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Lacaziosis and lacaziosis-like prevalence among wild, common bottlenose dolphins *Tursiops truncatus* from the west coast of Florida, USA

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ABSTRACT: Lacaziosis (lobomycosis; *Lacazia loboi*) is a fungal skin disease that naturally occurs only in humans and dolphins. The first reported case of lacaziosis in a bottlenose dolphin *Tursiops truncatus* occurred in 1970 in Sarasota Bay, Florida, USA, and subsequent photo-ID monitoring of the Sarasota Bay dolphin population has revealed persistence of the disease. The objectives of this study were to estimate lacaziosis prevalence (*P*) in 2 bottlenose dolphin populations on the west coast of Florida (Sarasota Bay and Charlotte Harbor) and compare disease occurrence to other published estimates of lacaziosis in dolphin populations across the globe. Historic photographic records of dolphins captured and released for health assessment purposes (Sarasota Bay) and photo-ID studies (Charlotte Harbor) were screened for evidence of lesions consistent with lacaziosis. Health assessment data revealed a prevalence of lacaziosis in the Sarasota Bay bottlenose dolphin population between 2 and 3%, and analyses of photo-ID data provided a lacaziosis-like prevalence estimate of 2% for Charlotte Harbor dolphins. With the exception of lacaziosis prevalence estimates for dolphins inhabiting the Indian River Lagoon ($P = 0.068$; $P = 0.12$), no statistically significant differences were seen among Sarasota Bay, Charlotte Harbor, and other published estimates. Although lacaziosis is a rare disease among these dolphin populations, studies that assess disease burden among different populations can assist with the surveillance of this zoonotic pathogen.

KEY WORDS: Lacaziosis · Lobomycosis · Bottlenose dolphin · *Tursiops truncatus* · Sarasota Bay · Charlotte Harbor

INTRODUCTION

Lacaziosis (lobomycosis) is a chronic skin disease naturally occurring only in humans and dolphins, and is caused by the fungal pathogen *Lacazia loboi* (Rodriguez-Toro 1993, Taborda et al. 1999, Ramos-e-Silva et al. 2009). Among dolphins, lacaziosis (LD) or lacaziosis-like disease (LLD) has been observed in 3 species including the bottlenose dolphin *Tursiops truncatus* (Migaki et al. 1971), the Indian Ocean bottlenose dolphin *Tursiops aduncus* (Kiszka et al. 2009), and the costero *Sotalia guianensis* (de Vries & Laarman 1973). Geographically widespread, LD and LLD has been reported in dolphins from waters surrounding South America (de Vries & Laarman 1973), Madagascar

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(Kiszka et al. 2009), France (Symmers 1983), and along the Gulf of Mexico coast (Migaki et al. 1971) and Atlantic coast (Caldwell et al. 1975) of the USA. Recently, lacaziosis has been discovered in historically naïve dolphin populations, suggesting an emergence of the disease or possible changes in host susceptibility, ranging patterns, or pathogen ecology (Rotstein et al. 2009).

Published estimates of LD and LLD prevalence among different dolphin populations range between 1.6 and 33% (Van Bressem et al. 2007), and methods used to derive these estimates include visual analyses of photographs from photo-ID surveys (Van Bressem et al. 2007), histological analyses of biopsies from capture-release health assessment projects (Reif et al. 2006) and stranding investigations (Durden et al. 2009) (Table 1). Bottlenose dolphin photo-ID and capture-release health assessment methods have been previously described (Würsig & Jefferson 1990, Wells et al. 2004). Although photo-ID data is not completely sensitive to the detection of lacaziosis (Murdoch et al. 2008) and capture-release projects can be laborious and expensive, if conducted over a sufficient period of time both sampling methods can provide a robust and longitudinal photographic record for individuals in a geographically defined population, provide a route to explore historic disease occurrence, and support monitoring and tracking of changes in disease incidence (Wells et al. 2004, Gulland & Hall 2005).

The objective of this study was to use photo-ID and capture-release health assessment data to estimate the prevalence of LD and LLD among 2 distinct populations of bottlenose dolphins inhabiting waters on the west coast of Florida, USA. Furthermore, we compared these estimates to previously published reports of LD and LLD among dolphins on the east coast of Florida (Indian River Lagoon, IRL; Fig. 1), as well as other populations from across the globe, to determine whether disease occurrence is varied among populations.

METHODS

Case definition. Lacaziosis cases (LD) were defined as dolphins that presented with lesions similar to the descriptions by Migaki et al. (1971) and Reif et al. (2006), as well as histological confirmation of *Lacazia loboi* in biopsied lesions that were obtained either during health assessment projects or necropsies (Ramos-e-Silva et al. 2009). Dolphins were classified as LLD if they presented with lesions resembling lacaziosis in gross appearance,

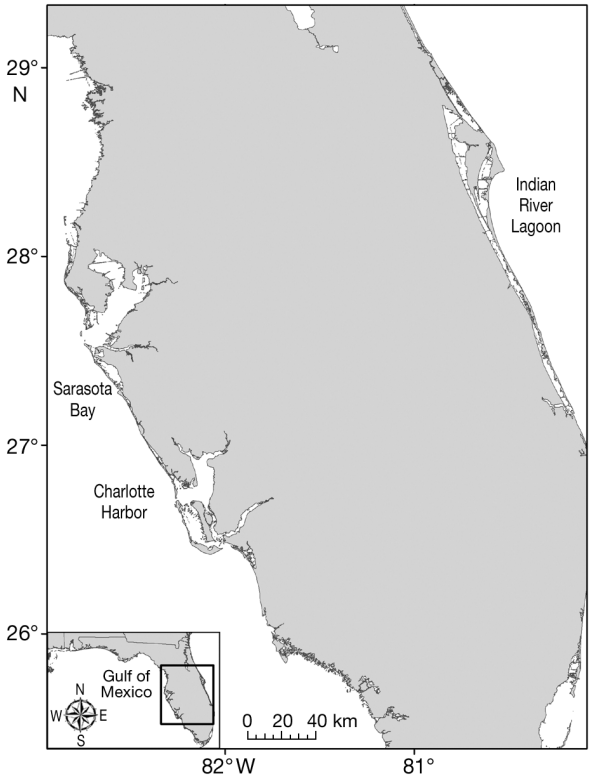

Fig. 1. Map of study areas, Sarasota Bay and Charlotte Harbor, and proximity to the Indian River Lagoon, Florida, USA

Table 1. *Tursiops truncatus* (*Tt*), *Tursiops aduncus* (*Ta*), *Sotalia guianensis* (*Sg*). Geographic location, publication source, species, sampling method and sampling period for dolphin populations with previously published lacaziosis (LD) or lacaziosis-like (LLD) prevalence estimates. IRL: Indian River Lagoon

Geographic location	Investigators	Species	Sampling method	Sampling period	Disease classification
IRL, FL, USA	Reif et al. (2006)	*Tt*	Capture-release	2003–2005	LD
IRL, FL, USA	Murdoch et al. (2008)	*Tt*	Photo-ID	1996–2006	LLD
IRL, FL, USA	Durden et al. (2009)	*Tt*	Strandings	2007	LD
Mayotte	Kiszka et al. (2009)	*Ta*	Photo-ID	2004–2008	LLD
Paranagua, Brazil	Van Bressem et al. (2009)	*Sg*	Photo-ID	2006–2007	LLD
Colombia	Van Bressem et al. (2007)	*Tt*	Photo-ID	2005–2006	LLD
Ecuador	Van Bressem et al. (2007)	*Tt*	Photo-ID	1990–1991	LLD
Santa Catarina, Brazil	Van Bressem et al. (2007)	*Tt*	Photo-ID	1993–2004	LLD
Tramandai, Brazil	Van Bressem et al. (2007)	*Tt*	Photo-ID	1991–2007	LD and LLD
Mampituba, Brazil	Van Bressem et al. (2007)	*Tt*	Photo-ID	2003–2004	LLD

but lacked histological confirmation of *L. loboi* (Van Bressem et al. 2007). Suspect cases of LLD were secondarily reviewed by a veterinary pathologist (D. S. Rotstein) for confirmation of disease diagnosis.

Sample populations. The 2 study populations, Sarasota Bay and Charlotte Harbor, are located on the central west coast of Florida, USA (Fig. 1). The Sarasota Bay dolphin community, which has been monitored and studied since 1970, is a demographically closed population comprised of approximately 160 individuals, the majority of which have known ages, sex, and familial lineages (Wells 2009). Routine photo-ID surveys began in Sarasota in 1980 (Wells 1991, 2003), and capture-release projects have been conducted since 1970 therefore providing a long-term record of life history parameters, body condition, and health indicators for dolphins in this population (Wells et al. 2004).

Charlotte Harbor and Pine Island Sound comprise the next largest estuary to the south of Sarasota Bay (Fig. 1), and bottlenose dolphins inhabiting the Charlotte Harbor estuary have also been studied since 1970 via aerial surveys, tagging, and photo-ID (Irvine & Wells 1972, Wells 1986, Wells et al. 1996). A boat-based, systematic photo-ID study was conducted for the Charlotte Harbor bottlenose dolphin population between the years 1990 and 1994, and in Pine Island Sound in 1996, resulting in estimates of a late-summer population size of approximately 300 dolphins for the Charlotte Harbor area and 250 for Pine Island Sound (Wells et al. 1996, 1997).

Sample size calculation and data acquisition. Sample size calculations were conducted, using the AusVet Animal Health Services online epidemiological calculator (www.ausvet.com.au), to determine the sampling periods for Sarasota Bay and Charlotte Harbor. For the Sarasota Bay LD prevalence estimate, capture-release health assessment data were used, and the sample size calculation was based on the minimum sample required to detect a prevalence equivalent to the Murdoch et al. (2008) lacaziosis estimate for the IRL (6.8%), a finite population (Cameron et al. 2003, Wagner et al. 2003), with 80% power and at least 75% test sensitivity (Murdoch et al. 2008). The finite sample size was based on annual abundance data for the Sarasota Bay bottlenose dolphin community between the years 1993 and 2008 (R. S. Wells unpubl. data). Based on the smallest abundance estimate between 1993 and 2008, the sample size calculator indicated that a minimum of 29 individuals would need to be screened to detect a lacaziosis prevalence equivalent to the reported estimate by Murdoch et al. (2008). Prevalence was assessed for two 10 yr periods (1980–1989, n = 106; and 1990–1999, n = 117) for the Sarasota Bay dolphin population. Detection of LD cases for the Sarasota Bay population was based on review of skin assessment datasheets, veterinary records, pathology reports, and photographs (Fig. 2) for all dolphins captured and released during the sampling periods.

For the Charlotte Harbor dolphin population, photo-ID data (Fig. 3) were used to estimate the prevalence of LLD, and a sample size calculation was conducted based on an 80% probability of detecting a prevalence equivalent to the lacaziosis estimate derived for the Sarasota Bay dolphins and other published studies (Table 1), given a large population size. Charlotte Harbor photo-ID and dart biopsy data from 2003 accounted for the greatest number of individually distinct dolphins sighted during a single year (n = 690; K. Bassos-Hull unpubl. data) and met the minimum sample size requirements for LD and LLD detection. All digital photo-ID images of Charlotte Harbor dolphins were obtained from the digital archive for 2003.

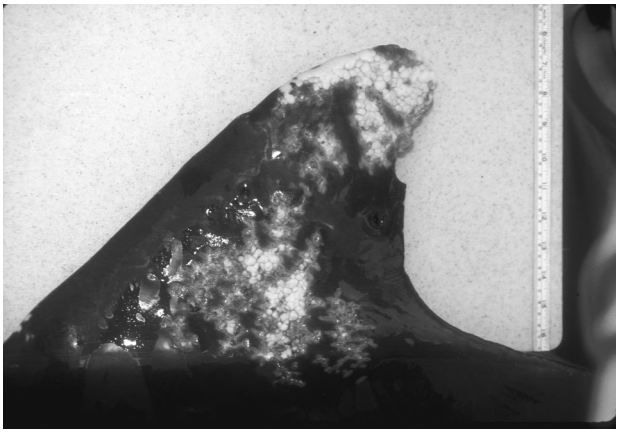

Fig. 2. *Tursiops truncatus*. Example of a bottlenose dolphin with confirmed lacaziosis (LD) from Sarasota Bay, FL, USA, capture-release health assessment. Photo credit: Sarasota Dolphin Research Program

Fig. 3. *Tursiops truncatus*. Example of lacaziosis-like (LLD) lesions on a bottlenose dolphin from Charlotte Harbor, FL USA. Photo credit: Sarasota Dolphin Research Program

Images were excluded from analysis if they revealed less than two-thirds of the dorsal fin or were (1) backlit, (2) extremely blurry, (3) distant, (4) not perpendicular to the camera angle, (5) obstructed by water or glare, or (6) depicted severely mutilated dorsal fins.

Statistical analyses. Prevalence (*P*) of LD in Sarasota was calculated as the proportion of dolphins captured and released between 1980–1989 and 1990–1999 with histologically confirmed lacaziosis. For the Charlotte Harbor dolphins, a raw prevalence (Hennekens & Buring 1987), which assumes a perfect diagnostic test for case detection, was calculated as the number of dolphins with LLD lesions relative to the total number of individuals with photographs suitable for analysis in 2003. However, Murdoch et al. (2008) revealed that photo-ID data were only 75% sensitive in detecting lacaziosis; therefore, an adjusted prevalence was calculated to account for an imperfect diagnostic test (Wagner et al. 2003). The raw LD and LLD prevalence estimates for Sarasota Bay and Charlotte Harbor, respectively were compared to each other with a Fisher's Exact Test (Rosner 2006) using SAS® 9.1 software (SAS). Both raw prevalence estimates were also compared to other previously published reports of LD and LLD in dolphin populations using a method for multiple comparisons of R×C proportions described by Horne & Plaehn (2007) and implemented as a SAS® macro (www.pnwsug.org/content/multiple-comparisons-2xc-proportions).

RESULTS

Sarasota Bay LD prevalence

Between the periods 1980–1989 and 1990–1999, a total of 106 and 117 individual bottlenose dolphins were captured and released during health assessment projects in Sarasota Bay, Florida, respectively. Of those dolphins, 3 individuals were classified as LD for the first sampling period (1980–1989) and 2 individuals for the second sampling period (1990–1999). In addition to the 3 LD cases during the 1980 sampling period, 2 other dolphins presented with lesions characteristic of lacaziosis; however, they could not be classified as LD as histological confirmation of *Lacazia loboi* was not conducted. For Sarasota Bay, the health assessment prevalence of LD was estimated to be 2.8% for 1980–1989 and 1.7% for 1990–1999. If the 2 LLD cases detected during the 1980–1989 sampling period were included in the prevalence estimation for Sarasota Bay dolphins, the LD/LLD prevalence would increase to 4.7% (Table 2). Except for one LLD case captured and released during the 1980–1989 sampling period, lacaziosis lesions were detected on both sides of the dorsal fin for the Sarasota Bay LD/LLD cases, and other anatomical sites for lesions included the head, rostrum, right and left flank, and fluke.

Charlotte Harbor LLD prevalence

In total, 690 individual bottlenose dolphins were photographed in Charlotte Harbor during 2003. Ninety-nine individuals were excluded from analysis based on previously described exclusion criteria. The photo-ID image screening found 52 dolphins that did not have evidence of LLD in their photographs, whereas 19 dolphins were classified as 'possible LLD' cases, and 11 animals were determined to be LLD cases by both investigators. 'possible LLD' cases included (1) animals with photographic evidence suggestive of early stages of lacaziosis lesions based on longitudinal observations from lacaziosis lesion progression modeling (Burdett Hart et al. 2010); or (2) animals with photographic evidence of lacaziosis-like lesions but lacking data post-2003 to confirm that the disease was chronic. Given that 11 cases of LLD were detected among dolphins photographically sampled in Charlotte Harbor during 2003, the prevalence of LLD was estimated to be 1.9% (Table 2). If the 'possible LLD' animals were included as cases, then the preva-

Table 2. *Tursiops truncatus*. Location, disease classification, sampling period and methods, and prevalence estimate inputs for the Sarasota Bay and Charlotte Harbor, FL, USA, bottlenose dolphin lacaziosis (LD) and lacaziosis-like (LLD) case sampling

Location	Disease classification	Sampling period	Sampling method	Cases	Non-cases	Prevalence estimate	95% CI
Sarasota Bay	LD	1980–1989	Capture-release	3	103	0.0283	0.0059, 0.0805
Sarasota Bay	LD and LLD	1980–1989	Capture-release	5	101	0.0472	0.0155, 0.1067
Sarasota Bay	LD	1990–1999	Capture- release	2	115	0.0171	0.0021, 0.0604
Sarasota Bay	LD	2004	Photo-ID	2	154	0.0128	0.0016, 0.0455
Sarasota Bay	LD and LLD	2004	Photo-ID	9	147	0.0577	0.0267, 0.1067
Charlotte Harbor	LLD	2003	Photo-ID	11	580	0.0190[a]	0.0095, 0.0337

[a]Indicates raw prevalence calculation. Adjustments for an imperfect diagnostic test (75% sensitivity; Murdoch et al. 2008) provided a prevalence estimate of 0.0253 (Wagner et al. 2003)

lence of LLD in Charlotte Harbor increased to 5.1%. Furthermore, the adjusted prevalence estimate for Charlotte Harbor dolphins was calculated to be 2.5% using only the LLD cases, and 6.8% if the 'possible LLD' cases were included.

A disadvantage of relying on photographs for skin lesion detection is that the entire body surface is usually not visible, which could lead to misclassification errors. Furthermore, in some cases, only one side of the dorsal fin is photographed, thereby further limiting the detection of skin lesions if they occur on only one side of the dorsal fin. For the Charlotte Harbor LLD cases, lesion occurrence on the dorsal fin was examined to assess possible misclassification bias due to exclusion of one side of the dorsal fin. Images of both sides of the dorsal fin were available for 9 of the LLD cases, and 100% of these cases had lesions present on both sides.

Sarasota Bay LLD

Using the LLD screening methods described for the Charlotte Harbor dolphin population, a photo-ID LLD prevalence estimate was derived for the Sarasota Bay dolphins to compare with the health assessment LD estimate. Digital images of bottlenose dolphins sighted in Sarasota Bay from 2004 photo-ID surveys were examined for LLD lesions as this was the first year in which digital photography was used for all 12 mo of photo-ID surveys. Of the 156 Sarasota Bay residents (R. S. Wells unpubl. data) that were screened for lacaziosis, 9 'possible' cases of LLD were identified, providing a LLD prevalence of 5.8% (Table 2). Two of the 'possible' Sarasota Bay LLD cases were confirmed LD cases as *Lacazia loboi* was observed in lesion biopsies (Table 2). A Fisher's Exact comparison of the photo-ID (P = 0.0577) and health assessment (P = 0.0472) LLD and LD estimates for Sarasota Bay revealed no significant differences in the prevalence estimates between the 2 methods (1980s LD only: p = 0.3970; 1990s LD only: p = 1.000; LD and LLD: p = 0.7868). These results suggest that both methods provide a comparable estimate of lacaziosis occurrence (~2%) in the Sarasota Bay dolphin population.

Prevalence comparisons

LD and LLD prevalence estimates have been reported for various dolphin populations across the globe (Table 3). The Sarasota Bay LD prevalence estimate for the 1990–1999 sampling period was used for comparisons with other populations because it was based on confirmed cases of lacaziosis and maintained consistency between sampling periods as most of the previously published LD/LLD prevalence estimates relied on data collected during the 1990s and 2000s. Multiple comparison tests revealed that there were no significant differences between the LD prevalence calculated for the Sarasota Bay population (P = 0.017) and LD/LLD prevalence estimates for other global dolphin populations (Table 3, $\alpha < 0.05$). Significant differences were found between the Charlotte Harbor prevalence estimate (P = 0.019) and 2 of the IRL estimates (Table 3, $\alpha < 0.05$; Reif et al. 2006, Murdoch et al. 2008).

DISCUSSION

Sarasota Bay and Charlotte Harbor LD/LLD prevalence estimates

Although the first case of lacaziosis in a dolphin was detected in Sarasota Bay in the early 1970s, and there

Table 3. *Tursiops truncatus*. Results from multiple comparisons of lacaziosis (LD) and lacaziosis-like (LLD) prevalence proportions among Sarasota Bay (0.0171, 95% CI 0.0021–0.0604) and Charlotte Harbor (0.0190, 95% CI 0.0095–0.0337), FL, USA, bottlenose dolphins and previously published population prevalence estimates. Data presented in the original publications were used to calculate 95% CI.. *Indicates a significant difference ($\alpha < 0.05$) in LD/LLD proportions; otherwise proportions are not significantly different. IRL: Indian River Lagoon

Population	Investigators	Proportion	95% CI	Sarasota Bay	Charlotte Harbor
IRL, FL, USA	Reif et al. (2006)	0.120	0.0564, 0.2156	–	*
IRL, FL, USA	Murdoch et al. (2008)	0.068	0.0507, 0.0894	–	*
IRL, FL, USA	Durden et al. (2009)	0.091	0.0192, 0.2433	–	–
Mayotte	Kiszka et al. (2009)	0.085	0.0316, 0.1749	–	–
Paranagua, Brazil	Van Bressem et al. (2009)	0.039	0.0107, 0.0965	–	–
Colombia	Van Bressem et al. (2007)	0.054	0.0066, 0.1819	–	–
Ecuador	Van Bressem et al. (2007)	0.016	0.0064, 0.0324	–	–
Santa Catarina, Brazil	Van Bressem et al. (2007)	0.051	0.0063, 0.1732	–	–
Tramandai, Brazil	Van Bressem et al. (2007)	0.200	0.0252, 0.5561	–	–
Mampituba, Brazil	Van Bressem et al. (2007)	0.333	0.0084, 0.9057	–	–

is evidence of the disease persisting in the population since the initial case detection, the overall prevalence of the disease is low (approximately 2 to 3%). Statistical analyses indicated that the Sarasota Bay prevalence was not significantly different than the estimates for other dolphin populations across the globe; however, most of those estimates are based on photo-ID analyses which must be regarded as minimum estimates of disease occurrence. The raw prevalence of LLD in Charlotte Harbor was calculated to be 1.9%; however, this estimate relied on data obtained through photo-ID studies, thereby requiring an adjustment for imperfect diagnostic testing (Wagner et al. 2003), which increased the estimate to 2.5%. The failure to detect significant differences between Sarasota Bay and Charlotte Harbor LD/LLD prevalence and other reported populations is likely due to the lack of precision in some of the reported estimates. For example, Van Bressem et al. (2007) reported a LLD prevalence of 33% among dolphins inhabiting the Mampituba Estuary in Brazil. The calculated confidence interval around this estimate was wide (0.0084 to 0.9057; Table 3) due to the small sample size, thereby making it difficult to find statistical differences between the Mampituba estimate and the LD/LLD prevalence for Sarasota Bay and Charlotte Harbor.

Although both populations occur in a similar region of the USA, the raw prevalence estimate for Charlotte Harbor was significantly lower than 2 estimates of LD and LLD in the IRL (Reif et al. 2006, Murdoch et al. 2008). However, when the prevalence was adjusted to account for photo-ID diagnosis and 'possible LLD' cases were included in the analysis, the Charlotte Harbor prevalence ranged between 2.5 and 6.8%, which is more comparable to the IRL estimates. Similarly to Charlotte Harbor, although not statistically significant, both LD prevalence estimates for Sarasota Bay were also lower than the estimate of lacaziosis in the IRL dolphin population.

Potential explanations for discrepancies in lacaziosis occurrence among dolphin populations have included geography, anthropogenic contamination, and variation in estuarine environmental conditions (Van Bressem et al. 2007, Murdoch et al. 2008). Although the reservoir for lacaziosis is currently unknown, if the occurrence or persistence of the pathogen is related to geography or climate, the differences in LD/LLD prevalence between the IRL, Sarasota Bay, and Charlotte Harbor are somewhat surprising as all 3 bodies of water are in the same geographic region and at a similar latitude (Fig. 1). Anthropogenic contaminants have been suspected to be associated with lacaziosis occurrence (Van Bressem et al. 2007, 2009, Reif et al. 2008, 2009); however, chemical contamination may not be explaining the observed differences in LD/LLD bottlenose dolphins on the east and west coasts of Florida as contaminant studies found no significant differences in polychlorinated biphenyls (PCBs), polyfluoralkyls (PFAs) (Houde et al. 2005, 2006) or mercury (Bryan et al. 2007, Stavros et al. 2007) between the 2 populations.

Some authors have suggested that environmental parameters such as salinity and water temperature could affect the prevalence of LD/LLD in dolphin populations (Van Bressem et al. 2007, 2009). The IRL, Sarasota Bay, and Charlotte Harbor are close in proximity; however, environmental factors such as salinity and freshwater influx are varied. The approximately 900 km^2 IRL is separated from the Atlantic Ocean by a long and narrow barrier island, in which 4 inlets provide the majority of saltwater input to the southern portion of the lagoon. With the exception of regions near stream mouths, the majority of the IRL has very little vertical stratification in salinity; however, large fluctuations in salinity are observed in the southern portion of the IRL where the majority of freshwater inputs and coastal inlets are located (Sumner & Belaineh 2005). Although stranded dolphins with lacaziosis have been recovered from northern portions of the IRL (Durden et al. 2009), all accounts of LD or LLD in free-ranging dolphins have occurred in the southern portion of the lagoon (Reif et al. 2006, Murdoch et al. 2008).

Compared to the IRL, both Charlotte Harbor and Sarasota Bay are smaller in size with areas approximating 700 km^2 (Pierce et al. 2004) and 140 km^2 (Sherblom et al. 1995), respectively. In contrast to the IRL, 3 major rivers supply freshwater input to Charlotte Harbor, resulting in a density-dependent, vertically stratified harbor with extreme hypoxic episodes at times (Pierce et al. 2004). We cannot rule out the possibility that differences in freshwater input between the west coast and east coast estuaries in Florida could influence the development and persistence of lacaziosis in these populations. Future research should examine the spatial distribution of LD/LLD cases in Sarasota and Charlotte Harbor relative to areas of freshwater input and other ecological factors that may influence the occurrence and persistence of the disease.

Limitations

Photo-ID studies provide longitudinal data on individuals; however, disease status may be subject to misclassification bias if skin lesions or other signs of disease are not presented on body parts that are routinely photographed, thus possibly underestimating the true population prevalence of a particular disease. Also, while many photo-ID programs are already in place and relatively inexpensive to conduct, etiologic

confirmation of disease status is not usually possible (Thompson & Hammond 1992, Wilson et al. 1997).

Although health assessment data may be more sensitive to the detection of skin disease, case discovery is only possible if the clinical signs are apparent at the point of sampling. Also, unless conducted over many years, these projects are usually subject to smaller sample sizes, thereby influencing the power for case detection. Finally, as demonstrated during the 1980–1989 sampling period, disease status cannot be confirmed unless suspect lesions are biopsied for etiologic determination.

Strengths

Despite these limitations, photo-ID data can be considered a random sample of the population and long-term, routinely conducted projects can yield longitudinal data allowing for the detection of incident cases and changes in health condition. Also, because capture-release projects are not feasible for health monitoring of many marine mammal populations, the data acquired from photo-ID studies provide an efficient, less expensive and non-invasive tool to assess the health of wild populations. Health assessment data provide a more sensitive measure of skin disease because the entire body can be viewed, and etiologic data can be obtained from lesion biopsies to confirm disease status, as well as other health parameters (Wells et al. 2004). If conducted over a sufficient period of time, health assessment projects are comparable to longitudinal cohort studies (Gulland & Hall 2005), and disease cases can be followed to assess changes in health condition relative to disease progression.

CONCLUSIONS

Lacaziosis may be considered endemic among the IRL (Murdoch et al. 2008) and Sarasota Bay dolphin populations; however, the occurrence of LD among Sarasota Bay dolphins is rare. The endemicity of LLD among Charlotte Harbor dolphins is unknown, but the occurrence of LLD is comparable to estimates of LD in Sarasota. Statistically, the LD and LLD prevalence estimates for Sarasota and Charlotte Harbor are comparable to published estimates of LD/LLD in other populations; however, caution should be used to compare estimates that rely on photo-ID data as they are minimum estimates of true disease occurrence. Future studies should use long-term sighting data of dolphins with LD/LLD to examine environmental and ecological factors that may contribute to disease occurrence and persistence.

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