Little known and rare in most parts of the world, pygmy and dwarf sperm whales (*Kogia breviceps* and *K. sima*) are common in the southeastern United States. Along the Atlantic coast of the United States, they are second only to bottlenose dolphins in numbers of stranded animals. These species remain a mystery to scientists in the most basic aspects of their biology, ecology and distribution. There are many reasons why we know so little about *Kogia* whales. These whales are so similar morphologically that, prior to 1966, only one species was recognized (*K. breviceps*). Thus, the body of information gathered until then was of limited use, as it was often unclear which species the investigator was referring to. Unlike their larger relatives the sperm whales, *Kogia* were never commercially exploited, which in turn meant that fewer specimens were available for scientific study, except for a few strandings scattered throughout the world. Observations at sea were also rare, as these animals do not approach vessels and are difficult to observe at the surface. These problems continue, as often air- and boat-based surveys will group sightings of both species into a single category, due to the difficulty in assigning the observations to the level of species. In addition, identifying *Kogia* in the field (both live and dead strandings) has often posed a daunting task, due to the overlapping ranges of morphometric characters used to separate the two species. This is particularly a problem in young and juvenile animals.

A breakthrough happened a few years ago when, in the course of long-term studies on the biochemistry and genetics of various marine mammal species, we stumbled upon another level of differentiation between the two *Kogia* species. We analyzed the hemoglobin patterns of *K. breviceps* and *K. sima* and found

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that the two species showed a clear distinction in their electrophoretic profiles, as had been previously discovered for inshore and offshore bottlenose dolphins from the same area. The ability to differentiate the two Kogia by analyzing their hemoglobins was extremely useful, and led us to examine the morphometrics of individual animals that had been confirmed to belong to each species by their hemoglobin profile. For all the animals with available blood data (54 K. breviceps and 14 K. sima), two morphometrics stood out; the distance from the snout to the center of the blowhole (snout-blowhole) in proportion to the animal's total length, and the height of the dorsal fin in proportion to the animal's total length. When used in conjunction, these two measurements diagnosed animals of both sexes and all size classes, as can be seen in the key provided in Fig. 1. These measurements are particularly useful in the case of living animals being transported to rehabilitation facilities, for they are dorsal in nature and can be taken with no additional stress to an animal laying on its ventral surface.

Since our initial finding of the differences in hemoglobin between the two Kogia species, we have developed an additional way to distinguish these whales. Mass spectrometry, an analytical technique which can be used to determine molecular weights, unambiguously distinguishes between K. breviceps and K. sima. Both hemoglobin (alpha-chain) and myoglobin yield diagnostic results (Table 1). Consequently, either blood or muscle can be used to confirm species identification among Kogia. The advantages of this technique are many. Very small samples are needed and these can be frozen or dried. In addition, samples can be collected from extremely decomposed animals (carcass codes 3-4). Given the difficulties with field identification of these whales, we strongly recommend that the collection of at least one of these tissues be a part of the information gathered during routine stranding events (even for Level A data). In cases where full necropsies are not feasible, blood can be easily collected from wounds or skin abrasions.

For the moment, analyses can be done at no cost. To have samples analyzed, please contact:

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The definitive species identification of Kogia allows for the use of stranding data for ecological and distributional studies. To gain insight into the feeding ecology and habitat utilization of Kogia whales, we have analyzed stable isotopic ratios of carbon and (continued on page 11)
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nitrogen in muscle tissues of stranded animals. The principle of this technique is that the elemental composition of tissues of a predator is similar to, or differs by a certain amount from, that of its prey. Whereas the carbon isotopic levels in tissues of the two species were similar, a reflection of similar primary producers in the feeding grounds of Kogia, nitrogen levels were significantly different, suggesting that these whales feed at different levels of the food chain. Using a relative scale comparing data from other cetacean species, we calculated that the two species differed in about 22% of their diet. The values obtained for K. sima were

Table 1. Hemoglobin and myoglobin molecular weights of pygmy and dwarf sperm whales. Values are presented in atomic mass units, and shown as mean ± one standard deviation. R is the range of values and n refer to sample sizes.

<table>
<thead>
<tr>
<th></th>
<th>Hemoglobin Alpha-Chain</th>
<th>Myoglobin</th>
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<tbody>
<tr>
<td><strong>Kogia breviceps</strong></td>
<td>15,249 ± 0.78 (r= 15,248-15,250)</td>
<td>17,267 ± 0.95 (r= 17,265-17,269)</td>
</tr>
<tr>
<td>n= 23</td>
<td>n= 28</td>
<td></td>
</tr>
<tr>
<td><strong>Kogia sima</strong></td>
<td>15,188 ± 0.66 (r= 15,187-15,189)</td>
<td>17,239 ± 0.79 (r= 17,238-17,241)</td>
</tr>
<tr>
<td>n= 13</td>
<td>n= 16</td>
<td></td>
</tr>
</tbody>
</table>

closer to species that typically inhabit deeper, offshore waters (e.g, the pan-tropical spotted dolphin, *Stenella attenuata*, and the Clymene dolphin, *S. clymene*), and those of *K. breviceps* were more similar to species that typically occupy waters over or near the continental shelf (the bottlenose dolphin, *Tursiops truncatus*, and the Atlantic spotted dolphin, *Stenella frontalis*). Detailed analyses of stomach contents of Kogia are being carried out to help understand the feeding ecology of both species, and further quantify the overlap in their diet. If you would like to contribute to this project by collecting samples from stranded animals (entire stomachs), please contact:

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We have only begun to unravel the mystery of pygmy and dwarf sperm whales. With dedicated studies, we hope to understand how these intriguing animals make a living in their natural environment and ultimately produce the scientific information necessary for their conservation and protection.