INTERNATIONAL DOLPHIN CONSERVATION PROGRAM

# TECHNICAL WORKSHOP ON CALCULATING $N_{MIN}$ FOR THE DOLPHIN STOCKS OF THE EASTERN PACIFIC OCEAN

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## DOCUMENT NMIN-03

## ALTERNATIVE POPULATION ESTIMATES FOR CALCULATING $N_{MIN}$

The Agreement of the International Dolphin Conservation Program (Annex 3, Article 1) states that:

> "The Parties shall establish, at a meeting convened pursuant to Article VIII of this Agreement, a per-stock, per-year dolphin mortality cap for each stock of dolphins, determined by the Meeting of the Parties, based on the best available scientific evidence, of between 0.2 percent and 0.1 percent of the Minimum Estimated Abundance ($N_{min}$) as calculated by the U.S. National Marine Fisheries Service or equivalent calculation standard as might be developed or recommended by the Scientific Advisory Board but in no event shall the total annual incidental dolphin mortality exceed five thousand, consistent with the provisions of this Agreement. In the year 2001 and thereafter, the per-stock, per-year cap shall be 0.1 percent of $N_{min}$."

$N_{min}$ is currently defined under United States guidelines (Barlow *et al*. 1995) as:

"the 20th percentile of a log-normal distribution based on an estimate of the number of animals in a stock (which is equivalent to the lower limit of a 60% 2-tailed confidence interval), calculated as:

$$N_{min} = N/\exp(z(\ln(1+CV(N)^2))^{1/2})$$

where N is the abundance estimate, CV(N) is the coefficient of variation of the abundance estimate, and z = 0.842." Note that $N_{min}$ incorporates not only the estimate of the abundance but a measure of the uncertainty about the estimate as well. Thus, calculation of per-stock mortality limits (SMLs) requires both estimates of the abundance of the stocks and the coefficient of variation (CV) of the estimates.

Current SMLs for most of the dolphin stocks are based on estimates of abundance and CVs from surveys during 1986-1990 (Wade and Gerrodette, 1993); estimates for northern and central common dolphins have been based on surveys conducted in 1992-1993 (Wade and Gerrodette, unpublished data). A series of surveys (1998-2000, 2003) has been completed by the NMFS to produce more up-to-date abundance estimates (NMFS 2002; Gerrodette and Forcada 2002, 2005; Gerrodette *et al*. 2005). During the 2nd and 3rd Meetings of the Parties to the AIDCP, held in October 1999 and June 2000 respectively, it was decided to re-evaluate using the 1986-1993 abundance estimates to calculate $N_{min}$ after the 1998-2000 surveys were completed. The $N_{min}$ estimates and SMLs currently used by the AIDCP are listed in Table 1.

**Literature Cited**


Barlow, J., Swartz, S.L., Eagle, T.C., and Wade, P.R. 1995. U.S. marine mammal stock assessments: Guidelines for preparation, background, and a summary of the 1995 assessments. NOAA Tech. Memo. NMFS-OPR-6. 73 pp.

Gerrodette, T. and Forcada, J. 2002. Whitebelly spinner, striped and common dolphins, and pilot, sperm and Bryde's whales in the eastern tropical Pacific Ocean. SWFSC Admin. Rep. LJ 02-20. 24 pp.

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NMFS. 2002. Report of the scientific research program under the International Dolphin Conservation Program Act. 100 pp.

Wade, P.R. and T. Gerrodette. 1993. Estimates of cetacean abundance in the eastern tropical Pacific. Rep. Int. Whal. Commn. 43: 477-493.

**TABLE 1.** Abundance estimates, $N_{min}$, and per-stock mortality limits (SML = 0.1% of $N_{min}$) based mainly on the 1986-1993 NMFS surveys (Wade and Gerrodette, 1993; unpub. data for northern and central common dolphins). Included are the preliminary 2004 mortality estimates for comparision.

| STOCK | N | $N_{min}$ | SML |
|---|---|---|---|
| **Spotted dolphin (*Stenella attenuata*)** | | | |
| Northeastern stock | 730,900 | 648,920 | 648 |
| Western/Southern stock | 1,298,400 | 1,145,149 | 1,145 |
| **Spinner dolphin (*Stenella longirostris*)** | | | |
| Eastern stock | 631,800 | 518,495 | 518 |
| Whitebelly stock | 1,019,300 | 871,982 | 871 |
| **Common dolphins (*Delphinus delphis* and *D. capensis*)** | | | |
| Northern stock | 713,700 | 562,719 | 562 |
| Central stock | 239,400 | 207,298 | 207 |
| Southern stock | 2,210,900 | 1,845,561 | 1,845 |