

MEMORANDUM

TO: Steve Reilly
FROM: Bill Perrin
DATE: 25 Jan 99
SUBJECT: Letter of 14 Jan from Jim Joseph to Mike Tillman

As you asked, I have looked at the question of the "missing juveniles" as raised by Jim on page 4 (3rd paragraph) of his letter. He notes that NMFS saw a dearth of age 5-15yr spotted dolphins (juveniles) killed in the fishery in 1973-81 and concludes that this selectivity may be biasing the TVOD abundance estimate/index downward at present, with increased recruitment possibly masked by the bias during a lag period.

The NMFS study was by Barlow and Hohn (1984, SWFC TM 48). They concluded that the anomaly (which was almost entirely in the female distribution -- their fig. 1 attached) was not due to a transient change in recruitment, as it was present in sample from all years, but was most likely caused by a bias in the sampling. A deduction was that juveniles were missing from the samples perhaps because they segregated in smaller schools not set on by the tuna seiners, dolphins of a related species (striped dolphin) being known to segregate by age and sex in Japanese waters.

An important factor has been overlooked in considering the anomaly. Powers and Barlow (1979, SOPS/79/31) showed that the proportion of the kill of spotted dolphins that is made up of calves was greater for small-kill sets. They also showed that small-kill sets killed relatively more females. The anomalous "dip" in the age distributions could as well be characterized as a **surplus** of larger calves and adult females as it can be seen as a **dearth** of juveniles. Powers and Barlow concluded that large kills were more cross-sectional than small kills. As most kills in the fishery in the last couple of decades have been small, this possibly could account for the bias in the aged samples.

A number of hypotheses are possible:

a) *The animals processed by the observers did not represent the observed kill.* The average proportion of the kill processed never rose above about 25% and in some years was considerably less. The observers were supposed to process a random sample of the kill but in fact processed the first dolphins that came to hand. Any variation with age or sex in where the

dolphins were killed in the net or in the order in which they came aboard (or whether they came aboard) would be reflected in bias.

b) *The observed kill did not represent the actual kill* - Barlow and Hohn noted that very small calves (neonates) were present in less-than-expected numbers in the age sample. Some work underway by Andy Dizon's group also indicates this. One possibility is that these calves floated because of their high fat/mass ratio and were backed out before they could be counted. Such cryptic kill for any age/sex group would bias the observer's sample.

c) *The kill did not represent the animals captured* - This gets to the question again of relative vulnerability; particular age/sex classes (e.g., lactating females and their nursing calves) could exhibit less stamina or adaptive behavior and therefore die disproportionately while being held.

d) *The animals captured did not represent the animals chased* - The seiner often does not catch all the dolphins it chases. A protracted chase may result in the animals being strung out and some escaping the net circle. These could perhaps be the more vigorous and unencumbered animals (large juveniles and adult males?).

e) *The animals chased did not represent the school as first sighted* - When a school is large, it is the practice to identify the part of the school that is carrying the fish and to attempt to cut that piece out and encircle it. If the school has subcomponents varying in age and sex, and if the tuna for some reason tend to associate with one or another subcomponent, a bias in the animals chased would result.

While the seiners don't often set on small schools of spotted dolphins, they do look them over for tuna, and the observer does log them when they are seen. It seems highly unlikely that, if such schools of juvenile females existed, they would have been distributed in areas not traversed by the tunaboats or totally ignored by the fishermen and the observers.

Given the above, it is most likely that the anomaly in the age distribution of females in the old data was the result of an operational bias, possibly due to variation in vulnerability by age and sex. It would be interesting to collect new, more carefully controlled data from the present fishery and subject them to analysis including the covariates size of kill, size of school, length of chase, proportion of school captured, etc.

cc: Barlow, Dizon, Archer

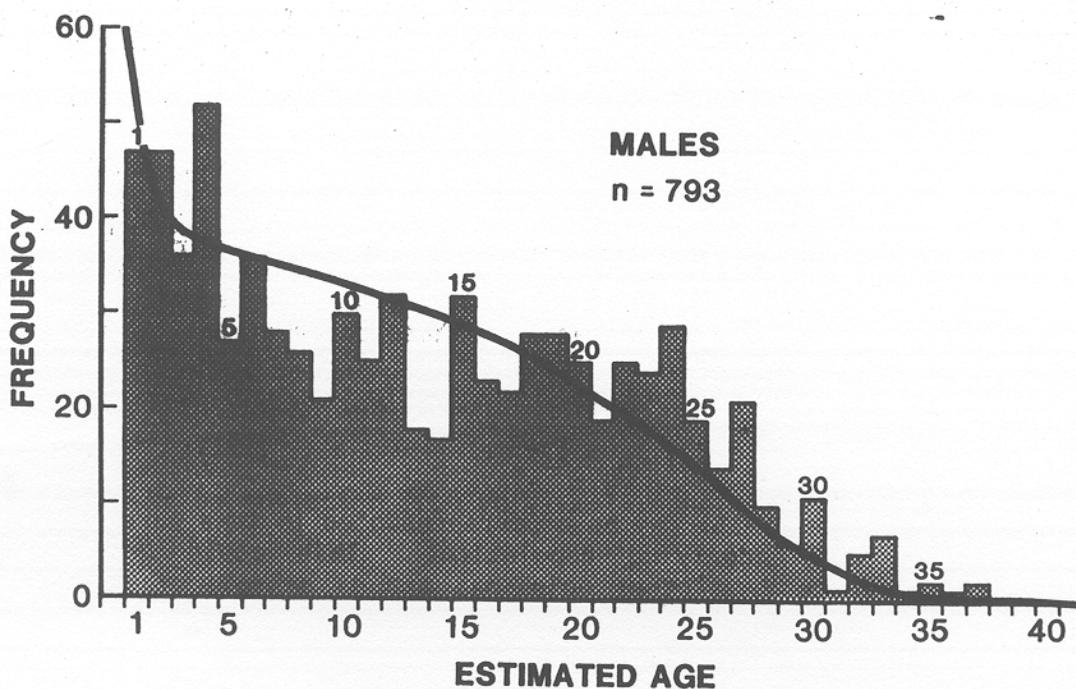
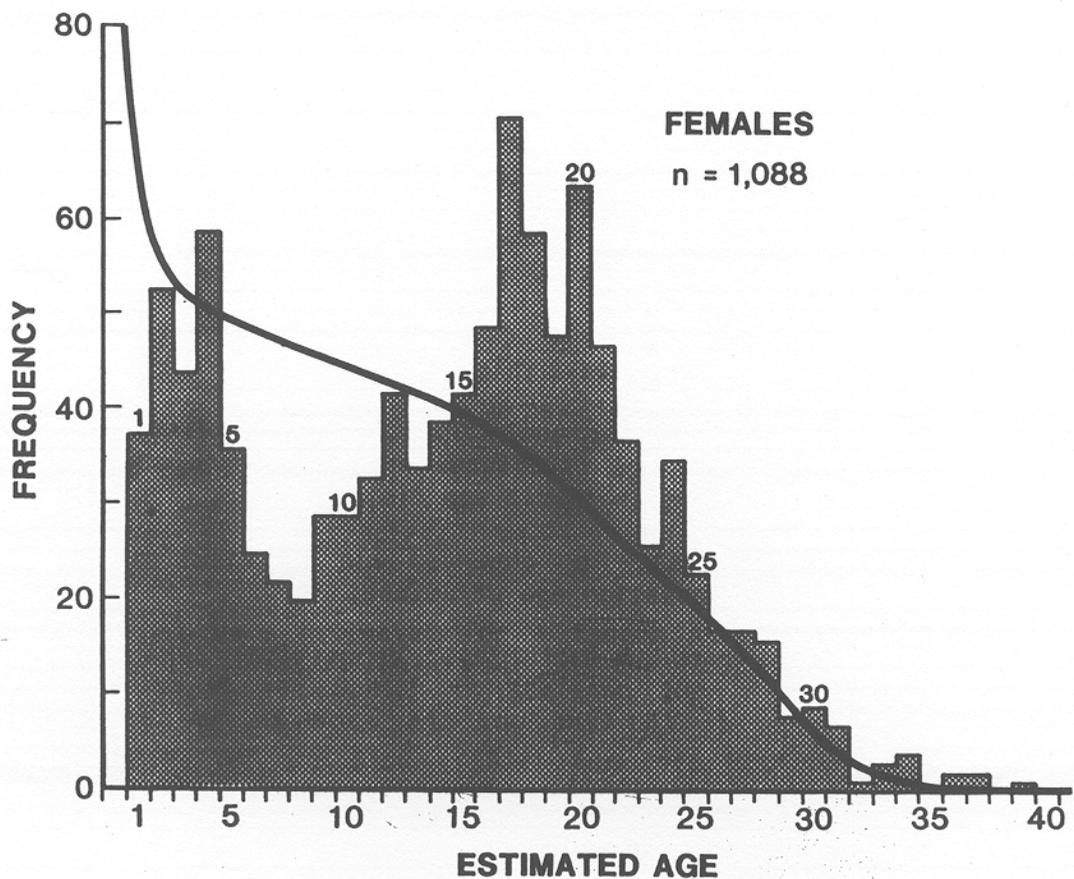


Figure 1. Observed age frequency distributions for female and male spotted dolphins based on tooth aging samples (1973-81) (figures from Hohn and Myrick. Age distribution of the kill of spotted dolphins, *Stenella attenuata*, in the eastern tropical Pacific, in prep.). Solid curves represent typical stable age distributions for the given sample sizes based on a generalized mammalian pattern of age specific mortality⁴.