Fripp (2005) discusses a common difficulty facing researchers of dolphin vocal behavior in identifying which dolphin in a group is vocalizing. Her discussion focuses on one method used by previous researchers (e.g., McCowan 1995; McCowan and Reiss 1995a, b, 2001; McCowan et al. 1998; Miksis et al. 2002) to identify the vocalizing individual under captive conditions, namely the use of bubblestream emission concurrent with whistle production. She identifies three major problems with the use of bubblestreams for evaluating dolphin whistle repertoires: (1) bubblestreams are not independent, (2) bubblestream use is context-dependent, and (3) bubblestream whistles are not representative of the repertoire.

While I generally agree with Fripp (2005) that more modern methods (such as hydrophone arrays) for identifying vocalizers under captive and especially field conditions should be used when possible, I think it is equally important to point out that the data comparisons and resulting interpretations regarding bubblestream whistles in her paper seem problematic. Each of Fripp’s (2005) arguments are addressed below.

**Bubblestream Whistles are Not Independent**

Fripp (2005) does show that bubblestream whistles are not emitted in an independent fashion. The fact that bubblestreams tend to be produced in clusters instead of sporadically and that the same whistle type tends to be produced in succession provides evidence for this lack of independence. However, because whistling in general may occur in clusters with the same whistle type being produced in succession (as the signature whistle hypothesis supports), this lack of independence may have nothing to do with bubblestreams in particular but rather with whistling in general. In order to conclusively demonstrate that it is the bubblestream whistles themselves that are biased in this regard, one needs to compare bubblestream whistles with non-bubblestream whistles with respect to temporal clustering and the types of whistle

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1 McCowan and Reiss (2001) did not confine their whistle sample to those that were produced concurrent with bubblestreams, as stated on p. 30 of Fripp (2005). Half of the whistles were collected from individuals that were isolated by the side of the pool and thus produced “in air,” as frequently conducted in signature whistle studies (Caldwell et al. 1990 for review).
produced in succession. Without these data, one cannot conclude that this lack of independence is due to bubblestream emission alone.

**Bubblestream Use is Context Dependent**

Similar to above, the data on context for bubblestream whistles in Fripp (2005) are also presented in isolation. Because no data are provided on the context for non-bubblestream whistles one cannot conclude that bubblestream whistles are *more* or even *differently* context dependent than non-bubblestream whistles. We certainly expect that whistling in general will have context dependent characteristics, as do all other forms of vocal communication across species (e.g., alarm calling). Without data on the context of non-bubblestream whistling, one cannot conclude that bubblestream whistles *in particular* are biased with respect to context.

**Bubblestream Whistles are Not Representative of the Repertoire**

Perhaps the most problematic feature of Fripp's paper concerns the analyses conducted to conclude that bubblestream whistles are not representative of the dolphins' repertoire. First, the assumption that samples are independent is in violation of the use of the $\chi^2$ test. These data were not collected from 392 individuals but rather 392 samples were repeatedly collected from a total of six animals (three female adults, three male calves).

Second, despite this independence violation, the statistical approach used in Fripp (2005) does not actually test the proposed hypothesis, namely whether or not bubblestream whistles are representative of non-bubblestream whistles and thus the whistle repertoire. Fripp (2005) tests whether each bubblestream distribution is significantly different from a uniform distribution (see Fig. 1). But the correct question

![Figure 1](image)

*Figure 1.* Graphical representation of the hypothesis tested in Fripp (2005)—does each bubblestream distribution differ from a uniform distribution? (Clusters 1–10 from left to right).
is whether the distribution of whistles across clusters is similar or dissimilar between adult or calf bubblestream whistles and non-bubblestream whistles (see Fig. 2). It is not important if whistles tend to cluster nonuniformly across types. We expect some whistle types to be produced at higher rates than other whistle types in dolphins as demonstrated in both the signature whistle and non-signature whistle studies (Caldwell et al. 1990 for review; McCowan and Reiss 2001 for review; McCowan et al. 1999, 2002). To attest to this fact, even the non-bubblestream whistles are not uniformly distributed across clusters ($\chi^2 = 243.2$, df = 8, $P < 0.0005$), as indicated in table 4 of Fripp (2005).

So if we test the correct hypothesis instead, while ignoring the lack of independence in the dataset, we find that differences in the distributions of non-bubblestream whistles and bubblestream whistles are not that pronounced. Conducting two different statistical tests and using the Monte Carlo simulation to generate 99% confidence intervals for our $P$-values, we find that the distribution of calf bubblestream whistles are not significantly different from that of non-bubblestream whistles, while the distribution of adult female bubblestream whistles does differ significantly from that of non-bubblestream whistles (see Table 1). However, because the sample size for adult bubblestreams is so sparse ($n = 18$), one should be especially cautious in concluding that bubblestream whistles do not represent their repertoire until further samples are collected.
Table 1. Likelihood ratio test and $\chi^2$ test (df = 8) for comparisons between the distributions of whistles allocated to clusters for calf bubblestream, adult bubblestream, and non-bubblestream whistles (Monte Carlo estimate of $P$-value in parentheses; 10,000 iterations sampled).

<table>
<thead>
<tr>
<th>Statistical test</th>
<th>Calf bubblestream: non-bubblestream</th>
<th>Adult bubblestream: non-bubblestream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likelihood ratio test</td>
<td>14.87 (0.064–0.071)</td>
<td>46.0 (0.000–0.0007)</td>
</tr>
<tr>
<td>$\chi^2$ test</td>
<td>15.39 (0.053–0.059)</td>
<td>46.0 (0.0006–0.0012)</td>
</tr>
</tbody>
</table>

Therefore the results in Fripp (2005) do not support the hypothesis that bubblestream whistles are unrepresentative of the dolphin whistle repertoire. If anything, in testing the correct hypothesis, we find that bubblestream whistles seem somewhat representative of, at least, calf repertoires. Yet, because the composition of the data for non-bubblestream whistles is unknown, any conclusions drawn from the data in Fripp (2005) may be in error.

LITERATURE CITED


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