

Review of
LONG TERM RESEARCH
IN THE EASTERN TROPICAL PACIFIC

A Proposal from the Southwest Fisheries Science Center
NOAA Fisheries Service

dated
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By
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This report contains my review of the Eastern Tropical Pacific Dolphin Research Plan contained in the proposal “LONG TERM RESEARCH IN THE EASTERN TROPICAL PACIFIC” from the Southwest Fisheries Science Center (SWFSC), dated June 2006. The research program that the SWFSC designed contains four components: abundance estimation, ecosystem studies, stress and other fishery effect studies, and stock assessment. My area of expertise allows me to primarily comment on the study design and statistical analysis for abundance estimation by line transect methods.

I base my review on three documents provided by the Center for Independent Experts (CIE). These documents are: the above referenced proposal from SWFSC, Second Review of Transect Sampling Methods to Obtain Population Size Estimates for Northeastern Offshore Spotted and Eastern Spinner Dolphins by Paul A Medley (23 August 2002), and Report Of The Scientific Research Program Under The International Dolphin Conservation Program Act, by the Southwest Fisheries Science Center (17 September 2002).

Is the scope of the proposal adequate and appropriate?

The scope of the proposal is adequate and appropriate, however technical details are not provided to allow full assessment of adequacy of methods to meet the objectives of the project. The Proposal has a “trust me” tone and presentation that is not appropriate or adequate for in depth scientific peer review. While I do not anticipate insurmountable problems with the implicitly implied line transect methods for estimation of abundance of dolphins, the fact is that biases exist and variances (standard errors) are relatively large. Improvements can be made in these large complex surveys.

Are any areas addressed in less, or more, depth than needed?

All four sections of the proposal, including the estimation of abundance by line transect methods, suffers from a lack specific details on the methods for data collection, planned statistical analyses, and adequacy of “sample sizes” to provide useful statistical estimates with acceptable precision and accuracy. If this proposal is not the appropriate place to provide the details, then details should be provided in appendices or otherwise be made available. It is not possible to fully provide scientific peer review of the proposed survey to meet the stated objectives, based on the details provided.

Are the approaches proposed unbiased?

Responsive movement of dolphins, estimation of the probability of detection of schools on the survey line, i.e., $g(0)$, and potential bias in estimation of absolute abundance are important issues that should be addressed in this proposal for design and analysis of new line transect surveys. The magnitude of the potential bias is apparently unknown while the stated objectives in the Proposal include estimation of absolute abundance, not just trend in an index for population sizes. This is a potential problem for northeastern offshore spotted and eastern spinner dolphins, but would appear to be more so for coastal spotted dolphins. Coastal spotted dolphins were infrequently sighted during the earlier large-area surveys carried out to assess the status of the other two stocks. Further, apparently multiple subspecies of the coastal spotted dolphins exist, each of which may have different responses to the survey vessels.

Paul A Medley in his “Second Review of Transect Sampling Methods to Obtain Population Size Estimates for Northeastern Offshore Spotted and Eastern Spinner Dolphins,” dated 23 August 2002, raised the same issue. He continued to suggest that “...the best way to estimate this effect would be to increase the use of helicopters in aerial-monitoring of school movements before and after detection by the research vessel. Such information could be continued to be collected on future surveys.” I agree that helicopters or other methods, including the use of double observers, should be proposed and fully described in the proposal. Details might best be provided in an appendix or otherwise be made available.

The protocol for conduct of the surveys should include plans for obtaining the most accurate and precise measurements of distance to schools, using methods that will allow comparison of results with past surveys. For example, are the methods in Kinzey and Gerrodette (2003) [Kinzey, D., and T. Gerrodette. 2003. Distance measurements using binoculars from ships at sea: accuracy, precision and effects of refraction. *Journal of Cetacean Research and Management* 5:159-171.] to be used? The proposal should include written protocols for at sea data collection or otherwise provide the information.

The Proposal should include written protocols, perhaps in appendices, for the planned statistical analysis of the anticipated data, including the authors’ plans for QA/QC of the data, ‘calibration of observers’ for estimation of group sizes, modeling the probability of detection in the line transect surveys by species and year, bootstrapping for estimation of standard errors, checking of computer software, etc. Future data analyses should not be restricted to planned analyses in the Proposal, however a detailed path from data collection to analysis by known methods should be provided.

Does the proposal represent Best Available Science? If not, what specifically would be required to meet that designation, in your opinion?

The Proposal, for example, included the statement: “Statistical models for line-transect analyses now include factors other than perpendicular distance that affect detection probability (Buckland et al. 2004). The SWFSC has developed multivariate line-transect models and software that cope with the unique aspects of ETP dolphin surveys, such as mixed-species schools, correction factors for school size estimates, and unidentified sightings. Further development of these models will improve estimates of dolphin abundance.” (pg 55). This proposed work represents state of the art research on analysis methods to improve estimates of dolphin abundance; however, details provided in the proposal are not sufficient to allow assessment of scientific adequacy of research plans for development of these models or for meeting other research objectives.

Similarly, the statement is made that “Bayesian methods hold large promise here, both for components of the line-transect analysis, such as effective strip width (Karunamuni and Quinn 1995) and group size (Solow and Palka 1996), as well as for successive abundance estimates in a time series (Gazey and Staley 1986). Eguchi and Gerrodette (in prep.) have outlined a Bayesian line-transect analysis procedure.” (pg. 57). Again, these are state of the art methods for analysis, but it is not possible to provide a scientific judgment on the usefulness of the procedure for analysis of future and past line transect data based on the information provided.

Sub-proposals should be provided for major components of anticipated research. If the protocols and sub-proposals are too bulky to include as part of the proposal to administrators, then they should be provided separately to reviewers of the technical aspects of the proposal.

Comment on the proposal's strengths and weaknesses, and suggest any additional lines of research that appear promising.

A strength of the proposal is that the authors include a one-time "process" cruise to examine key aspects of sampling methods. Specifically, the authors plan to test the effects of passing vs. closing modes in line transect surveys, effects of passing/closing on bias of abundance estimates, and to determine if there are interactions with the particular types of patchiness encountered in the ETP. Also, effects of echosounder(s) on estimation of abundance and methods to improve school size estimation will be considered. These are worthwhile research objectives; however, the weakness of the proposal is that insufficient detail is included to judge the scientific adequacy of study designs or planned analysis methods. There is no indication that studies to vary detection parameters experimentally in the process cruise, as suggested by Medley (see above reference), will be included, nor discussion of why they are not going to be included. There was no evidence that any of Medley's recommendations were addressed in the proposal.

Based on the material provided, there has been inadequate line transect survey of coastal stocks of dolphins. The restricted, near-shore range of these stocks is not well covered by the standard pelagic monitoring cruises. Also, near-shore surveys of dolphins in shallow water may require unique line-transect methods: use of smaller boats in addition to "the survey vessel," zig-sag (saw tooth) patterns along shorelines and in bays, safety restrictions in shallow water, etc. Testing of these methods may be necessary during the process cruise. Unique aspects of line-transect survey design close to shore will likely require unique data analysis procedures. Research to develop or improve unique data analysis procedures for coastal stocks has not been adequately considered in the Proposal.

Extremely large schools (outliers) will apparently be included in the analysis as just another observation, with bootstrapping to estimate standard errors of estimates. On the surface this seems very reasonable. I was once faced with one extremely large group of Pacific walrus spotted by Soviet Union Scientists in an aerial survey for estimation of abundance of the shared population of walrus between the USA and the Soviet Union (now Russia). Inclusion of the group in the estimate of density changed the population estimate by an order of magnitude (we dropped the group from the estimation of density and later added the ocular estimate of the size of the group in). Plans for handling potential outliers should be included in the present proposal.

Overall, are the individual sections well integrated into the proposal as a whole? If not, what could be done to improve integration?

I had no issues with integration of the individual sections into the proposal as a whole.

SUMMARY CONCLUSION

Significant improvements in methods for design and analysis of transect surveys have been made by personnel from the SWFSC over the past 25 years. However, final explicit written protocols for study design, data collection, and data analysis are not provided in the proposal. Explicit written sub-proposals for needed research are not provided. I cannot provide a complete scientific peer review of implicitly implied methods. That said, I have confidence that useful estimates of abundance will be obtained from the proposed research and survey if conducted under the administration and/or guidance of senior personnel at SWFSC including, but not limited to, J. Barlow, T. Gerrodette, and J. Forcada.

APPENDIX A

Bibliography of materials provided by the Center for Independent Experts

Anon. (2006) Long term research in the Eastern Tropical Pacific. A Proposal from the Southwest Fisheries Science Center, NOAA Fisheries Service

Dower, J.F. 2002. A review of ecosystem research in the IDCPA science report. Review paper prepared for the University of Miami Center of Independent Experts, 17 p.

Drinkwater, K. 2002. Final review of the report of the scientific research program under the International Dolphin Conservation Program Act. Review paper prepared for the University of Miami Center of Independent Experts, 30 p.

McAllister, M. 2002. Review of the International Dolphin Conservation Program Act Scientific DRAFT Report. Review paper prepared for the University of Miami Center of Independent Experts, 43 p.

Martineau, D. (2002) Review. 2001 chase encirclement stress studies on dolphins targeted in eastern tropical Pacific Ocean purse seine operations. Review paper prepared for the University of Miami Center of Independent Experts, 31 p.

Medley, P. (200) Second Review of transect sampling methods to obtain population size estimates for northeastern offshore spotted and eastern spinner dolphins. Review paper prepared for the University of Miami Center of Independent Experts, 25 p.

Ortiz, R. (2002) Final Report on the IDCPA Program. Review paper prepared for the University of Miami Center of Independent Experts, 16 p.

Reilly, S.B., Donahue, M.A., Gerrodette, T., Forney, K., Wade, P., Balance, L., Forcada, J., Fiedler, P., Dizon, A., Perryman, W., Archer, F.A. & Edwards, E. F. (2005) Report of the scientific research program under the International Dolphin Conservation Program Act. NOAA-TM-NMFS-SWFSC-372

APPENDIX B
Statement of Work

Subcontract between the University of Miami and Western EcoSystems Technology, Inc.
(Lyman McDonald)

STATEMENT OF WORK
Eastern Tropical Pacific Dolphin Research Plan

Background

The topic of the review is the evaluation of a long-term research plan to monitor the abundance and environment of several species of tropical pelagic dolphins that are killed in the purse seine tuna fishery of the eastern tropical Pacific (ETP), and the evaluation of reasons for the apparent lack of recovery of depleted stocks. The Southwest Fisheries Science Center (SWC) has been conducting research in the ETP since the 1960's. Research topics through the 1980's ranged from assessing direct dolphin mortality in the fishery to an examination of fundamental aspects of biology and life history, monitoring the numbers and types of dolphins being taken, conducting sighting surveys of dolphin abundance from ships to estimate abundance and trends over time, and collecting data and samples on a broad range of attributes of the physical and biological environment.

In a 1997 amendment to the Marine Mammal Protection Act, Congress directed the National Marine Fisheries Service to undertake a research program to determine, by the end of 2002, whether the fishery was having a "significant adverse impact" on depleted dolphin stocks in the ETP. The research program that the SWC designed included four components: abundance estimation, ecosystem studies, stress and other fishery effect studies, and stock assessment. This research culminated in a Final Science Report (FSR) in 2002 and thirty-four separate science papers to provide information for answering the question posed by Congress.[] The FSR contained the following primary conclusions: (1) northeastern offshore spotted dolphins were at 20% and eastern spinner dolphins at 35% of their pre-fishery levels of the late 1950's, levels largely unchanged since the 1970s; and (2) neither population is recovering at a rate consistent with these levels of depletion and very substantial reductions in reported kills. Data on the possible causes for the continued depletions were too sparse to be conclusive on possible ecosystem effects, but existing information did not support the occurrence of the 70% reduction in effective carrying capacity that would be required to cause the dolphin stocks to remain stable at such low levels. Data and results on possible indirect fishery effects also were inconclusive, but did disclose a common pattern of separation of cows and nursing calves. More data and studies are needed to bring closure to questions surrounding the lack of substantial progress toward recovery by these severely depleted dolphin stocks. The long-term ETP research proposal describes a program of action directed at this closure.

Reviewer Responsibilities

The Center of Independent Experts (CIE) shall provide four expert reviewers. Each reviewer's duties shall require a maximum of seven days of effort, including time to read relevant documents and to produce an individual written report consisting of their comments and recommendations. No travel is required, so each reviewer shall work from their home location.

Each reviewer's report shall reflect his/her area(s) of expertise, and no consensus opinion (or report) will be required. Further, each reviewer shall only comment on sections within his/her area of expertise.

Expertise needed to review the proposed long-term research plan, including its methods, scope and priorities, includes the following: (1) cetacean biology, (2) line transect-based abundance estimation and stock assessment modeling, (3) biological oceanography and pelagic marine ecology, and (4) population identity – stock structure.

Documents supplied to the reviewers shall consist of the (1) Long-Term Research Proposal in the ETP, (2) 2002 Final Science Report, and (3) CIE reviews of the Final Science Report. The reviewers shall become familiar with the research plan and the background documents.

Specific Reviewer Tasks and Schedule

1. Read and consider the 2002 Final Science Report and CIE reviews of the Final Science Report that provide context and background on research in the eastern tropical Pacific Ocean.
2. Read and analyze the Long-Term Research Proposal for the ETP that describes the SWC's approach to resolve the cause(s) of the apparent lack of recovery by depleted dolphin stocks in the ETP.
3. Specific points to be addressed (at minimum) for sections within each reviewer's area of expertise:
 - (a) Is the scope of the proposal adequate and appropriate?
 - (b) Are any areas addressed in less, or more, depth than needed?
 - (c) Are the approaches proposed unbiased?
 - (d) Does the proposal represent Best Available Science? If not, what specifically would be required to meet that designation, in your opinion?
 - (e) Comment on the proposal's strengths and weaknesses, and suggest any additional lines of research that appear promising.
4. Specific points to be addressed (at minimum) for all sections:
 - (a) Overall, are the individual sections well integrated into the proposal as a whole? If not, what could be done to improve integration?
5. No later than August 1, 2006, submit a written report¹ to the CIE that addresses the points in items 3 and 4 above. See Annex I for additional details on the report outline. Each report shall be sent to Dr. David Die, via email at ddie@rsmas.miami.edu, and to Mr. Manoj Shivilani, via email at mshivilani@rsmas.miami.edu.

¹ Each written report will undergo an internal CIE review before it is considered final.

ANNEX I: REPORT GENERATION AND PROCEDURAL ITEMS

1. The report should be prefaced with an executive summary of comments and/or recommendations.
2. The main body of the report should consist of a background, description of review activities, summary of comments, and conclusions/recommendations.
3. The report should also include as separate appendices the bibliography of materials provided by the Center for Independent Experts and a copy of the statement of work.

Please refer to the following website for additional information on report generation:
http://www.rsmas.miami.edu/groups/cimas/Report_Standard_Format.html
