A Review of Ecosystem Research in the IDCPA Science Report

Prepared for the UM Independent System for Peer Reviews

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Executive Summary: As part of a review to address the status of depleted dolphin stocks in the Eastern Tropical Pacific (ETP hereafter), NMFS scientists from the Southwest Fisheries Science Center (SWFSC) conducted two multi-year research programs during the late 1980's (the Monitoring of Porpoise Stocks project, or MOPS) and late 1990's (the *Stenella* Abundance Research project, or STAR). The results from these two programs were presented in a series of nine research papers which were reviewed by a panel of independent experts (contracted via the Center for Independent Experts (CIE)). As part of the review, the Panel met with the NMFS scientists at the SWFSC for two days in March of 2002. Following the meeting, Panel members each submitted a report summarizing his/her impressions of the ecosystem research, and making specific recommendations as to how the nine research papers might be improved. The current report reviews the revised versions of these nine ecosystem research papers and evaluates the extent to which the NMFS scientists incorporated suggestions made by the CIE Panel.

***Summary of Findings*:**

1. In short, the NMFS scientists have done a good job of incorporating as many of the reviewers' suggestions as possible, within the very limited time available to them.

2. In many cases, the authors acknowledged that, although specific suggestions (particularly those concerning new analyses) were worth considering, the limited time available precluded their conducting such analyses within the available time frame. In such cases, the authors generally stated that although such analyses would not be included in the IDCPA Science Report, they would be duly incorporated before the papers in question were submitted to peer-reviewed scientific journals.

3. In those (admittedly few) instances where the authors disagreed with specific suggestions and/or interpretations made by the reviewers, adequate evidence was provided by the authors to support their point of view.

***Overall recommendation*:** Having now undergone two rounds of rigorous review by independent experts, and having duly incorporated many of the comments made by those reviewers, this

collection of ETP ecosystem research papers is ready to be incorporated into the IDCPA Science Report. I see no need for any further review of these papers.

1. BACKGROUND: Purse-seining for tuna in the ETP began in the late 1950's, after it was discovered that spotted dolphins (*Stenella attenuata*) and spinner dolphins (*S. longirostris*) formed mixed aggregations with yellowfin tuna (*Thunnus albacares*). In the early days of the fishery, little attempt was made to minimize dolphin mortality during seining operations. Some estimates put the number of dolphins killed annually to be as high as 200,000 - 800,000.

In 1972 the U.S. Congress passed the Marine Mammal Protection Act (MMPA), in part, as an attempt to reduce the impact of activities such as purse-seine fisheries on dolphin stocks. Among its recommendations, the MMPA stated that "measures should be taken immediately to replenish any species or population stock which has diminished below its optimum sustainable level." By the late 1980's, some ETP dolphin stocks had declined to levels resulting in their designation as “depleted”. By 1992, due largely to improved fishing practices, fishery-related mortality of ETP dolphins had fallen to levels considered unlikely to impede the future recovery of these depleted stocks (*i.e.* direct fishing-related mortality is now believed to be 0% in about 90% of seine sets). In 1997 the International Dolphin Conservation Program (IDCPA) was established by an act of Congress. Its mandate was to determine whether purse-seining continues to have significant adverse impact on depleted ETP dolphin stocks. Data used in the IDCPA assessments came from two primary sources: the Monitoring of Porpoise Stocks (MOPS) project (1986-90), and the Stenella Abundance Research (STAR) project (1998-2000). Both projects involved massive field efforts, generally four months of marine mammal and ecosystem surveys per year, on each of two large oceanographic vessels, plus the collection of a wide variety of ancillary biological and oceanographic data.

2. DESCRIPTION OF REVIEW ACTIVITIES: A preliminary IDCPA report was submitted to Congress in 1999. At that time, there was no evidence of significant recovery of the depleted ETP dolphin stocks. Furthermore, there was no indication of any significant change in the ETP ecosystem that could explain the apparent lack of recovery. At that point, however, data was still being collected under the STAR program. In 2002, an international panel of five ocean scientists was formed to review the results of these ecosystem studies (contracted via the Center for Independent Experts (CIE)). NMFS scientists from the SWFSC produced a series of working papers for the review panel. The overall management question put to the panel was: "*Has there been a change in the ETP ecosystem that might affect the recovery of dolphin stocks from depleted levels*?"

The review panel met with the scientists at the SWFSC from March 6-8, 2000, where the NMFS scientists presented their data and provided interpretations of their results. The meeting also afforded an opportunity for the review panel to raise further questions about the ecosystem studies and offer

alternative interpretations of the results. The review panel was then instructed to consider the results from these working papers in light of two specific questions:

- *Has there been a change in the ETP ecosystem?*
- *Are there temporal patterns in the ecosystem, and how are they best described?*

Following the meeting with the NMFS scientists, the panel members each submitted a report in which they evaluated of the conclusions drawn by the authors, and suggested changes and/or additional analyses to improve the papers.

The goal of the present report is to examine revised versions of the nine ecosystem research papers (for inclusion in the final IDCPA Science Program Review) and evaluate the extent to which the authors addressed the suggestions made by individual panel members (hereafter 'Reviewers'). To do this, I first read all the reports submitted by the Ecosystem Review Panel members (*i.e.* J. Dower, K. Drinkwater, G. Hunt, H. Oxenford and P. Thompson) generally, each report made specific comments and recommendations on all nine ecosystem research papers. I then read the nine revised ecosystem research papers, paying particular attention to sections in which the authors explained how they chose to deal with the Reviewers' comments (in a manner similar to the role filled by a journal editor when considering manuscripts revised in response to referees' comments). I submitted a draft report to the Center for Independent Experts on August 13th, and on August 16th I participated in a conference call resolving some outstanding issues between the other Reviewers and some of the SWFSC scientists.

3. SUMMARY OF COMMENTS:

Summary of the Reviewers Comments: In reading the Reviewers comments it was clear that the panel supported the conclusions reached by the NMFS scientists. In particular, the panel members agreed unanimously that, *based upon the evidence presented,* there was no indication of a significant ecosystem change in the ETP. The panel members did point out, however, that the short and fractured nature of both the various physical and biological time-series (but particularly the biological time series) made it quite difficult to detect ecosystem trends for the period in question. Several Reviewers also commented that rather than compare conditions between MOPS and STAR, the more telling test would have been to compare the MOPS and STAR data with data collected prior to the last significant regime shift in the ETP (1976-77), when ETP dolphin numbers were significantly higher. Thus, if ecosystem conditions are contributing to the current lack of recovery, then the comparison of data from the two different regimes might prove instructive. Unfortunately, since pre-1977 data are quite scarce, making direct comparisons is problematic. The reviewers unanimously recommended that, wherever possible, pre-1977 data be re-examined in light of this question. Particular mention was made of the late 1960's EASTROPAC program , the data from

which have never been fully analyzed (in fact, in some cases, the data are still not converted to electronic format). The panel urged the authors to secure this data as soon as possible.

Comments on Revised Versions of the Ecosystem Research Papers: In this section I will briefly review the changes made by the authors in response to the Reviewers' comments. I also examine those suggestions that the authors chose not to include and whether, in my opinion, the authors were justified in doing so. In short, the NMFS scientists have done a fine job of incorporating as many of the reviewers' suggestions as possible within the very limited time available to them.

In many cases, the authors acknowledged that although specific suggestions (particularly those concerning new analyses) were worth considering, time restraints precluded their inclusion in the final IDCPA Science Report. However, the authors generally stated that such analyses would be incorporated before the submission of the papers in question to peer-reviewed scientific journals. In instances where the authors disagreed with specific suggestions made by the Reviewers, adequate evidence was provided by the authors to support their point of view.

Ballance et al. (2002) An overview of eastern tropical Pacific ecosystems studies within the context of International Dolphin Conservation Program Act research

> ***Comments:*** As this paper was primarily an introduction to the MOPS and STAR ecosystem research studies, it received very specific few comments from the Reviewers. Where specific comments were made, however, these appear to have been included in the revised draft.

Ballance *et al.* (2002) Investigations into temporal patterns in distribution, abundance and habitat relationships within seabird communities of the eastern tropical Pacific

> ***Comments:*** In general, the Reviewers unanimously supported the conclusions of this paper. Most of the minor changes suggested by the Reviewers have been incorporated into the revised draft. While several more, substantial issues were raised (mainly related to additional analyses that may strengthen the paper), the authors acknowledged that, time constraints precluded their inclusion in the revised draft; these comments may, however, be included in future work, and before submitting the manuscript to a peer-reviewed scientific journal. Given (i) the very limited time available to the authors between receiving the Reviewers' comments and producing the revised draft, and (ii) that in no case were the Reviewers' suggestions likely to change the general conclusions, these decisions seem appropriate.

Fielder & Philbrick (2002) Environmental change in the eastern tropical Pacific Ocean:

Observations in 1986-1990 and 1998-2000

Comments: The Reviewers supported the general conclusion of this paper (*i.e.,* following the last regime change in 1976-77, there was no discernible change in the ETP physical environment). Numerous suggestions were made regarding improvements for future data collection, which the authors state would then be duly considered . All Reviewers also urged the acquisition of any pre 1977-77 data for comparison with MOPS and STAR biological data from MOPS and STAR (a theme common to several other of the papers). The authors provided reasonable rebuttals for the three Reviewer suggestions which they chose not to incorporate into the revised draft.

Fiedler (2002) Environmental change in the eastern tropical Pacific Ocean: Review of ENSO and decadal variability

Comments: The Review panel unanimously supported the general conclusions of this paper, (*i.e.* ENSO was the dominant physical forcing signal in the ETP, followed by decadal-scale variability). e . Broadly speaking, the Reviewers' comments for this paper were similar to those for Fiedler & Philbrick (2002) (e.g., suggestions for future data collection were noted by the authors for consideration at that time). Numerous small changes and suggestions have been incorporated into the paper. The authors also provided reasonable rebuttals for five specific Reviewer proposals, excluded from the revised draft.

Gerrodette & Forcada (2002) Estimates of abundance of striped and common dolphins, and pilot, sperm and Bryde's whales in the eastern tropical Pacific Ocean

Comments: A (supposedly) revised version of this paper, postedon the CIE Website, was, in fact, identical to the original version I had reviewed in March. During the August 16th conference call , lead author Tim Gerrodette explained this had been merely an oversight, and that his co-author and he fully intend to incorporate the following specific Reviewers' suggestions (see below) in time for inclusion in the IDCPA Science Report:

· The abundance estimates need some sort of confidence limits.

· Given the large gap in the middle of the time series, linear regression is not an appropriate analysis of this data; instead, the use of an ANOVA approach, or some sort of distribution-free technique would be more appropriate.

· Figure 3 should be redrawn so that the MOPS and STAR data are not connected as a continual series. Visually, this gives a misleading impression that abundances are increasing between 1990-1998 (a conclusion not substantiated by the statistics).

Pitman *et al.* (2002) Temporal patterns in distribution and habitat associations of prey fishes and squids

Comments: The Reviewers agreed this paper presented some of the strongest evidence for biological changes during the MOPS and STAR programs. In both programs, the abundances of squids and forage fish were low at the beginning of the program and increased toward the end of the program. Pitman et al. suggest this may be evidence for rapid recovery of these stocks after a pair of El Niño events, a suggestion generally supported by the Reviewers. A wide range of comments were offered by the Reviewers, most of which were deferred by the authors for inclusion in future peer-review publications. While this certainly seems reasonable with respect to any substantially new analyses, the "editorial" changes (aimed mainly at clarifying the Methods), should probably be made before inclusion in the IDCPA report (the authors should refer to Oxenford's commentary in Point 1, pg. 51 of the revised manuscript). Several reviewers again remarked on the inclusion of EASTROPAC data into any future analyses, which the authors have agreed to do. Reasonable rebuttals were provided for the two Reviewer suggestions with which the authors did not agree.

Moser *et al.* (2002) Preliminary report on ichthyoplankton collected in manta (surface) net tows on marine mammal surveys in the eastern tropical Pacific: 1987-2000

Comments: This paper presents a huge amount of datawhich the authors have not completely analysed . Two distinct [ichthyoplankton?] species complexes are identified, and preliminary conclusions suggest no significant temporal abundance or distribution trends between MOPS and STAR (the apparent increased abundance during STAR was likely a sampling artefact). The Reviewers supported these findings. Suggestions for further analyses included examination of the oblique bongo samples from STAR (to consider vertical distributions), and comparison of MOPS/STAR data with larval data from the EASTROPAC project. Suggestions were also made for any future sampling (*e.g.,* preserve a sampling-subset for otolith analyses). The authors acknowledge the need for these further analyses, and will begin comparisons with the EASTROPAC data set in 2003.

Reilly *et al.* (2002) Recent information to aid in detecting regime shifts in the eastern tropical Pacific Ocean

Comments: Although in this paper Reilly et al. synthesize the data presented in the other papers, few obvious temporal patterns emerge. In fact, as pointed out by nearly all the Reviewers, temporal trends are difficult to identify from the short time series (particularly when data are available for only about half of the years in question). This constraint was originally cited by the authors as justification against further analyses on these data. However, based on Reviewer comments, an additional figure (Figure 11) was added to the revised manuscriptin an attempt to look for coherence between the various time series. This new analysis suggests that extreme anomalies among the various ETP time series tend to coincide with El Niño years.

Reilly *et al.* (2002) Eastern tropical Pacific dolphin habitats - Interannual variability 1986-2000

Comments: Reviewers supported the general conclusions reached by this paper, which showed that habitat associations and distributions of dolphins did not change significantly between MOPS and STAR years. Several Reviewers raised concerns about the way the CCA analyses were conducted, and suggested alternative strategies for grouping and stratifying samples, as well as for choosing appropriate oceanographic variables. The authors have made a concerted effort to incorporate as many of these new analyses in the time available (indicating that other suggestions will be incorporated prior to journal publication). In several cases the authors acknowledge that the revisions substantially improved model performance. In the few instances where the authors disagreed with the Reviewers' comments, they have provided an ample defence of their opinion. I did note, however, that some of Drinkwater's "editorial" comments had not been corrected (*e.g.* missing or incomplete reference cited in the text, etc.).

4. CONCLUSIONS/RECOMMENDATIONS:

· Having now undergone two rounds of rigorous review by independent experts, and having duly incorporated many of the comments made by those Reviewers, this collection of ETP ecosystem research papers is ready to be incorporated into the IDCPA Science Report. I see no need for any further review of these papers.

· I am satisfied with the way that the Reviewers' comments were rebutted in those instances where the authors disagreed with Reviewers.

· Due to the time constraints imposed on the authors, many of the changes suggested by the Reviewers have not yet been implemented. In most cases the authors indicate that these changes will be made prior to publication. This seems entirely reasonable, assuming of course that the changes in question actually are made at a later date!

· One of the recurrent themes in the Reviewers comments was the need to secure any pre-1977 data from the ETP to facilitate comparison between MOPS/STAR (when dolphin stocks were consistently low) and conditions during the previous oceanographic regime (when stocks were more abundant). Particular mention was made of the EASTROPAC program data , and every attempt should be made to ensure that these data are not lost.

· Several Reviewers commented on the surprising lack of data on the current condition of ETP dolphins. Although perhaps outside the scope of the ecosystem research *per se*, the fact that dolphins are long-lived top predators suggests that they integrate changes in the physical environment over many years, possibly decades. Thus, there may be a good case to requir e examination of all dolphins killed during ETP seining operations .

· The Reviewers unanimously felt that further field sampling is necessary, not only to track the fate of ETP dolphin stocks, but to better understand how the ETP ecosystem functions and how variability in the physical environment interacts with fishing activities.

APPENDIX I: Bibliography of Materials Provided for this Review:

Dower, J.F. 2002. A review of ecosystem research in the eastern tropical Pacific during the monitoring of porpoise (MOPS) and *Stenella* Abundance Research (STAR) Programs. Review paper prepared for the University of Miami Center of Independent Experts, 26 p.

Drinkwater, K.F. 2002. Review of Ecosystem Research conducted as part of the studies to assess the impact of the eastern tropical Pacific yellowfin tuna purse seine fishery on dolphin stocks. Review paper prepared for the University of Miami Center of Independent Experts, 25 p.

Hunt, G.L.Jr. 2002. Review of eastern tropical Pacific ecosystem studies. Review paper prepared for the University of Miami Center of Independent Experts, 22 p.

Oxenford, H.A. 2002. Review of eastern tropical Pacific (ETP) Ocean ecosystem studies. Review paper prepared for the University of Miami Center of Independent Experts, 23 p.

Thompson, P. 2002. Center for Independent Experts review of NMFS studies of ETP ecosystems. Review paper prepared for the University of Miami Center of Independent Experts, 17 p.

1. IDCPA research program:

SWFSC. 2002. Report of the overall IDCPA research program and results.

2. Abundance estimates for depleted dolphin stocks:

Brandon, J., T. Gerrodette, W. Perryman and K. Cramer. 2002. Responsive movements and g(0) for target species of research vessel surveys in the eastern tropical Pacific Ocean. Administrative Report No. LJ-02-02, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Forcada, J. 2002. Multivariate methods for size-dependent detection in conventional line transect sampling. Administrative Report No. LJ-02-07, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Gerrodette, T and J. Forcada. 2002. Estimates of abundance of northeastern offshore spotted, coastal spotted, and eastern spinner dolphins in the eastern tropical Pacific Ocean. Administrative Report No. LJ-02-06, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Gerrodette, T., W. Perryman and J. Barlow. 2002. Calibrating group size estimates of dolphins in the eastern tropical Pacific Ocean. Administrative Report No. LJ-02-08, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Kinzey , D., T. Gerrodette and D. Fink. 2002. Accuracy and precision of perpendicular distance measurements in shipboard line-transect sighting surveys. Administrative Report No. LJ-02-09, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Review of Ecosystem Research in the IDCPA Science Report

***3. Ecosystem studies*:**

Ballance, L. T., P. C. Fiedler, T. Gerrodette, R. L. Pitman and S. B. Reilly. 2002. An overview of eastern tropical Pacific ecosystems studies within the context of International Dolphin Conservation Program Act research. Administrative Report No. LJ-02-14, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Ballance, L. T., R. L. Pitman, L. B. Spear and P. C. Fiedler. 2002. Investigations into temporal patterns in distribution, abundance and habitat relationships within seabird communities of the eastern tropical Pacific. Administrative Report No. LJ-02-17, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Fiedler, P. C. 2002. Environmental change in the eastern tropical Pacific Ocean: Review of ENSO and decadal variability. Administrative Report No. LJ-02-16, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Fielder, P. C. and V. A. Philbrick. 2002. Environmental change in the eastern tropical Pacific Ocean: Observations in 1986-1990 and 1998-2000. Administrative Report No. LJ-02-15, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Gerrodette, T. and J. Forcada. 2002. Estimates of abundance of striped and common dolphins, and pilot, sperm and Bryde's whales in the eastern tropical Pacific Ocean. Administrative Report No. LJ-02-20, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Moser, H. G., P. E. Smith, R. L. Charter, D. A. Ambrose, W. Watson, S. R. Charter and E. M. Sandknop. 2002. Preliminary report on ichthyoplankton collected in manta (surface) net tows on marine mammal surveys in the eastern tropical Pacific: 1987–2000. Administrative Report No. LJ-02-18, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Pitman. R. L., L. T. Ballance and P. C. Fiedler. 2002. Temporal patterns in distribution and habitat associations of prey fishes and squids. Administrative Report No. LJ-02-19, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Reilly, S. B., L. T. Ballance, P. C. Fiedler, T. Gerrodette, R. L. Pitman, H. G. Moser, L. B. Spear and J. M. Borberg. 2002. Recent information to aid in detecting regime shifts in the eastern tropical Pacific Ocean. Administrative Report No. LJ-02-22, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Reilly, S. B., P. C. Fiedler, T. Gerrodette, L. T. Ballance, R. L. Pitman, J. M. Borberg and R. L. Holland. 2002. Eastern tropical Pacific dolphin habitats - Interannual variability 1986-2000. Administrative Report No. LJ-02-21, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

4. Stress and other possible fishery effects:

Chivers, S. J., and M. D. Scott. 2002. Tagging and tracking of Stenella spp. during the 2001 Chase Encirclement Stress Studies Cruise. Administrative Report No. LJ-02-33, NMFS, Southwest Fisheries Science Center,

8604 La Jolla Shores Drive, La Jolla, CA 92037.

Cowan. D. F., and B. E. Curry. 2002. Histopathological assessment of dolphins necropsied onboard vessels in the eastern tropical Pacific tuna fishery. Administrative Report No. LJ-02-24C, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Cramer, K., and W. L. Perryman. 2002. Estimation of reproductive and demographic parameters of the eastern spinner dolphin (Stenella longirostris orientalis) using aerial photography. Administrative Report No. LJ-02-31, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Dizon, A., A. Allen, N. Kellar, and Sárka Southern. 2002. Stress in spotted dolphins (Stenella attenuata) associated with purse-seine tuna fishing in the eastern tropical Pacific. Administrative Report No. LJ-02-26, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Edwards, E. F. 2002. Behavioral contributions to separation and subsequent mortality of dolphin calves chased by tuna purse-seiners in the eastern tropical Pacific Ocean. Administrative Report No. LJ-02-28, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Edwards, E. F. 2002. Energetics consequences of chase by tuna purse-seiners for spotted dolphins (Stenella attenuata) in the eastern tropical Pacific Ocean. Administrative Report No. LJ-02-29, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Forney, K. A., D. J. St. Aubin, and S. J. Chivers. 2002. Chase Encirclement Stress Studies on dolphins involved in eastern tropical Pacific Ocean purse seine operations during 2001. Administrative Report No. LJ-02-32, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Mesnick, S. L., F. I. Archer, A. C. Allen, and A. E. Dizon. 2002. Evasive behavior of eastern tropical Pacific dolphins relative to effort by the tuna purse-seine fishery. Administrative Report No. LJ-02-30, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Pabst, D. A., W. A. McLellan, E. M. Meagher, A. J. Westgate. 2002. Measuring temperatures and heat flux from dolphins in the eastern tropical Pacific: Is thermal stress associated with chase and capture in the ETP-tuna purse seine fishery? Administrative Report No. LJ-02-34C, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Romano, T., K. Abella, D. Cowan, and B. Curry, 2002. Investigation of the morphology and autonomic innervation of the lymphoid organs in the pantropical spotted, spinner, and common dolphins (Stenella attenuata, Stenella longirostris and Delphinus delphis) incidentally entangled and drowned in the tuna purse-seine fishery in the eastern tropical Pacific. Administrative Report No. LJ-02-25C, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Romano, T., M. Keogh, and K. Danil. 2002. Investigation of the effects of repeated chase and encirclement on the immune system of spotted dolphins (Stenella attenuata) in the eastern tropical Pacific. Administrative Report No. LJ-02-35C, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Santurtún, E., and F. Galindo. 2002. Coping behaviors of spotted dolphins during fishing sets. Administrative Report No. LJ-02-36C, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Southern, S., A. Allen, and N. Kellar. 2002. Molecular signature of physiological stress based on protein expression profiling of skin. Administrative Report No. LJ-02-27, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

St Aubin, D. J. 2002. Further assessment of the potential for fishery-induced stress on dolphins in the eastern tropical Pacific. Administrative Report No. LJ-02-23C, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

St. Aubin, D. J. 2002. Hematological and serum chemical constituents in pantropical spotted dolphins (Stenella attenuata) following chase and encirclement. Administrative Report No. LJ-02-37C, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

5. Quantitative stock assessment of depleted dolphins:

Archer, F. and S. J. Chivers. 2002. Age structure of the Northeastern spotted dolphin incidental kill by year for 1971 to 1990 and 1996 to 2000. Administrative Report No. LJ-02-12, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Archer, F., T. Gerrodette and A. Jackson. 2002. Preliminary estimates of the annual number of sets, number of dolphins chased, and number of dolphins captured by stock in the tuna purse-seine fishery in the eastern tropical Pacific, 1971-2000**.** Administrative Report No. LJ-02-10, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Chivers, S. J. 2002. Age structure of female eastern spinner dolphins (*Stenella longirostris orientalis*) incidentally killed in the eastern tropical Pacific tuna purse-seine fishery. Administrative Report No. LJ-02-11, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Wade, P. R. 2002. Assessment of the population dynamics of the northeastern offshore spotted and the eastern spinner dolphin populations through 2002. Administrative Report No. LJ-02-13, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

6. Coastal spotted dolphins:

Escorza-Trevino, S., A. Lang and A. E. Dizon. 2002. Genetic differentiation and intraspecific structure of eastern tropical Pacific spotted dolphins, *Stenella attenuata*, revealed by mitochondrial and microsatellite DNA analyses. Administrative Report No. LJ-02-38, NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

APPENDIX II: Statement of Work

STATEMENT OF WORK

Consulting Agreement Between The University of Miami and Dr. John Dower

Background

The tuna purse seine fishery has used the association between tuna and dolphins to fish in the eastern tropical Pacific Ocean (ETP) for over five decades. Three stocks of dolphins were depleted by high historical levels of dolphin mortality in tuna purse seine nets, with an estimated 4.9 million dolphins killed during the fourteen-year period 1959-1972. After passage of the Marine Mammal Protection Act (MMPA) in 1972 and the increased use of fishing equipment and procedures designed to prevent dolphin deaths, mortality decreased during the late 1970s, 1980s, and 1990s to levels that are generally considered biologically insignificant.

While changes in the fishery have dramatically reduced the observed mortality of dolphins, the MMPA, as amended by the International Dolphin Conservation Program Act (IDCPA), requires that the National Marine Fisheries Service (NMFS) conduct research consisting of three years of population abundance surveys and stress studies to form the basis of a determination by the Secretary of Commerce regarding whether the "intentional deployment on, or encirclement of, dolphins by purse-seine nets is having a significant adverse impact on any depleted dolphin stock". The Secretary must make a final finding in this regard by December 31, 2002. It should be noted that this issue is controversial and particularly relevant to persons involved with NMFS, the US and non-US tuna industry, and environmental groups.

The topic of this review is the IDCPA Science Report that will be presented to the Secretary of Commerce, along with information obtained under the IDCP, and other relevant information to form the basis of the Secretary's final finding. The IDCPA Science Report is comprised of the results of all research activities required under section 304(a) of the MMPA, as amended by the IDCPA. Each major component of this report has been separately considered in a series of independent peer reviews conducted by the Center for Independent Experts (CIE). These consist of: the Abundance Review (October 15-17, 2001) the Stress Review (February 4-6, 2002), the Ecosystem Review (March 6-8, 2002), and the Assessment Model Review (April 3-5, 2002).

Abundance Review

The topic of this review was the abundance of several species of tropical pelagic dolphins that associate with tuna and are killed in the ETP purse seine tuna fishery. Estimates of dolphin abundance based on cruises carried out in 1998-2000 form a central part of these studies. The main task of the consultant was to review the methods used to estimate abundance from line-transect data, including covariate detection models. The fact that these dolphins occur in a wide range of school sizes presents unique problems for the estimation of expected group size, so considerable effort has been devoted to this analysis. Documents supplied to the reviewers included draft manuscripts describing the covariate analysis, simulations to test the performance of several estimators, calibration of school size estimates, and assignment of partially identified sightings. Background papers included previous relevant publications and reports. The raw data and software used in the analysis were also made available.

Stress Review

The stress studies mandated in the IDCPA include: 1) a review of relevant stress-related research and a three-year series of necropsy samples from dolphins obtained by commercial vessels; 2) a one-year review of relevant historical demographic and biological data related to the dolphins and dolphin stocks; and 3) an experiment involving the repeated

chasing and capturing of dolphins by means of intentional encirclement. This review included a suite of studies subsumed under this general topic, and a brief description of these studies follows.
The necropsy program analyzed samples from about 50 dolphins killed incidentally during fishing operations. Historical biological samples and data were analyzed to investigate stress-activated-proteins (SAPs) in the skin in dolphins killed in the fishery and live-sampled via biopsy. Historical data were also examined to assess separation of cows and calves during fishing operations. Chase Encirclement Stress Studies were conducted during a two-month research cruise aboard the NOAA ship McArthur in the ETP. During this project, the team worked in cooperation with a chartered tuna purse seine vessel to study potential effects of chase and encirclement on dolphins involved in tuna purse seine operations. Dolphins groups were found to be much more dynamic than previously recognized, making it extremely difficult to recapture groups of dolphins over the course of several days to weeks, as planned.

In the end, nine different dolphins were tracked for 1-5 days during the course of the study, including two animals outfitted with a thermal tag that recorded heat flux, temperature, and dive data. Individual radio-tagged dolphins and 1-4 associated roto-tagged dolphins were recaptured on several occasions spanning shorter periods of 1-3 days. Six satellite tags were deployed to record movement and dive data on dolphins that were not recaptured. Biological data and samples were collected from as many captured dolphins as possible, and include: 70 blood samples, of which 18 were from repeat captures of marked individuals; 283 skin samples, of which 17 were from previously captured and sampled animals; 449 analyzable thermal images; 52 core temperatures; and 95hrs of heat flux data. Females with calves were noted on several recapture occasions, and one known calf was skin sampled during an initial and subsequent capture.

Ecosystem Review

To complement the three-year abundance studies, population assessments were made for the following years: 1986, 1987, 1988, 1989, 1990, 1998, 1999, and 2000 with a primary goal being to determine if populations that were historically reduced in size are increasing over time. Should the assessments indicate no increase (lack of recovery), three broad categories of factors could be the cause: a) effects from the fishery; b) effects from the ecosystem; c) an interaction between the proceeding two factors. This need to attribute causality for a potential lack of recovery serves as the primary justification for ecosystem studies. By investigating the physical and biological variability of the ecosystem of which the dolphin stocks are a part, we establish a context which can be used to better interpret trends in dolphin abundance. A lack of recovery that is not mirrored by some other change in the ecosystem would largely eliminate an ecosystem hypothesis, leaving fishery effects as the most likely cause.

This review included a suite of studies subsumed under the general topic of ecosystem research in the ETP. The basic approach was to compare ecosystem parameters over time with a primary goal being to look for indications of a potential ecosystem shift. The power of these ecosystem studies increased with the number of environmental variables, taxa, and trophic levels included, and with the time period spanned (although most ecosystem data available for these investigations were collected concurrently with dolphin assessment data aboard NOAA research vessels and are restricted to the late 1980s and late 1990s).

The general components of the ecosystem research included: 1) physical and biological oceanography: sea surface temperature, thermocline characteristics, phytoplankton and zooplankton distribution and relative abundance; 2) larval fishes: distribution and relative abundance; 3) flying fishes: distribution, relative abundance, and habitat relationships; 4) seabirds: distribution, absolute abundance, and habitat relationships; and 5) cetaceans: distribution, absolute abundance, and habitat relationships.

Assessment Model Review

As indicated above, NMFS was charged with essentially determining whether or not the depleted dolphin stocks are recovering, and if so, at what rate and at what level of certainty. The topic of this review was the overall framework that

will be to estimate the growth rate of two dolphin populations of interest, the northeastern offshore spotted dolphin and the eastern spinner dolphin, using growth rates estimated by fitting a population model to the three-year and other available estimates of abundance. For this review, estimates from research vessel surveys using line transect methods are available for three periods: 1979-83 (four estimates), 1986-90 (five estimates), and 1998-2000 (three estimates), for a total of twelve estimates over twenty-one years. Reviewers were also asked to evaluate the inclusion or exclusion of a set of fishery-dependent indices of abundance, resulting from data collected by tuna vessel observers. Two types of population growth rate will be estimated: (1) exponential rate of change from 1979-2000 and (2) intrinsic rate of increase under the assumption of a density-dependent model where pre-exploitation population size in 1958 is considered carrying-capacity. Both an aggregated population model and an age-structured model will be used. Bayesian statistics, using a numerical integration method, were used to estimate a probability distribution for the population growth rate.

Specific Reviewer Responsibilities

For the final IDCPA Science Program Review, expertise is needed to review all components of the research described above, specifically with respect to NMFS' incorporation of comments previously received from the topical reviews also described above. Reviewers will be provided with the draft IDCPA Science Report, as well as comments received as a result of the CIE reviews and explanations of how/why such comments were or were not incorporated into the report.

The reviewer's duties shall not exceed a maximum total of 11 days, including:

· 2-3 days to read the draft IDCPA Science Report (to be provided to the reviewers by no later than August 2, 2002);

· 2-3 days to produce a written report of the reviewer's comments and recommendations on the draft report;

· 1-2 days to discuss via telephone, on August 15-16, 2002, with relevant NMFS staff from the NMFS La Jolla Laboratory, the incorporation of comments and any related questions; and

· 2-3 days to revise the written report based on those discussions.

It is expected that each reviewer will have participated in the earlier CIE reviews of IDCPA research described above and will not require general presentations of research results, but will focus on addressing comments and recommendations included in the reviewers' reports in his/her topic area. Reviewers should particularly consider whether the responses to the original review comments are sufficient and acceptable, in a manner similar to the role filled by a journal editor when considering manuscripts revised in response to referees' comments.

Each reviewer's report shall reflect the reviewer's area of expertise; therefore, no consensus opinion (or report) will be required. Specific tasks and timings are itemized below:

1. Read and become familiar with the draft IDCPA Science Report provided in advance;

2. No later than August 13, 2002, submit a written report of findings, analysis, and conclusion in the individual reviewer's topic area to NMFS;

3. Discuss relevant documents with scientists from the NMFS La Jolla Laboratory via telephone on August 15-16, 2002, to facilitate proper incorporation of reviewers' comments;

4. No later than August 23, 2002, submit a revised written report of findings, analysis, and conclusions based on discussions held with relevant NMFS staff from the NMFS La Jolla Laboratory. The written report (see Annex I) should be addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David

Review of Ecosystem Research in the IDCPA Science Report

Die, via email to ddie@rsmas.miami.edu, and to Mr. Manoj Shivlani, via email to mshivlani@rsmas.miami.edu.

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.

4. Individuals shall be provided with an electronic version of a bibliography of background materials sent to all reviewers. Other material provided directly by the center must be added to the bibliography that can be returned as an appendix to the final report.