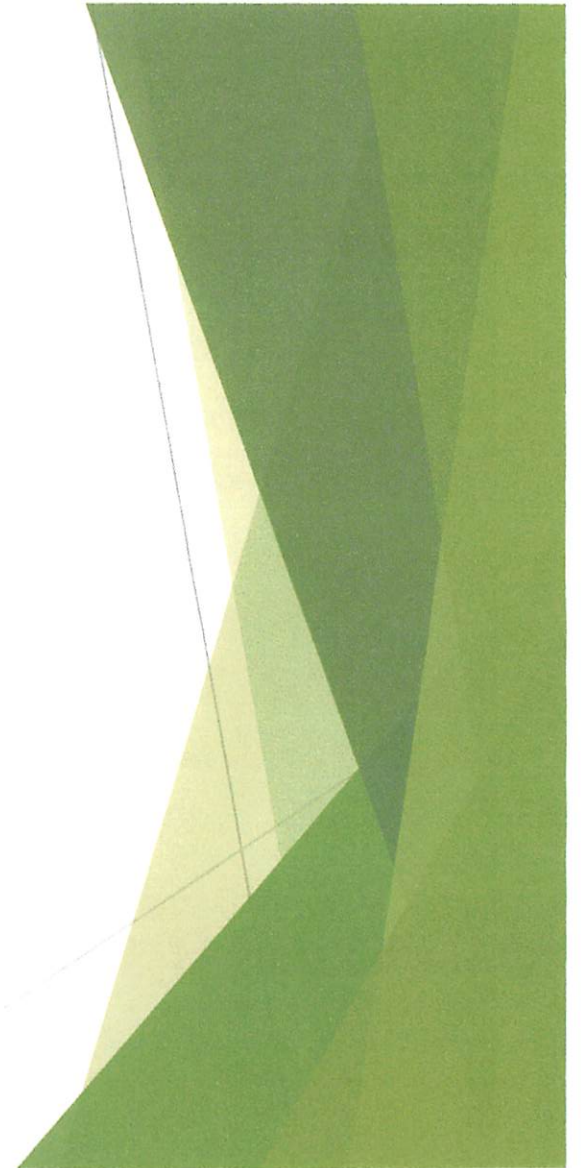
Snorkel Related Drownings, Oahu - Demographics

- ▶ 60 identified cases since 2011
- ▶ 6 yo to 82 yo
- ▶ Average age = 54.6
- ▶ 45 males / 15 females
- ▶ 53 tourists = 88%



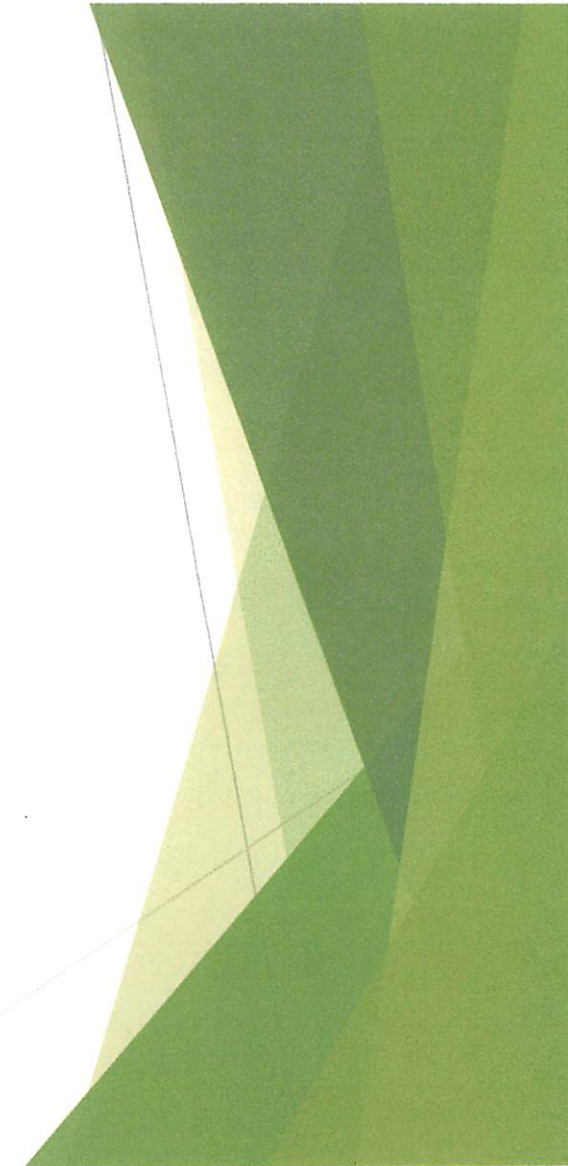
Natural Diseases

- ▶ Drownings associated with:
 - ▶ Atherosclerosis = 24
 - ▶ CABG = 4
 - ▶ Old Infarct (fibrosis) = 9
 - ▶ Stent = 3
 - ▶ Hypertension = 32
 - ▶ Arrhythmia = 3
 - ▶ Lacunar Infarcts = 2
 - ▶ Acute Hemorrhage = 1
 - ▶ Arteriolar Nephrosclerosis = 4 ??
 - ▶ ASCVD and/or HSCVD = 36 = 60%



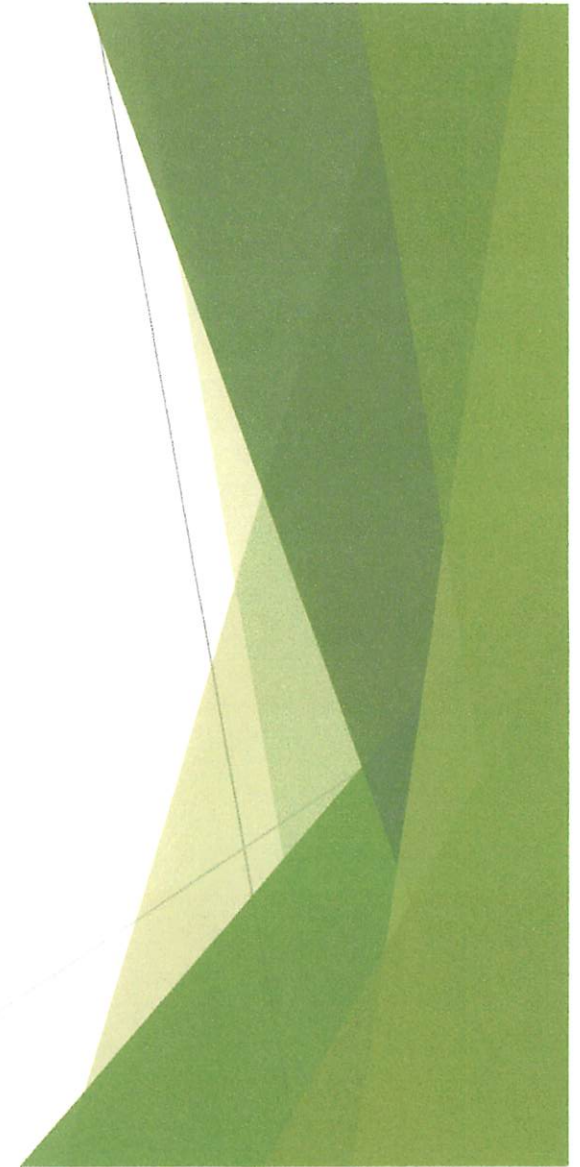
Natural Diseases (cont.)

- ▶ Diabetes Mellitus = 6
 - ▶ Hyperglycemia = 1 ??
- ▶ Obesity = 7
- ▶ Overweight = 25
- ▶ Obese + Overweight = 53.3%
- ▶ Other:
 - ▶ Thyroid Disease = 1
 - ▶ Pulmonary Hypertension = 1
 - ▶ Cardiac Valve Disease = 1
 - ▶ Arrhythmia not associated with HSCVD = 1



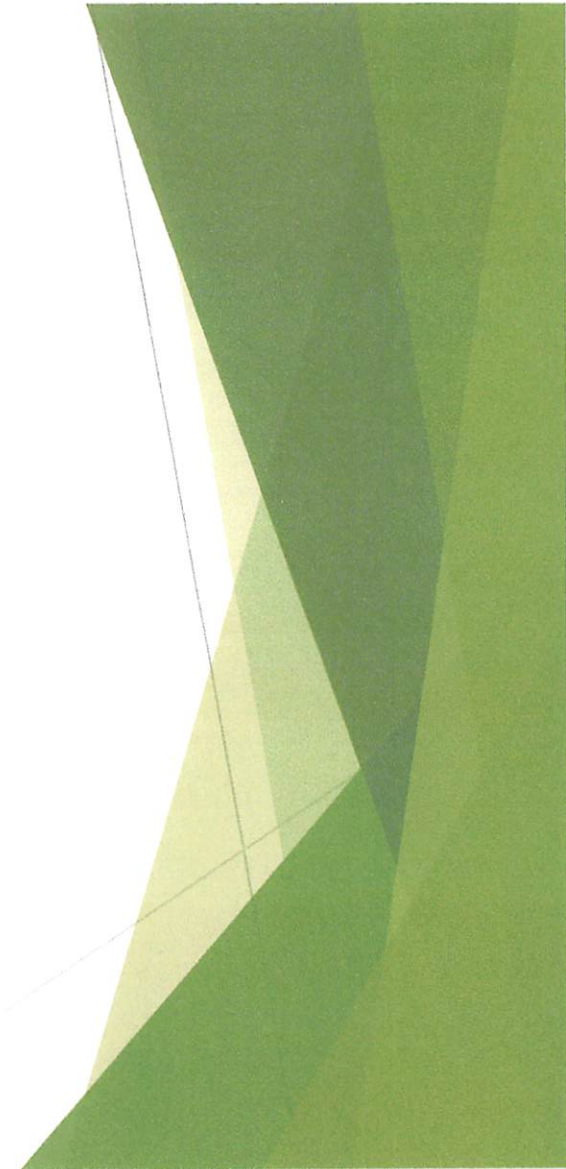
Drugs and Alcohol

- ▶ Only 1 case with methamphetamine and 1 with Alcohol!
- ▶ Both Residents
- ▶ 1 THC and 2 with Opiates (not elevated)



Drowning - Establishing the Diagnosis

- ▶ Bodies found in water:
 - ▶ May not be drowning.
 - ▶ What were they doing before they entered water?
 - ▶ How did they get in water?
 - ▶ Were they alive before entering?
 - ▶ Human factors:
 - ▶ Fitness
 - ▶ Risk-taking
 - ▶ Swimming ability
 - ▶ Diseases
 - ▶ Intoxications



Drowning - Diagnosis (cont.)

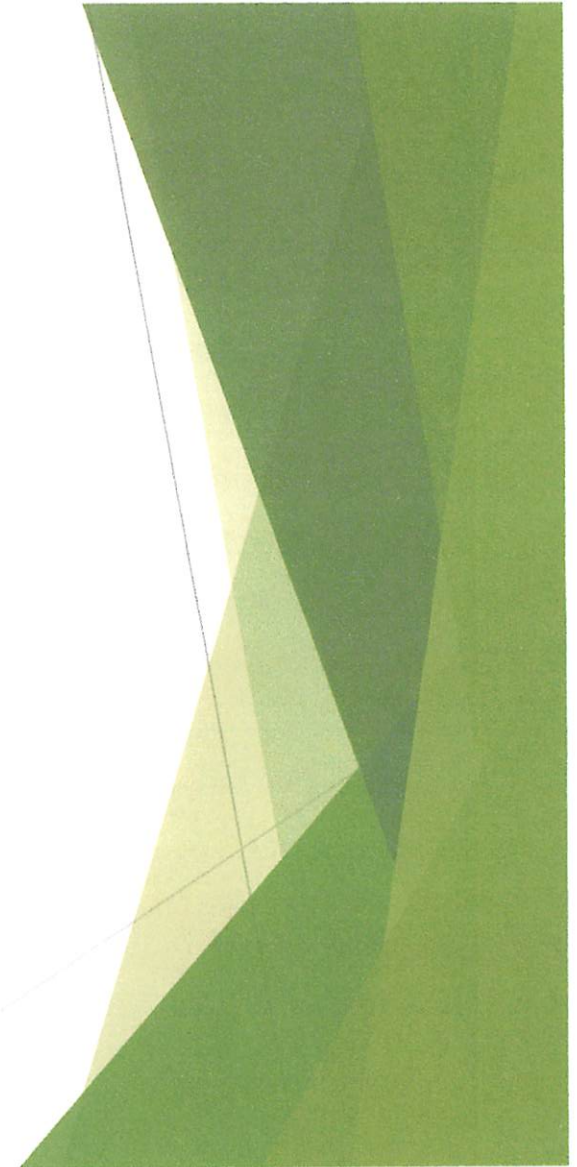
▶ Environmental Factors:

- ▶ Water temperature
- ▶ Current
- ▶ Terrain
- ▶ Depth
- ▶ Floating objects (boats)
- ▶ Injurious flora and fauna

▶ Witness Accounts

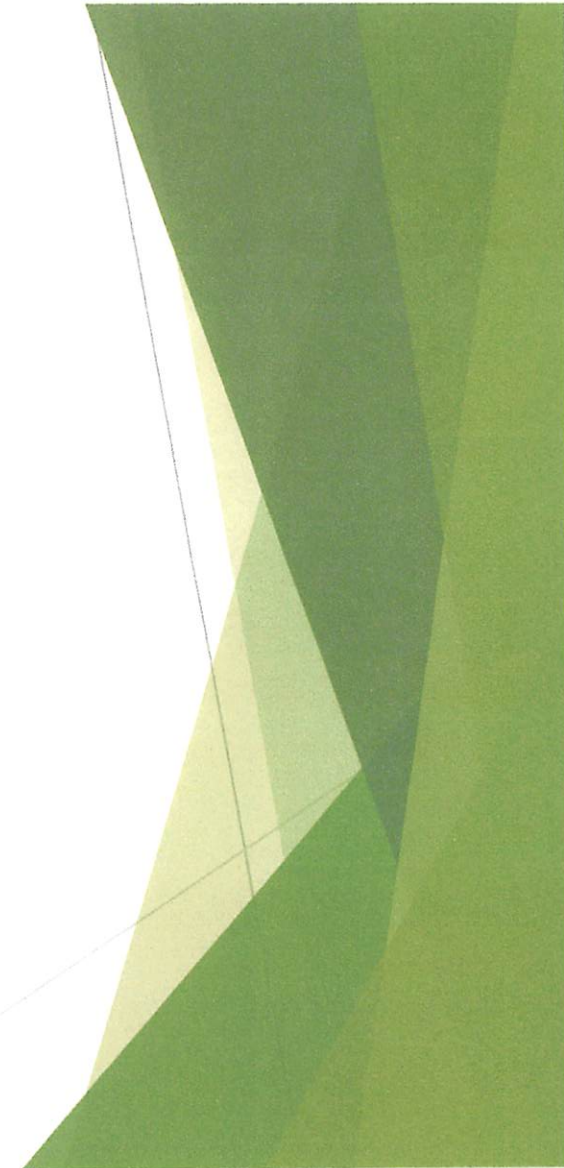
▶ Should the person be there?

- ▶ Body sinks, then floats as putrefaction occurs (may never surface if cold enough)



Drowning - Autopsy Findings

- ▶ Wrinkling of skin (hands and feet) - occurs within 30 minutes
- ▶ Rigor (longer for cold water, shorter for warm)
- ▶ Livor (may indicate floating)
- ▶ Decomposition (slower than on land until removed from water)
- ▶ Hemorrhage in mastoid sinuses
- ▶ Water in airway/lungs, stomach, sinuses of skull
 - ▶ Foam cone in oral cavity (mixing of water and air)
 - ▶ Passive movement into these areas
- ▶ Injuries - Antemortem vs. Postmortem
 - ▶ Not always easy to tell due to blood leaching



Drowning - Diagnosis

- ▶ Drowning requires autopsy for diagnosis.
- ▶ Diagnosis of exclusion.
- ▶ Drowning “trumps” natural disease unless there was no submersion before death.
- ▶ Investigation is as important as autopsy findings!



Questions??

