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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
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Testimony of
WILLIAM J. AILA, JR.
Chairperson

Before the House Committee on
WATER, LAND, AND OCEAN RESOURCES

Friday, February 11, 2011
9:00 AM
State Capitol, Conference Room 325

In consideration of
HOUSE BILL 578
RELATING TO SHARK FEEDING

House Bill 578 would establish specific penalties for violations of Section 188-40.6, Hawaii Revised Statutes (HRS) relating to shark feeding. The Department of Land and Natural Resources feels that this bill is not necessary.

General administrative penalties as provided in Section 187A-12.5, HRS, would already apply and are very similar to the proposed amendments, with the exception of the seizure and forfeiture provisions. With respect to the seizure and forfeiture, the activity being prohibited does not involve fishing; therefore seizure and forfeiture should not include items such as commercial marine license and fishing equipment.

Thank you for this opportunity to provide testimony.

har3 - Megan

From: safewatersforhawaii [safewatersforhawaii@gmail.com]
Sent: Thursday, February 10, 2011 8:32 AM
To: WLOtestimony
Cc: Rep. Sharon Har; Rep. Jerry Chang; Rep. Rida Cabanilla; Rep. Mele Carroll; Rep. Pono Chong; Rep. Denny Coffman; Rep. Robert Herkes; Rep. Ken Ito; Rep. Hermina Morita; Rep. Mark Nakashima; Rep. Gil Riviere; Rep. Cynthia Thielen
Subject: STRONG SUPPORT OF HB 573 Regarding Illegal Shark Feeding - 2.11.09 - Friday 9am House Conference Room 325

HB 573 WLO on Friday, 02-11-11 9:00AM in House Conference room 325

Aloha to the House Water, Land & Ocean Resources Committee,
Chair Rep. Chang and Vice-Chair Rep. Har,

Safe Waters for Hawai'i is a grass roots community movement representing thousands and thousands of people across the
State of Hawai'i from a wide variety of ocean activity organizations, to environmental groups, to hula halau, to trustees for the Office of Hawaiian Affairs and
former Governor Ben Cayetano (please see list below). All want the practice of illegal shark feeding to end in the ocean waters of Hawai'i.

HB 573 addresses the increase of penalties and fines for those illegally feeding sharks for commercial activities. It is an easy
bill to support, we can't see why anyone would not support the bill. Commercial shark tour operators on O'ahu say they are not illegally feeding sharks
so we don't see why they, or anyone else, would disagree with having 573 passed. HB 573 will help dissuade illegal shark feeding throughout
all State waters of Hawai'i.

The issue of illegal shark feeding for commercial activities stretches beyond the North Shore of O'ahu and affects all of us in the State of Hawai'i
where all tour ventures must comply with the state law which clearly states it is illegal to feed sharks for commercial activities.

Fines, penalties and enforcement need to be increased dramatically to reflect the serious negative implications illegal shark feeding has
on our ocean community and ocean ecosystem in Hawai'i. By increasing the fines and penalties, clearly stated in HB 573, it will deter
illegal shark feeding in the state waters of Hawai'i.

We ask for your support of HB 573. Please listen to the voices of thousands and thousand of people who want the serious offense of
illegal shark feeding to end in our ocean waters.

Mahalo,
Safe Waters for Hawai'i

www.safewatersforhawaii.com

Safe Waters for Hawai'i

Community Organizations & Individuals who have joined with the efforts of Safe Waters for Hawai'i

Ka Iwi Coalition
Save our Surf
Native Hawaiian Legal Corporation
Na Wahine O Ke Kai, Womens Moloka'i to O'ahu Canoe Race Commission
Livable Hawai'i Kai Hui
Hawai`i State Bodysurfing Association
Hui O He'e Nalu, Da Hui, North Shore
Malama Maunalua
Hawai'i Kai Boating Club
Halau No'eau Kahelemauna
Kulana Huli Honua
Betty Kanuha Foundation, Hawai'i
Waikiki Swim Club
Maui Sierra Club
Halau Hula O Na Lei Mokihana
North Shore Canoe Club
Manu o ke Kai Canoe Club North Shore
Hawaiian Canoe Club, Maui
Kihei Canoe Club, Maui
Anuenue Canoe Club
Waikiki Beach Boys Canoe Club
Hui Nalu Canoe Club
Kamehameha Canoe Club
Kumulokahi Canoe Club
Koa Kai Canoe Club
Waimanalo Canoe Club
Windward Canoe Club
Kailua Canoe Club
Kawaikini Canoe Club, Kaua'i
North Shore Renegades Canoe Club, Maui
Halau Hula Namakahonuakapiliwale
Hawai'i Military Surfing Organization
Surfrider Foundation, O'ahu Chapter
Hawai'i Kai Neighborhood Board
Kuli'ou'ou Kalani-Iki Neighborhood Board
The Waimanalo Neighborhood Board
Windward Ahupua'a Alliance
The Waimanalo Construction Coalition
'O Hina I Ka Malama Hawaiian Immersion Moloka'i High School
Kuhai Halau O Kahealani Pa Olapa Kahiko
Hawaiian-Pipeline.com
Makana Aloha Group, California
Oswald Stender, Trustee Office of Hawaiian Affairs
Walter Heen, Trustee Office of Hawaiian Affairs
Dr. Carlos Andrade, Director Center for Hawaiian Studies UH Manoa
Ben Cayetano, Former Governor of the State of Hawai'i
(in 2002 Governor Cayetano signed the law prohibiting
feeding sharks in State Waters)
Pelagic Shark Research Foundation, Santa Cruz, California
The Humane Society of the United States

har3 - Megan

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 10, 2011 10:24 AM
To: WLOtestimony
Cc: hlgwsf@gmail.com
Subject: Testimony for HB578 on 2/11/2011 9:00:00 AM
Attachments: T0 The House of Representatives.doc

Testimony for WLO 2/11/2011 9:00:00 AM HB578

Conference room: 325
Testifier position: oppose
Testifier will be present: No
Submitted by: Jeff Roberts
Organization: Hawaiis Liifeguard & Water Safety Fund
Address: Guadalcanal Circle Kapolei Hi.
Phone: 808-888-0188
E-mail: hlgwsf@gmail.com
Submitted on: 2/10/2011

Comments:
I support this operation,North Shore Shark Tours. Have we forgotten the recent U.H. studies concerning the negative complaints and showing, the tour does not bring danger closer to our shores.

TO THE

COMMITTEE ON WATER, LAND, AGRICULTURE, AND OCEAN RESOURCES

HOUSE OF REPRESENTATIVES

THE TWENTY-SIXTH STATE LEGISLATURE

REGULAR SESSION OF 2011

TO THE

COMMITTEE ON WATER, LAND, AGRICULTURE, AND OCEAN RESOURCES

HOUSE OF REPRESENTATIVES

THE TWENTY-SIXTH STATE LEGISLATURE

REGULAR SESSION OF 2011

TESTIMONY IN OPPOSITION TO HB 578 – RELATING TO SHARK FEEDING

THE HONORABLE JERRY. L. CHANG, CHAIR,

AND MEMBERS OF THE COMMITTEE:

My name is *Jeff Roberts*, and I amThe *Director of a local water safety non profit HLWSF.* I strongly oppose HB 578. The penalties proposed in this bill are excessive, onerous, uncalled for and unnecessary. The logical reason penalty provisions should be increased is because they are not successfully detouring the illegal action. However there

has not been a single shark feeding conviction in the state of Hawaii. Furthermore, the punishment does not fit the infraction and might be likened to seizing your automobile and drivers license and charging you $15,000 for speeding.

HRS 188-40.6 falls under fishing rights and regulations. I believe the intent of the law is to protect the safety of ocean users. The underlying supposition is that feeding sharks too close to shore will increase the shark concentration near shore and therefore lead to more encounters with sharks and possibly attacks on ocean users. There is no evidence that the sharks species predominantly observed on the shark viewing tours (Galapagos and Sandbar sharks) have been identified near shore.

As the law stands, it is perfectly legal to chum or feed in waters as much as you want, directly off Waikiki, Haliewa or anywhere else within state waters, with the intent to fish for and "take" a shark. I presume this would usually lead to killing that shark. I don't comprehend how feeding for the purpose of taking a shark poses any less risk to the safety of ocean users. There are many other activities which bring sharks closer to shore and possibly affect the safety of ocean users such as the moi fish farms, the Waikiki night shark fishing tours, fisherman cleaning their catch in harbors or just outside, etc. None of these activities are regulated.

The original and unspoken intent of HRS 188-40.6 is to restrict shark cage viewing tours from operating in state water. Shark cage viewing tours do operate outside of the state water demarcation. I am sure the committee is aware of the current public controversy over these tours. In fact, the situation has recently gotten out of control and anti-shark tour extremists have resorted to committing arson on two shark tour boats. This is a felony crime. I believe there is no real need for this proposed legislation HB 578 and it only supports the anti shark-tour extremists incorrect position, which is not founded upon any empirical evidence that the shark cage viewing tours do any harm to ocean public safety or the environment. Furthermore, the shark cage viewing tours are a viable eco-friendly, educational and safe tour which provides local employment opportunities, tax income to the state, and patronage to the local business community. Passing this provision unjustifiably and discriminatorily targets a viable and legally operating business.

I respectfully strongly oppose HB 578

Thank you,
For letting me aloowing me to testify

BEFORE THE
HOUSE COMMITTEE ON
WATER, LAND AND OCEAN RESOURCES

Representative Jerry Chang, Chair
Representative Sharon Har, Vice Chair

HB 578 RELATING TO SHARK FEEDING

TESTIMONY OF
THOMAS BUSH, ESQ.
Alston Hunt Floyd & Ing

State Capitol, Room 325
Friday, February 11, 2011, 9:00 am

Chair Chang and members of the Committee:

My name is Tom Bush, and I represent North Shore Shark Adventures (NSSA). NSSA is a locally-owned ecotourism company that enables residents and tourists alike to observe sharks in their native environment. NSSA is **STRONGLY OPPOSED** to HB578.

In the eleven years that NSSA has been in operation, it has taken over 600,000 people on its shark tours. They have safely taken people of all ages, from a ninety-two year old gentleman celebrating his birthday, to three-year olds; as well as persons with special needs, including children suffering from autism or quadriplegics. NSSA uses the tours to educate its guests on the sharks and other marine live viewed. NSSA has never had any incidents or attacks involving the sharks. Their safety record is perfect.

We recognize that some have expressed a negative perception of the shark tours. This is extremely unfortunate and is not based on facts. It is perceived by some that shark tours draw sharks inland, causing increased shark attacks to surfers and ocean users; and so ultimately threaten the health and safety of Hawaii residents. These perceptions are false and unsubstantiated. **We ask this Committee look to scientific evidence and studies as a key factor in its decision-making on this bill.**

In 2009, scholars from the University of Hawaii (Hawaii Marine Biology Institute and the Department of Zoology) and the Center for Shark Research in Florida published a peer-reviewed scientific study of NSSA and Hawaii Shark Encounters (HSE) activities to specifically analyze the shark ecology and ecotourism impacts on the general public.[1] Its detailed findings, comprising of data and research conducted between 2004 and 2008, concluded that shark tours have a "negligible impact on public safety". See attachment. In particular, the study stated the following:

[1] NSSA and HSE are the only two shark tour / cage-diving operators currently existing in Hawaii.

- There is negligible impact on the public safety resulting from shark tours due to the remoteness of the sites;
- There is no increase in shark attacks on the North Coast of Oahu since shark cage diving began;
- The shark tours mimic activities of crab fishing vessels which have operated in the area without incident for over 40 years;
- Over 98% of sharks attracted by cage diving are Galapagos and sandbar sharks, which rarely bite people;
- Other potentially dangerous species of sharks (tiger shark, hammerhead, or white shark) occasionally visit Hawaii shark cage diving sites, but there is no evidence that the rate of shark attacks along the adjacent coast has increased significantly since the advent of shark cage diving operations in 2001.[2]

The UH Hawaii Institute of Marine Biology continues to conduct shark monitoring studies at the dive sites where the NSSA operates. To my understanding, all evidence confirms that the shark tours have not led or caused the sharks in that habitat to travel into inshore areas used for in-water recreation. There is no evidence of shark attacks connected with the shark tour in its 11 years of operation or any heightened danger to the public as a result of the tours. In short, the shark tours, as presently operating, are safe to both the public and the sharks.

This bill is a flawed because it seeks to punish what has developed into a scientific and educational enterprise for which there no proof of any harm to either human or shark. It creates draconian and unconstitutional remedies to punish the two shark tour operators on the North Shore unless they modify their tours to provide for the killing of sharks. Under current Hawaii law, "shark feeding" within state marine waters is considered illegal unless the sharks are killed. In other words, a tour can be conducted pretty much anywhere in Hawai`i waters with as much chumming as the tour operator wants, as long as the tour aims to catch and kill sharks ("harvesting" the sharks is the euphemism used). This, in fact, is being done by others right along Oahu's South Shore.

If this measure is enacted, it would encourage the very behavior it presumably is intended to discourage. To protect their businesses, boats and other equipment from seizure because of "chumming" allegations, tour operators would be encouraged to change their focus from education of the public to mounting a shark-killing tour, in which case there would be no restrictions on where the tours would operate or what amount of chumming would be allowed.

It should be noted that NSSA enjoys staunch community support and directly brings much business to the town of Haleiwa because their boats are located in Haleiwa harbor so our customers must travel there for the tours. Its beneficial effects are felt further throughout Hawaii

[2] Carl G. Meyer, Jonathan J. Dale, Yannis P. Papastamatiou, Nichlas M. Whitney, and Kim N. Holland, Seasonal Cycles and Long-term Trends in Abundance and Species Composition of Sharks Associated with Cage Diving Ecotourism Activities in Hawaii, Environmental Conservation, p. 1 to 8 (April 23, 2009).

as North Shore Shark Adventures provides a promotional activity for top tour companies in Hawaii and on the mainland, including JTB Hawaii, JALPAC Hawaii, American Express Travel, Expedia, and the MWR offices on every Military Base on Oahu. The company is also promoted by a number of Hotels including the Kahala Mandarin, Halekulani, all the Sheraton Hotels, and the Ihilani Hotel.

As you consider this bill, please realize that: (1) the North Shore shark tours have operated for 11 years without any safety incident of any kind, (2) the scientific studies support that the tours pose a negligible public risk and the tours provide additional opportunity for scientific study, (3) the tours are educational in a way that poses no threat to humans or sharks, (4) the tour has had beneficial economic effects to the Haleiwa community and to our entire State, and (5) the bill's passage would only encourage the killing of sharks that pose no threat to humans.

On behalf of North Shore Shark Adventures, we respectfully request that you vote against the passage of this bill. Thank you for the opportunity to testify on this matter.

Environmental Conservation: page 1 of 8 © 2009 Foundation for Environmental Conservation doi:10.1017/S0376892909990038

Seasonal cycles and long-term trends in abundance and species composition of sharks associated with cage diving ecotourism activities in Hawaii

CARL G. MEYER[1]*, JONATHAN J. DALE[1,2], YANNIS P. PAPASTAMATIOU[1], NICHOLAS M. WHITNEY[3] AND KIM N. HOLLAND[1]

[1]*Hawaii Institute of Marine Biology, University of Hawaii at Manoa, PO Box 1346, Coconut Island, Kaneohe, HI 96744, USA,* [2]*Department of Zoology, Edmonson Hall, University of Hawaii at Manoa, Honolulu, Hawaii 98822, USA and* [3]*Center for Shark Research, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, Florida 34236, USA*

Date submitted: 14 October 2008; Date accepted: 23 April 2009

SUMMARY

Shark cage diving is both popular and controversial, with proponents citing educational value and non-extractive use of natural resources and opponents raising concerns about public safety and ecological impacts. Logbook data collected 2004–2008 from two Oahu (Hawaii) shark cage diving operations were analysed to determine whether such voluntary records provide useful insights into shark ecology or ecotourism impacts. Operators correctly identified common shark species and documented gross seasonal cycles and long-term trends in abundance of Galapagos (*Carcharhinus galapagensis*), sandbar (*Carcharhinus plumbeus*) and tiger sharks (*Galeorcerdo cuvier*). Annual cycles in shark abundance may indicate seasonal migrations, whereas long-term trends suggest gradual exclusion of smaller sandbar sharks from cage diving sites. Numerically dominant (> 98%) Galapagos and sandbar sharks are rarely implicated in attacks on humans. Negligible impact on public safety is supported by other factors such as: (1) remoteness of the sites, (2) conditioning stimuli that are specific to the tour operations and different from inshore recreational stimuli and (3) no increase in shark attacks on the north coast of Oahu since cage diving started. Tracking studies are required to validate logbook data and to determine whether sharks associated with offshore cage diving travel into inshore areas used for in-water recreation.

Keywords: cage diving, Galapagos shark, Hawaii, sandbar shark, shark ecotourism

INTRODUCTION

With an estimated 38 million sharks harvested each year there is concern that some shark populations have been seriously depleted or extirpated (Clarke *et al.* 2006). Wholesale removal of these top predators may also lead to trophic cascades and phase shifts in marine ecosystems (Stevens *et al.* 2000; Bascompte *et al.* 2005; Myers *et al.* 2007). There is an urgent need for management strategies that promote sustainable use of sharks (Topelko & Dearden 2005; Clarke *et al.* 2006). One possible strategy for reducing the harvest of vulnerable populations is to use ecotourism (i.e. 'shark watching') to generate revenue from live sharks (Topelko & Dearden 2005; Johnson & Kock 2006; Laroche *et al.* 2007). Ecotourism already provides substantial economic incentives for non-extractive use of other marine and terrestrial megafauna (for example whale watching tours and African safari parks), and recent decades have seen shark ecotourism grow in popularity (Orams 2000; Hoyt 2001; Akama & Kieti 2003; Topelko & Dearden 2005; Johnson & Kock 2006).

Shark ecotourism is an umbrella term that covers a broad spectrum of activities ranging from passive observation at locations where sharks are naturally abundant, to contrived events such as attracting and hand feeding sharks (Burgess 1998; Topelko & Dearden 2005; Johnson & Kock 2006; Laroche *et al.* 2007). Cage diving, which typically uses provisioning (such as chumming with fish scraps) to attract sharks to cages containing snorkellers or scuba divers, is one such activity that has already proven both popular and controversial (Bruce 1995; Johnson & Kock 2006). For example, in Gansbaai (South Africa), over 20 000 shark divers directly contribute an estimated US$ 1.6 million annually to the local village economy (Topelko & Dearden 2005). Cage diving proponents argue that such activities provide the public with opportunities to safely view sharks in their natural environment, and that this helps to demystify these frequently vilified predators (Topelko & Dearden 2005). Opponents counter that the provisioning associated with cage operations increases the risk of shark attacks on recreational ocean users in adjacent areas, and also disrupts the natural ecology of these large predators (Topelko & Dearden 2005; Johnson & Kock 2006; Laroche *et al.* 2007). Concerns over potential negative impacts of provisioning have resulted in regulatory responses ranging from the licensing of shark cage diving operators in Australia and South Africa, to legislative bans on shark feeding in state (Florida and Hawaii) and federal waters of the USA (Carwardine & Watterson 2002; Topelko & Dearden 2005; Johnson & Kock 2006). These legislative actions against shark

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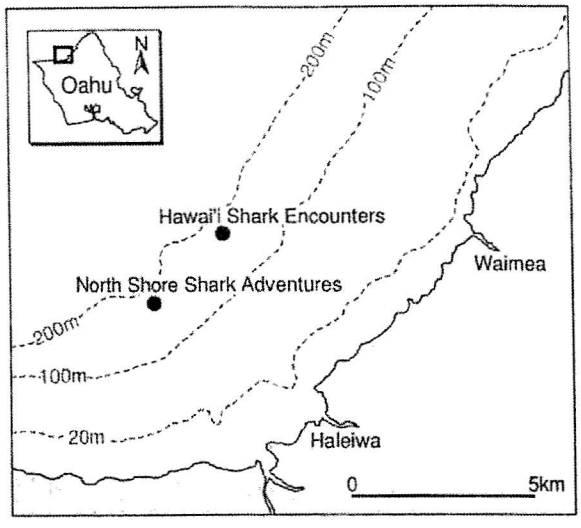

Figure 1 Location of shark tour operations (solid points) off the north coast of Oahu (Hawaiian Islands, USA). Inset shows area of detail on Oahu.

ecotourism have been taken even though local fisheries already provision shark populations with discard and waste produce without necessarily increasing the risk of shark attack.

In Hawaii, commercial shark cage diving activities are a relatively recent phenomenon with two commercial companies establishing operations off the north coast of Oahu in 2001 (North Shore Shark Adventures [NSSA]) and 2004 (Hawaii Shark Encounters [HSE]). These activities have capitalized on a pre-existing phenomenon of sharks congregating around crab fishing boats to feed on bait discarded from traps (J. Pavsek, personal communication 2007). A small commercial crab fishery, targeting *Portunus sanguinolentus*, started off the north coast of Oahu in the 1960s and, within five years, sharks were regular visitors to crab boats operating traps in depths of 60 to 120 m (J. Pavsek, personal communication 2007). The current shark cage diving activities take place 4.8 km offshore (beyond Hawaii state waters) in depths of 140 m (Fig. 1), and mimic the general characteristics of crab fishing activities (i.e. a 10 m diesel powered vessel ties up to a mooring line and dispenses fish scraps). As has been the case in other geographic locations (for example see Bruce 1995), Hawaii commercial shark tourism cage diving operations are a source of controversy and speculation, fuelled by a lack of empirical data on which to base objective assessments of risk and ecological impact.

One potential source of useful empirical information is voluntary logbook records kept by cage diving operators of the numbers and species of sharks observed on each tour (see Bruce 1995; Malcolm *et al.* 2001; Theberge & Dearden 2006). In Hawaii, these records represent a considerable sampling effort with multiple (up to six) daily counts conducted by each operator on most days of the year. Such logbooks may contain information useful for evaluating the ecological impact of cage diving activities and assessing how shark populations are changing over time. For example, logbooks could provide baseline information on species composition and relative abundances of sharks associated with cage diving activities, as well as yield insights into seasonal cycles and longitudinal changes in shark numbers (see Malcolm *et al.* 2001; Theberge & Dearden 2006). However, these records are not collected by trained observers, hence it is important to account for potential observer bias when analysing data and interpreting results (Malcolm *et al.* 2001; Theberge & Dearden 2006). This situation is analogous to using logbook data from commercial fishers to make inferences about fishing practices and fish stocks (Walsh *et al.* 2002). Such non-scientific data sources can provide useful insights as long as biases in the relationship between logbook data and actual values are understood and accounted for (Walsh *et al.* 2002).

In the present study, we evaluated 2004–2008 logbook data from Hawaii commercial shark cage diving operations to determine whether such records can provide useful insights into the status of coastal shark populations and the public safety implications of shark ecotourism. Our specific objectives included: (1) characterizing observer bias and determining how this influenced precision and accuracy of logbook records, (2) obtaining basic information on species composition and abundance of sharks associated with commercial tours, (3) identifying temporal patterns in shark abundance and species composition, and (4) evaluating tour impacts by comparing observed patterns with what is known about shark natural ecology in Hawaii.

METHODS

Shark cage diving operations and data collection

Shark cage diving activities are conducted at sites located 4.8 km (3 miles) offshore from Haleiwa on the north coast of Oahu (Hawaiian Islands, USA) (Fig. 1). Two commercial companies (HSE and NSSA) use sites 3.4 km apart in water depths of 140 m. Each operator conducts up to six tours daily at 1–2 h intervals beginning at 07:00. Cage diving is conducted from 10 m vessels that shuttle snorkellers out to the tour sites. The vessels attach to an offshore mooring on 85% of trips and drift in the vicinity of the mooring on the remaining 15%. Sharks typically appear soon after the vessel arrives, apparently initially attracted by the vessel engine noise. A floating cage is deployed behind the boat, snorkellers enter the cage and a small amount of bait (fish scraps) is used to keep sharks close to the cage for easy viewing and photography (Appendix 1, see Supplementary material at URL http://www.ncl.ac.uk/icef/EC_Supplement.htm). Shark counts are conducted by the boat captain operating the tour (multiple captains work for each company). Counting protocols are consistent between companies and individual captains. Counts are made from the back deck by visually estimating numbers and species of sharks seen at or close to the surface around the

cages (Appendix 1, see Supplementary material at URL http://www.ncl.ac.uk/icef/EC_Supplement.htm). Counts are conducted as rapid scans of the visual field around the cage thus minimizing the chances of counting the same individual sharks repeatedly. Several such counts are conducted during each 1 h tour, with the single highest count being recorded.

Data validation and analyses

To rule out any systematic species misidentification or large-scale exclusion of unreported species, we used a 40 slide photo-identification test to quantify the ability of each tour captain to accurately identify coastal shark species found in Hawaii. The test consisted of two components: (1) 20 photographs taken at the cage diving sites featuring the three most common shark species (Galapagos, sandbar and tiger) at these locations, and (2) 20 photographs from other locations featuring the above species plus grey reef sharks (*Carcharhinus amblyrhynchos*), blacktip reef sharks (*Carcharhinus melanopterus*), whitetip reef sharks (*Triaenodon obesus*) and a great white shark (*Carcharodon carcharias*). Photographs included dorsal views of sharks taken from above the surface and underwater images of the dorsal, ventral, side and frontal views of the subject shark(s). The test was designed to specifically evaluate the ability of tour captains to (1) accurately identify the numerically dominant species at tour sites, and (2) identify (or at least recognize as different species) other coastal sharks. Prior to individually taking the test, captains were told only that the photographs were of sharks found in Hawaiian waters. We used a two-way ANOVA with replication to compare mean scores between companies and different sections of the test.

We also visited the cage diving sites, where we observed and captured sharks associated with cage diving to confirm the reported species composition. Thirty-six sharks (25 Galapagos, 10 sandbar and one tiger) were captured by handlining after the operators first visually identified them to species level while the animals were swimming around the boat. As no independent observer data were available with which to assess the accuracy of the reported shark counts, we used frequency histograms to detect bias in count precision (such as a tendency to record 10 sharks when there may have been 9 or 11, or to record values in multiples of 5 more frequently than consecutive integers). Histograms were generated for each of the two most common shark species reported by each operator.

We evaluated possible confounding effects of the close proximity (3.4 km apart) of the two cage diving sites on shark counts by comparing the mean counts obtained at each site when both companies were simultaneously conducting tours, with mean counts obtained when only one of the two companies was present. The assumption was that if the proximity of the two cage diving sites resulted in competition for a limited pool of sharks, then mean counts would be significantly higher when only one operator was present. A general linear model was used to compare the mean shark counts obtained on 09:00 hour tours with either one or both companies operating. Variability due to month and year was accounted for in the model.

We evaluated differences in Galapagos, sandbar and tiger shark abundances between the two sites by using two sample t-tests to compare square root transformed monthly mean counts from each company. To ensure equal sample sizes, only months for which both companies had logbook data were included in the analysis. The veracity of logbook records was further examined by using regression analyses to compare the mean monthly counts of sandbar and Galapagos sharks recorded by each of the two tour operators. We assumed that two companies operating so close together should record significantly similar gross patterns of shark abundance even if absolute abundances varied between sites. Regression analyses were also used to examine the relationship between abundances of sandbar and Galapagos sharks (mean monthly counts) for each tour operator, and to evaluate long-term trends in shark abundance at the cage-diving sites.

One of the assumptions of ordinary least squares regression, including general linear models, is independence of the error terms. However, with time series data, residuals from regression models are often correlated over time. Autocorrelation in the residuals increases the chance of statistically significant but spurious relationships (Type I error rates will be greater than the specified alpha; Pyper & Peterman 1998), thus we tested for autocorrelation in the residuals from all regression models using the Durbin-Watson statistic (Durbin & Watson 1951). When the statistic indicated significant autocorrelation, the data were first-differenced to account for the autocorrelation (Thompson & Page 1989). Count data were square root transformed prior to analysis in order to meet requirements for parametric testing

RESULTS

Observer bias

Captains ($n = 5$ per company) successfully identified sharks in 90–100% (mean score = 96%) of the 20 photographs featured in part 1 (images of Galapagos, sandbar and tiger sharks from cage diving sites) of the species identification test. They scored 60–95% (mean score = 76%) on part 2 of the test (wider variety of shark species pictured in reef and open water environments), with grey reef sharks being the most commonly misidentified species. A two-way ANOVA with replication indicated no significant difference in test scores between companies ($F = 1.02$, $df = 1$, $p = 0.33$), but significantly higher test scores on part 1 of the test than part 2 ($F = 23.1$, $df = 1$, $p < 0.001$).

Our direct observations, together with 53 underwater photographs taken at the cage diving sites over five years, confirmed that the species being viewed were predominantly Galapagos (*Carcharhinus galapagensis*) and sandbar (*Carcharhinus plumbeus*) sharks, and that there was no evidence of other misidentified carcharhinids. The frequency of shark numbers reported for the two main species showed

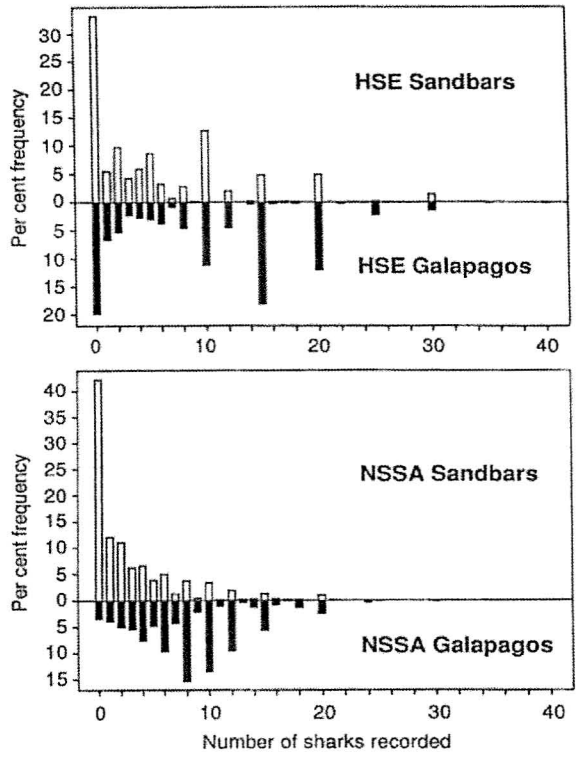

Figure 2 Frequency histograms of shark counts reported for Galapagos (black bars) and sandbar sharks (unshaded bars) at cage diving sites operated off the north coast of Oahu (Hawaii, USA) by Hawaii Shark Encounters (HSE, top) and North Shore Shark Adventures (NSSA, bottom).

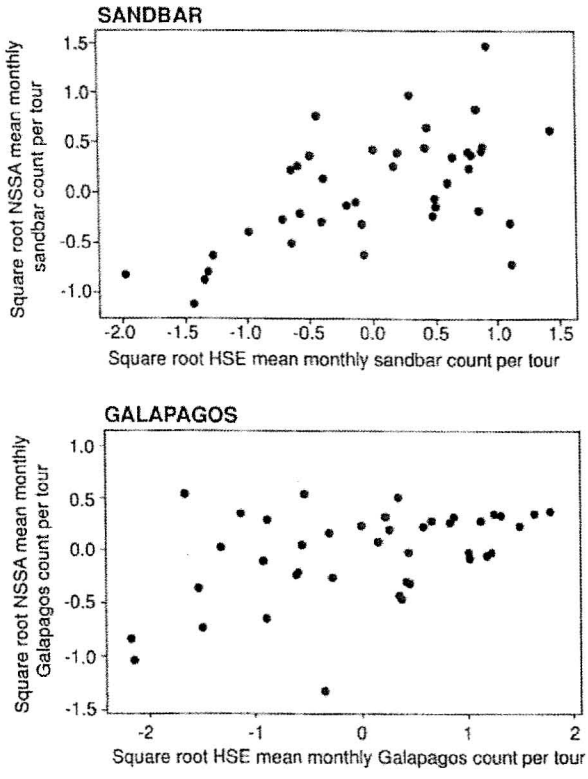

Figure 3 Regression analyses comparing the mean monthly counts of sandbar (top) and Galapagos (bottom) sharks recorded by each of the two tour operators (Hawaii Shark Encounters [HSE] and North Shore Shark Adventures [NSSA]). Data were square root transformed prior to analysis.

signs of rounding bias. Specifically, for counts of >4 sharks there was a tendency for even numbers to be reported more frequently than odd numbers, and for counts ≥12 sharks there was a tendency for numbers in multiples of five (i.e. 15, 20, 25, 30) to be reported at much higher frequencies than other consecutive integers (Fig. 2). There were positive linear relationships between the mean monthly counts of sandbar and Galapagos sharks conducted independently by the two Hawaii cage diving companies (Fig. 3; sandbar: sqrt NSSA sandbar = 0.29 + 0.40 sqrt HSE sandbar, $R^2_{adj} = 0.33$, $p < 0.001$; Galapagos: sqrt NSSA galapagos = −0.29 + 0.19 sqrt HSE galapagos, $R^2_{adj} = 0.19$, $p < 0.003$).

Species composition, abundance and size

Collectively, the two operators conducted 8495 counts (1 count per tour) on 1545 days during the period from January 2004 to August 2008 (Table 1). The total number of sharks counted on each tour ranged from 0 to 46 (median 12 sharks per tour). There were no significant differences between mean counts obtained when only one company was on site and counts taken when both companies were operating simultaneously. Galapagos and sandbar sharks were the numerically dominant species at cage diving sites, respectively accounting for 74.6% and 23.6% (HSE and NSSA combined) of all sharks observed (Table 1). The median number of Galapagos sharks counted on each tour (10) was higher than the median number of sandbars (1). Other shark species were occasionally present, including tiger sharks (*Galeocerdo cuvier*, 1.8%), hammerheads (*Sphyrna* spp., < 0.1%), whale sharks (*Rhincodon typus*, < 0.1%) and a single white shark (*Carcharodon carcharias*, < 0.1%) (Table 1). There were significant differences in sandbar and tiger shark counts between the two cage diving sites only 3.4 km apart, with HSE recording higher numbers of these species than NSSA (sandbar t = 3.48, df = 76, $p = 0.001$: tiger t = 5.72, df = 52, $p < 0.001$). Mean Galapagos shark counts did not differ significantly between the two companies (t = −0.45, df = 60, $p = 0.656$).

A total of 10 sandbar sharks (all male), 25 galapagos sharks (17 male, 8 female) and one tiger shark were captured and measured at the cage diving sites. Sandbar shark size was in the range 159–184 cm total length (TL) and all individuals had calcified claspers. Female Galapagos sharks were 197–273 cm TL and male Galapagos sharks 185–286 cm TL. Twelve of 17

Table 1 Summary of data collected by commercial shark cage diving operators (Hawaii Shark Encounters [HSE] and North Shore Shark Adventures [NSSA]) from 2004–2008. Shark numbers indicate the sum of all sharks documented by tour counts (one count recorded per tour). * Other species include hammerhead, white and whale sharks. The values in parentheses are percentages.

Operator	*Counts*	*Galapagos*	*Sandbar*	*Tiger*	*Other**	*All sharks*
HSE	4152	39 080 (67.2)	17 145 (29.5)	1918 (3.3)	45 (0.1)	58 188
NSSA	4343	42 831 (82.9)	8748 (16.9)	61 (0.1)	5 (< 0.1)	51 646
Total	8495	81 912 (74.6)	25 893 (23.6)	1979 (1.8)	50 (< 0.1)	109 834

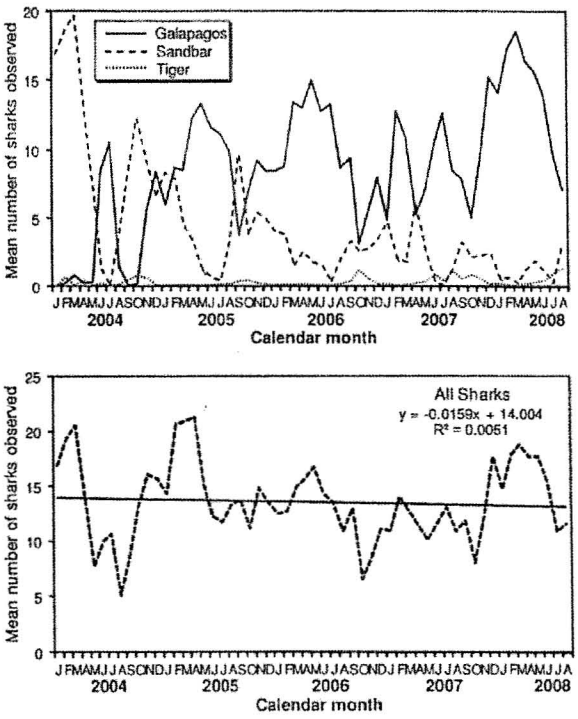

Figure 4 Variation in monthly abundance (mean number of sharks per tour) of Galapagos (solid line), sandbar (dashed line) and tiger sharks (dotted line) at cage diving sites operated off the north coast of Oahu (Hawaii).

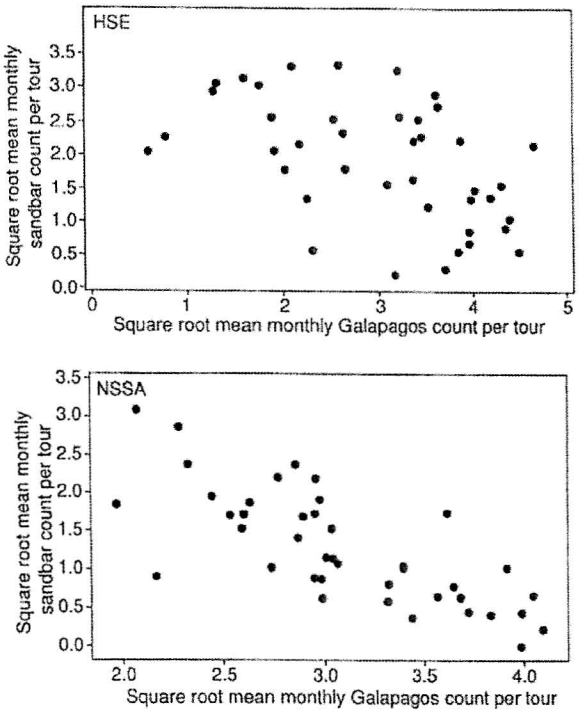

Figure 5 Regression analyses of relationships between abundances of Galapagos and sandbar sharks documented by Hawaii Shark Encounters (HSE, top) and North Shore Shark Adventures (NSSA, bottom). Data used in regression models were mean monthly counts, square root transformed prior to analysis.

male Galapagos sharks had calcified claspers. The single male tiger shark captured (300 cm TL) had calcified claspers.

Temporal patterns in species composition and abundance

Galapagos, sandbar and tiger sharks exhibited both seasonal cycles and long-term trends in abundance at cage diving sites. Seasonal cycles of Galapagos and sandbar shark abundance were phase shifted with respect to one another, with peak abundances of sandbar sharks coinciding with lowest abundances of Galapagos sharks and vice versa (Fig. 4). Galapagos shark abundance typically peaked during spring and summer, and declined sharply during September and October, whereas sandbar sharks were least abundant during spring and summer, and most abundant during autumn (Fig. 4). Regression indicated mean monthly counts bore inverse relationships between HSE (sqrt sandbar = 3.12 – 0.41 sqrt galapagos, $R^2_{adj} = 0.22$, $p < 0.001$) and NSSA (sqrt sandbar = 4.26 – 0.96 sqrt galapagos, $R^2_{adj} = 0.55$, $p < 0.001$) Galapagos and sandbar sharks (Fig. 5). The regression models accounted for 22% (HSE) and 55% (NSSA) of the variation in sandbar and Galapagos shark counts (Fig. 5). Tiger shark sightings peaked during autumn and were lowest during winter and spring (Fig. 4). There was no significant long-term trend in total shark numbers (all species combined) at the cage diving sites (Fig. 4; $y = -0.0159x + 14.004$, $R^2 = 0.0051$, $p = 0.602$), but the relative abundances of the dominant species changed over time. There were long-term increases in Galapagos (Fig. 6; $y = 0.1747x + 3.787$, $R^2 = 0.35$, $p < 0.001$) and tiger shark numbers (Fig. 6; $y = 0.0056x + 0.088$, $R^2 = 0.07$,

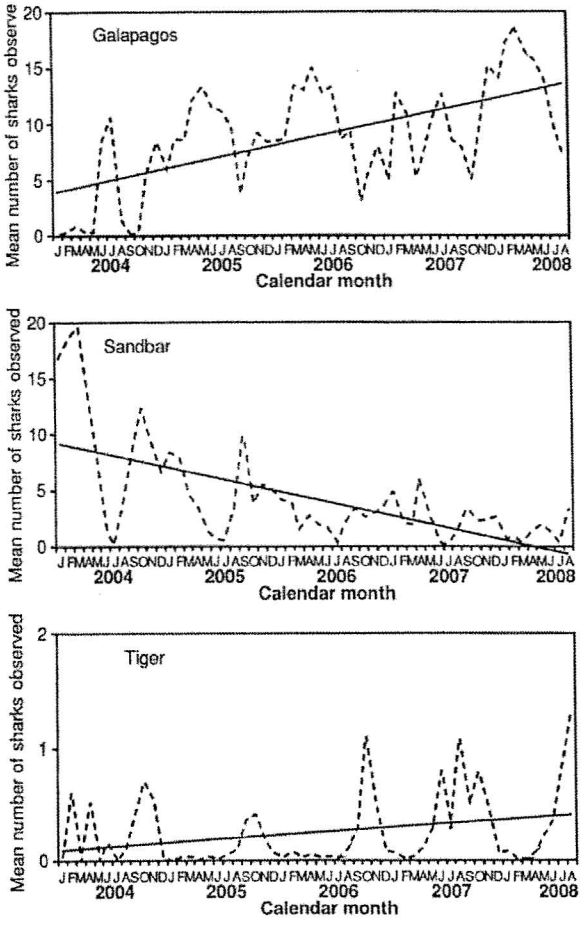

Figure 6 Trends in abundance of Galapagos, sandbar and tiger sharks at ecotourism sites off Haleiwa (Oahu, Hawaiian Islands, USA), 2004–2008.

$p = 0.033$), and significant long-term decreases in sandbar numbers at cage diving sites (Fig. 6; $y = -0.1783x + 9.2952$, $R^2 = 0.40$, $p < 0.001$).

DISCUSSION

The potential of shark watching ecotourism as a vehicle for collecting scientific data on the status of shark populations has been recognized by researchers in several countries (Bruce 1995; Malcolm *et al.* 2001; Theberge & Dearden 2006). Two primary concerns with the accuracy of data are: (1) correct identification of shark species, and (2) consistent count methodology that accurately documents shark abundance. A few shark species (such as white sharks, whale sharks and tiger sharks) are highly distinctive, but most carcharhinids are rather similar in appearance (see Castro 1983; Compagno 1984; Compagno *et al.* 2005). When viewed from above however, there are distinct differences in colouration between sandbar and Galapagos sharks (sandbars are lighter in colour, see Supplementary material at URL http://www.ncl.ac.uk/icef/EC_Supplement.htm) that make these two species relatively easy to distinguish from one another. Personnel counting sharks at Hawaii cage diving sites correctly identified photographs of the numerically dominant species (Galapagos, sandbar and tiger sharks) 96% of the time, indicating that experienced lay observers can reliably identify sharks in familiar settings. Although some boat captains misidentified photographs of grey reef sharks during testing, this species is very rare around Oahu, with no individuals caught during fishing efforts in the 1960s and 1970s despite using over 12 000 hooks (Wass 1971; Papastamatiou *et al.* 2006).

Ecotourism operations such as those in Hawaii, that routinely observe multiple sharks, may not yield precise counts but could still provide useful information on gross seasonal or long-term trends in shark abundance and distribution. For example, seasonal cycles in shark abundance observed at Hawaii cage diving sites from 2004 to 2008 indicate that current cage diving activities are not permanently entraining sharks to ecotourism sites. Sharks visit these locations on a primarily seasonal basis, despite year-round availability of food. Seasonal cycles of shark abundance have also been noted from cage diving operations in both Australia and South Africa (Malcolm *et al.* 2001; Johnson & Kock 2006).

Seasonal cycles in Galapagos and sandbar shark abundance at cage diving sites match seasonal fluctuations in shark catch rates documented around Oahu during the 1960s and 1970s (Wass 1971, 1973; Wetherbee *et al.* 1996). Similar patterns in shark catch rates and ecotourism logbook records collected decades apart suggest long-term seasonal migrations, possibly related to reproduction; We observed only sexually mature male sandbar sharks at offshore cage diving sites and logbook records indicate a spring and summer decline in sandbar shark numbers at these locations. Wass (1971, 1973) examined Hawaii shark catch data and hypothesized that male sandbar sharks move into shallow water during spring and summer to mate. Our results support this hypothesis and suggest that breeding migrations may be responsible for the seasonal cycles of sandbar shark abundance at cage diving sites. The factors underlying seasonal fluctuations in Galapagos shark abundance are unclear. Both shark ecotourism counts and historical catch rates display summer peaks for Galapagos sharks, but only ecotourism data show marked autumnal dips in Galapagos abundance in successive years. These declines do not correspond with previous descriptions of the Galapagos shark reproductive cycle in Hawaii; Galapagos sharks in Hawaii are thought to mate during winter and spring, with parturition also occurring during the spring (Wetherbee *et al.* 1996). We found mature and immature Galapagos sharks of both sexes at cage diving sites, further indicating breeding migrations are an unlikely explanation for the autumnal decline in abundance.

Analyses of logbook data also revealed significant long-term trends in shark abundance at cage diving sites. In 2004–2008, Galapagos and tiger shark abundances increased,

while sandbar shark abundance decreased. Hawaii currently has no coastal fisheries either targeting sharks or with a significant shark bycatch, hence fisheries are not a likely cause of decreasing sandbar abundances or increases in abundance of the other species. The observed trends may be a localized, behaviourally-mediated phenomenon, with larger sharks (Galapagos and tiger) gradually excluding smaller sandbar sharks from the cage diving sites over time. This hypothesis is supported by a significant inverse relationship between abundance of sandbar and Galapagos sharks at cage diving sites, evident even over short (seasonal) timescales. Historical catch data also suggest that these species segregate spatially at both inter- and intra-island scales (Wetherbee *et al.* 1996; Papastamatiou *et al.* 2006). Existence of a possible dominance hierarchy among shark species using the cage diving sites complicates interpretation of long-term trends in abundance of individual shark species at these locations. The ecological significance of changing species composition at the cage dive sites is unclear, but worthy of additional study and monitoring. Overall shark abundance (all species combined) however, showed no significant long-term trends, suggesting that logbook data could still provide a fishery-independent method for detecting gross changes in shark populations, such as general depletion of coastal sharks.

Logbook records also revealed significant differences in sandbar and tiger shark abundance but no significant difference in Galapagos shark abundance between two cage diving sites only 3.4 km apart. In broad terms there are two possible explanations for these results: (1) they are artefacts of differences in tour operations or counting methods between companies, or (2) there are generally more sandbar and tiger sharks at the HSE site. We found no evidence of differences in counting methods between companies that would account for these differences. The differences in tiger shark numbers are especially unlikely to be the result of counting errors as these sharks are highly distinctive and present in numbers low enough to be counted precisely. Logbook data appear to reflect actual long-term differences in shark abundance over relatively short distances. Although sandbar and tiger sharks are known to range over much wider distances than the 3.4 km between tour sites (Conrath & Musick 2008; Meyer *et al.* 2009), previous studies have documented patchy distribution of sharks over relatively small spatial scales (Heupel *et al.* 2006; Grubbs *et al.* 2007). Although fine-scale patchiness may influence absolute counts at tour sites, our results suggest that similar gross temporal patterns of abundance and long-term trends are still evident at both of these locations.

The public safety implications of shark cage diving operations are arguably the most contentious aspect of these activities. A recent study of the white shark cage diving industry in South Africa concluded that specific conditioning associated with these activities makes them unlikely to increase the risk of shark attacks on recreational ocean users in adjacent areas (Johnson & Kock 2006). This is despite the fact that white sharks are the species most frequently implicated in shark attacks on people (430 attacks worldwide; G. Burgess, International Shark Attack File, personal communication 2007). Our study indicates that current Hawaii shark diving operations also pose little risk to public safety. The shark assemblage associated with these activities was numerically dominated (> 98%) by Galapagos and sandbar sharks, which rarely bite people. Worldwide, there have only been five confirmed unprovoked attacks attributed to sandbar sharks and only one attack attributed to a Galapagos shark (G. Burgess, International Shark Attack File, personal communication 2009). Other potentially dangerous species (tiger shark, hammerhead spp. or white shark), occasionally visit Hawaii shark cage diving sites, but there is no evidence that the rate of shark attacks along the adjacent coast has increased significantly since the advent of shark cage diving operations in 2001. There were five confirmed shark attacks along the north coast of Oahu (38 km stretch of coastline between Kaena Point and Kahuku Point) during the 1990s (Global Shark Attack File [GSAF] 2009) and five confirmed shark bites in this area between 2000 and 2008 (GSAF 2009, Hawaii Division of Aquatic Resources 2009). Negligible impact on public safety is also supported by: (1) the remoteness of the sites, (2) the fact that the shark tours mimic activities of crab fishing vessels which have been operating in the same area for over 40 years and (3) inshore recreational stimuli (such as a surfer paddling on a 3 m surfboard) substantially differ from the conditioning stimuli associated with tour operations (*c.* 10 m diesel powered vessels operating several km offshore), and hence are unlikely to stimulate a conditioned feeding response (Johnson & Kock 2006).

Overall results suggest ecotourism logbook records may provide a useful tool for monitoring shark populations and understanding ecotourism impacts. Additional research using alternative methods is required to resolve key questions. Passive monitoring of sharks implanted with acoustic transmitters could be used to validate patterns documented by ecotourism operators, to determine where sharks go during seasonal migrations, to determine the turnover rate of sharks associated with cage diving sites and to evaluate whether sharks associated with offshore cage diving travel into inshore areas used for in-water recreation. Other emergent telemetry technologies, such as stomach pH transmitters (Papastamatiou *et al.* 2008), could be used to quantify daily ration size and evaluate the impact of supplemental feeding on shark foraging behaviour.

ACKNOWLEDGEMENTS

We thank Hawaii Shark Encounters and North Shore Shark Adventures for providing their logbook records for analysis.

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har3 - Megan

From: Rep. Sharon Har
Sent: Thursday, February 10, 2011 3:17 PM
To: har3 - Megan
Subject: FW: Water, Land & Ocean Resources Committee, HB 578
Attachments: Meyer etal. study.pdf

From: Edwin Ebisui Jr. [mailto:nshore808@msn.com]
Sent: Thursday, February 10, 2011 2:02 PM
To: Rep. Jerry Chang; Rep. Sharon Har
Subject: Water, Land & Ocean Resources Committee, HB 578

Dear Chairman Chang and Committee Members:

My name is Ed Ebisui and I write this letter in support of House Bill 578.

Sec. 188-40.6, Hawaii Revised Statutes, prohibits shark feeding for commercial purposes in State waters (0-3 miles from shore). Enacted in 2002, the section provides for nominal penalties for violations: $100 for a first offense; $200 for a second offense; and $500 for a third offense. By comparison, the federal law (16 USC Sec. 1866), applicable from 3-200 miles from Hawai`i's shores, calls for penalties up to $130,000 and asset (vessel) forfeiture.

This bill does not prohibit shark tour operations; it only increases the penalties for violation of existing laws to more meaningful levels, providing deterence from law violations, fostering compliance with the law and assisting law enforcement. It is interesting that the shark tour operators, who for years have consistently denied feeding the sharks, are so threatened by this bill; they only have a problem if they are continuing to feed the sharks.

That feeding wild animals, especially large predators, is detrimental to humans, the animals themselves and the environment cannot be disputed. The scientific principle is "habituation" and is well documented. It isn't coincidental that: 1) in the disappearances of swimmers, surfers and fishermen from Oahu's northshore, their bodies are never recovered; 2) that the Coast Guard, in February of 2007, while conducting rescue operations on an overturned pleasure boat between the shark tour sites and Haleiwa Harbor spotted large sharks circling below the boaters in the water clinging to the overturned boat; 3) that rescuers attempting to reach a visiting swimmer at Laniakea Beach in March of 2010 were unable to reach him or retrieve his body as large tiger sharks were actively feeding on his body; 4) that C&C lifeguards have reported steadily increasing shark sightings from northshore beaches since the tours began operations; 5) that sightings of tiger sharks feeding on sea turtles on the northshore have increased; 6) that encounters between surfers, swimmers, paddlers, divers and fishermen have dramatically increased.

I understand that the Committee may wish to be apprised of scientific studies on the issue. I am aware of a study on shark abundance and shark species composition at the shark tour sites offshore of Haleiwa, by Meyers et. al. and a copy is attached. Of note is the observation that the shark tours have altered the marine ecosystem as the smaller and naturally occurring sandbar sharks have been displaced by the larger, more aggressive tiger and galapagos sharks. I highlighted this observation at pages 6 and 7.

HB 578 is identical in substance with HB 2583, SD 2, which passed the Legislature last year but was vetoed by Governor Lingle. Much testimony was given by resident citizens and groups in favor of that bill. A petition requesting passage of the bill and signed by more than a thousand citizens was also distributed at the Legislature. I am confident that the views expressed in this letter is reflective of the majority sentiment in the community.

Should you have any question or need further information, please do not hesitate to call on me. My business telephone number is 622-3933. Thank you for your time and consideration.

Ed

Ebisui