REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT DATE	3. DATES COVERED *(From - To)*
31-12-02	Final	03-01-2002 – 12/31/2002

4. TITLE AND SUBTITLE

North Pacific Whale Calling Program

5a. CONTRACT NUMBER

5b. GRANT NUMBER

N00014-02-1-0328

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

WHOI proj. # 13032800

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Woods Hole Oceanographic Institution

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

ONR

20030312 240

12. DISTRIBUTION AVAILABILITY STATEMENT

Approved for public release – distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This seventh year of monitoring calling whales via SOSUS hydrophones has continued to provide good data on the seasonal distribution blue, fin, and humpback whales across the North Pacific. These data have allowed assessment of annual movements, environmental variability, and changes in call features. These data demonstrate (1) the occurrence and movements of calling components of the populations of these species in the offshore waters across the North Pacific, (2) the changes in these calls, (3) the estimated numbers of calling whales, (3) the correlation of calling with known features of population activities, (4) the annual patterns of offshore whale calling, and (5) tracks for individual whales. These have allowed good forecasts for the occurrence these strong biological noises.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			William A. Watkins
					19b. TELEPONE NUMBER *(Include area code)* 508-289-2571

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI-Std Z39-18

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31 December 2002

Dr. Robert C. Gisiner, Code 341
Marine Mammal Science and Technology
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Reference ONR Grant #N00014-02-10328

Dear Dr. Gisiner,

This is the final report for the work supported by ONR Grant #N00014-02-10328. The program of monitoring the calling whales across the North Pacific using U.S. Navy SOSUS and other systems has been highly successful. Thanks to ONR and SPAWAR, we've been able to complete another year of uninterrupted monitoring of the calling whales in the deep waters of the North Pacific, following the seasonal distribution of calling blue, fin, and humpback whales, as well as tracking a variety of other cetacean sound sources.

This is the seventh year of this program. The goal has been to describe the seasonal distribution of calling whales across the North Pacific over a long enough period to assess patterns of annual movements, species and environmental variability, and changes in call features. The focus has been on blue, fin, and humpback whales.

The result of the monitoring, has been robust measures of (1) the occurrence and movements of calling components of the populations of these three species in the offshore waters across the North Pacific, (2) tracking of changes in these calls, (3) estimates of numbers of calling whales, (3) correlation of calling with known features of population activities, and (4) repeated observations of the annual patterns of offshore whale calling. These have provided good forecasts for the occurrence these strong biological noises.

Our approach has been to use acoustic monitoring in the off-shore waters of the North Pacific. The sound data were analyzed from hydrophone arrays of the U. S. Navy's Sound Surveillance System (SOSUS) and any others that were available. The Navy data have been systematically monitored and analyzed at NOPF, Whidbey Is., WA, by operators (Joseph George and trained associates)

experienced in the operation of Navy sound processing systems and in identification of the whale calls. Calling whales have been monitored regularly over the last seven years during a rigid, consistent monitoring schedule over 16 hours on each of two, usually consecutive, days every week, centered on 1200 GMT to provide monitoring during both daylight and darkness across the Pacific.

Results of this monitoring continue to show the consistency of the whale seasonal distributions, different for each species. Blue whales calls are heard year-round, but with a strong seasonal peak in all regions occurring in the early fall from relatively scattered groups and individuals, particularly in the NW and NC regions. Fin whale calling is concentrated in mid winter from localized groups of whales occupying particular deep-water areas in the eastern and central regions, with no calling during the summer season. Humpback singing begins in winter in the NC and NE, moves to the SE region apparently with migration to and from southern waters, and then ends in spring back in NC waters. Environmental effects, such as from El Nino, were noted in the timing of blue whale calling, but not in fin or humpback sounds.

In addition to monitoring the seasonal variations in distribution of these calling whales, other whale sources have been monitored closely, including a unique "52-Hz" source that is likely a blue/fin hybrid tracked over ten seasons. Tracks for this whale for the ten years are attached (Figures 1-3) showing the variability from year to year as this whale seemingly emulates either blue or fin whale activities. Tracking of such sources demonstrates the potential reliability and detail of the passive acoustic systems for following the distribution and movements of calling whale populations.

Publications and reports of this work during this period:

Watkins, William A., and Mary Ann Daher. 2002 (monthly).
Whale calling in the North Pacific: comparison with previous years. Monthly Summary Reports for CNO/N45-ONR-NMFS-SPAWAR Analysis of Current Data on calling whales monitored at Whidbey Is. NOPF. Text 1 p., 12 pp graphic displays each. 12 unpublished Reports.

Watkins, William A., Mary Ann Daher, and Joseph E. George. 2001. Numbers of calling whales in the North Pacific. Technical Report No. WHOI-2001-16, Woods Hole Oceanographic Institution, Woods Hole MA 02543, 37 pp.

Moore, Sue E., William A. Watkins, Jeremy Davies, Mary Ann Daher, and Marilyn Dahlheim. 2002. Blue whale habitats in the Northwest Pacific: analysis of remotely-sensed data using a Geographic Information System. Oceanography 15(3): 20-25.

Watkins, William A., Mary Ann Daher, and Joseph E. George. In press. Year to year variations in whale calling in the North Pacific. U.S. Navy Journal of Underwater Sound. Biologics Issue.

Watkins, William A., Mary Ann Daher, Joseph E. George, and David Rodriguez. Submitted. Whale-like calls from unique 52-Hz source tracked over ten years in the North Pacific. Oceanography 21 pp.

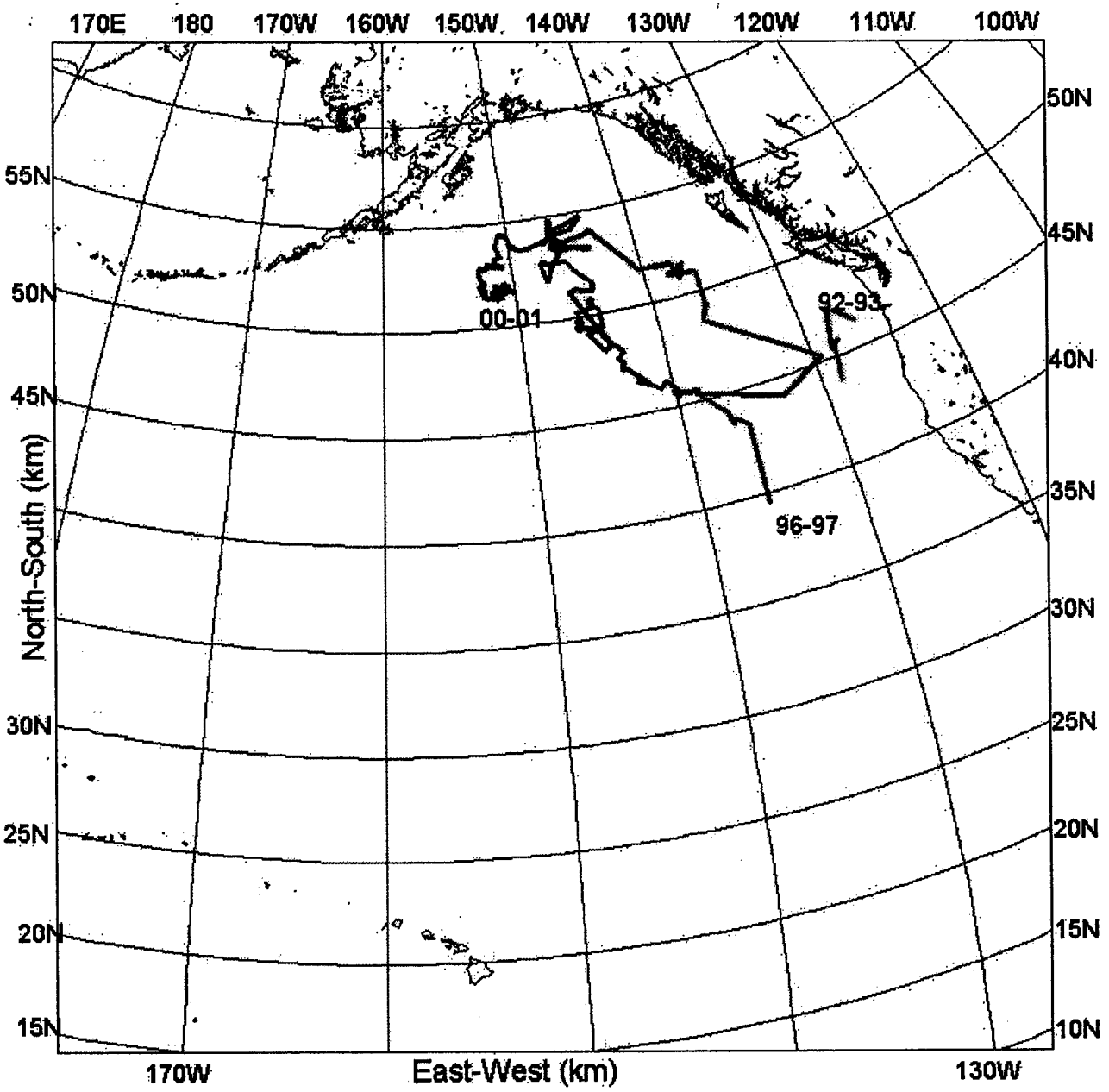
Watkins, William A., and Mary Ann Daher. 2002. Report of analysis of call type with geographic distribution for blue, fin, and humpback whales in the North Pacific. Unpublished report (showing no distinctions with distribution for fin and humpback whales, but distinct differences with region for blue whales, with "A" calls in the NW and NC regions and "AB" calls mixed with "A" calls in the NE and SE).

This has continued to be a very productive program, providing consistent, new, year-round data on the seasonal distribution and movements of the calling whale populations of the deep waters of the North Pacific basin.

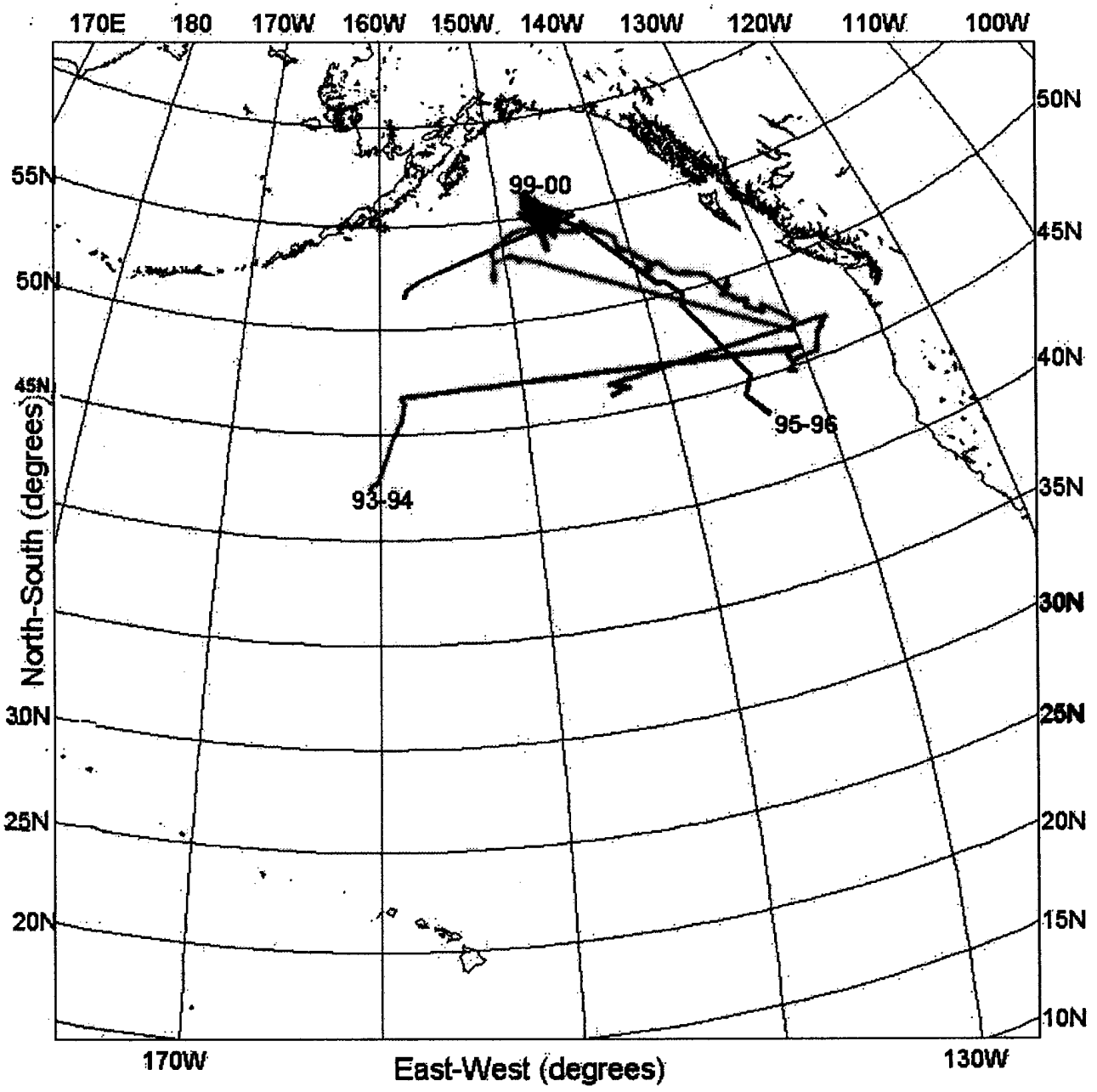
Sincerely,

Wm. A. Watkins

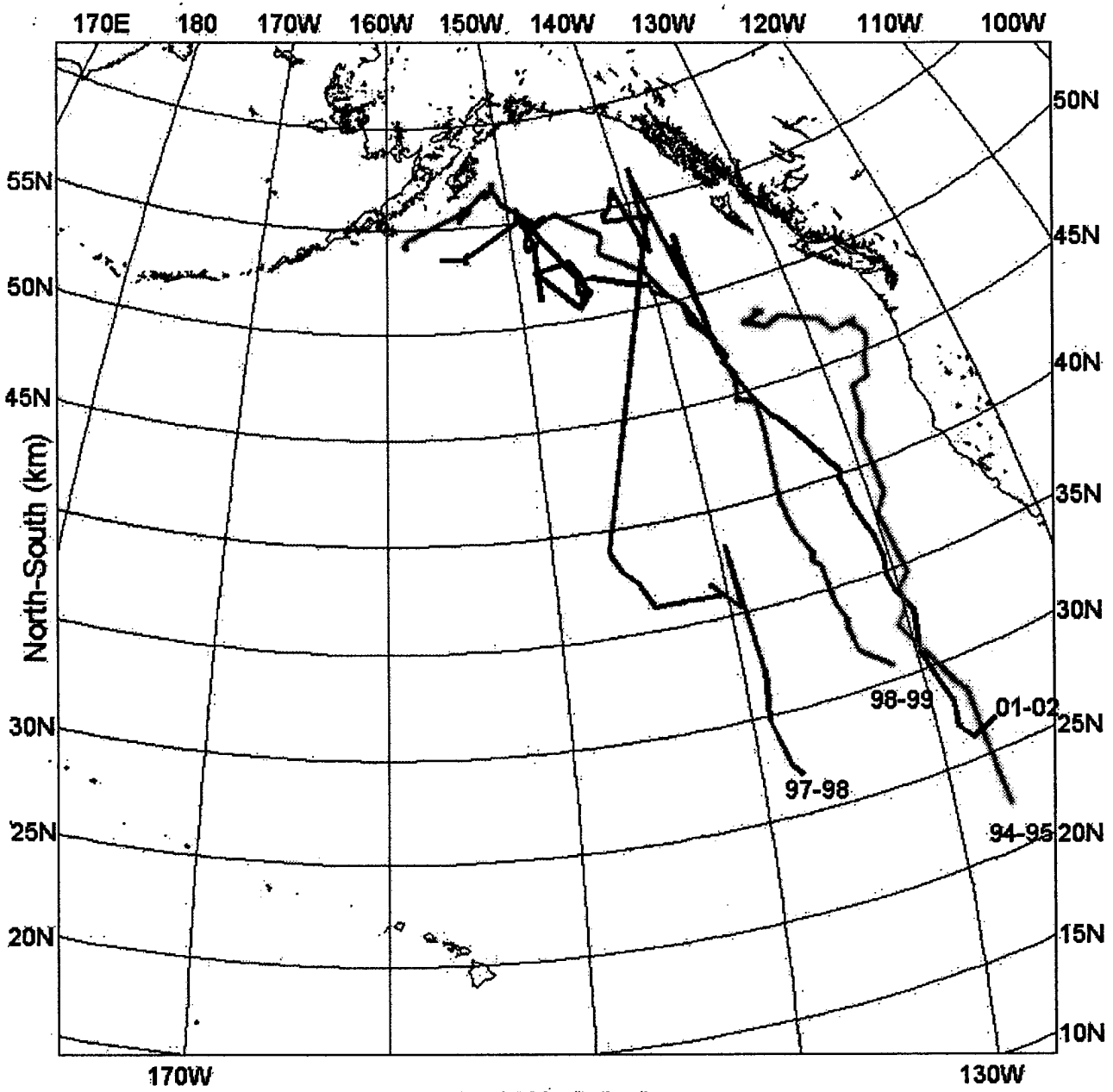
William A. Watkins



Meandering (A) Tracks



West-East (B) Tracks



North-South (C) Tracks