REPORT ON CETACEAN AERIAL SURVEY DATA COLLECTED BETWEEN THE YEARS OF 1974 AND 1982

Timothy Lee

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
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COLLECTED BETWEEN THE YEARS OF
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INTRODUCTION

In this paper I summarize the aerial survey data collected by the Southwest Fisheries Science Center (SWFSC) between the years of 1974 and 1982. This project was undertaken to allow comparisons to be made between cetacean distribution and abundance determined from older aerial surveys and the ones conducted more recently. To facilitate this comparison, I converted the data from the previous aerial surveys to the format that is being used currently for offshore surveys conducted by the Southwest Fisheries Science Center. The FORTRAN programs that accomplish this conversion, AIR74 and AIRYR, are listed in Appendices 1 and 2. I also rewrote the FORTRAN program ABUND, which was originally written for ship survey data, to produce summary statistics for aerial surveys (Program AIRBUND). In addition I changed the CRUZPLT program into AIRPLOT, a program that plots the data from the aerial surveys.

METHODS

The data collected before 1982 are stored in two different formats. The 1974 data are stored in one format (Appendix 3), and the data collected after 1974 are stored in a separate format (Appendix 4). Both formats have the sighting and transect record data separated into two files. The transect record contains information about position and speed of the aircraft, Beaufort sea state, and altitude of the plane, etc. The sighting record contains information about the position of marine mammals, the distance from the track line to the animals, species identification, "best" "high" and "low" school size estimates, etc. The new format has the sighting and transect information integrated into one file (Appendix 5). Each data line has a letter code in the fourth column that describes the type of event. For example, a resume effort event has an "R" code followed by the time and position effort was resumed.

Each of the species or stocks has a two-digit number assigned to it by the SWFSC (Appendix 6). This number is used on the observer data forms as a species identification code. Once a school of marine mammals has been spotted, the observers identify the species as best they can and estimate school size. It is not
always possible to identify the animals to the species or subspecies level, so there are also codes for "unidentified" species sightings. For example, code "05" is used for unidentified *Delphinus*, meaning the observers were unable to discern whether this was a school of long-beaked or short-beaked *Delphinus*.

Not all data were recorded for all years. For example, percent glare and declination angle were not recorded from 1974 to 1982. In addition, there were no independent observers prior to 1991.

Because the 1974 survey was the first SWFSC attempt at surveying for marine mammals from the air, it was largely a prototype experiment. The effort files are missing crucial data and it is not possible to determine whether the sightings were made on or off-effort. Because of this, the effort data were not converted and no plots of effort were made. Instead only the sightings were plotted.

There was no accurate key available for the 1974 data format. This made the process of converting the sighting data slow and laborious because the data had to be deciphered before it could be processed. In addition the sighting codes were much different from those used presently. First, the new data format uses letter codes for species rather than number codes. Secondly, certain codes were used that have no equivalent in the present format. For instance, the species code 4 was a code that represented "ETP Spotters and Spinners"; however, in the new format there are no mixed species codes. To compensate for this, mixed species codes were split into two separate codes during the conversion.

**SUMMARY OF AVAILABLE DATA**

In all there were five different aerial surveys conducted between 1974 and 1982.

1974 (Jan 26 - Feb. 14): This survey was conducted from a Gruman Goose aircraft that had been modified for use in aerial surveys. The plane flew at altitudes ranging from 1,000 to 1,500 feet and surveyed from Mazatlan, Mexico to Balboa, Panama searching for schools of dolphins. The survey was coordinated with a ship survey being conducted concurrently from the DAVID STARR JORDAN.

1977 (Jan 22 - June 21): This survey was conducted from two different aircraft. Phases one and two were conducted from a P2V-7 (SP-2H) Neptune anti-submarine patrol bomber, and phases three and four were conducted from a PBY-6A Catalina amphibious Navy patrol bomber. Phases one and two were conducted off the Pacific coast from Mazatlan, Mexico to Lima, Peru. Phase three surveyed
from San Diego, CA to San Jose, Costa Rica. Phase four surveyed around the Hawaiian Islands. The purpose of this survey was to search for dolphin schools with methods that were compatible with line-transect analysis. Transect lines are illustrated in Figure 1.

1979 (Jan 22 - Apr. 25): This survey was conducted from a PBY-5A Catalina, a modified amphibious patrol aircraft. The aircraft surveyed along the Pacific between Puerto Vallarta, Mexico and Lima, Peru searching for schools of dolphins. The survey was coordinated with two ship surveys being conducted during the same time interval by the DAVID STARR JORDAN and the TOWNSEND CROMWELL. The purpose of coordinating the three surveys was to quantify the bias from ship surveys caused by dolphins avoiding the ship. Transect lines are illustrated in Figure 2.

1981 (March 7 - April 5): This survey was conducted from a Beech AT11 aircraft that surveyed near Liberia, Costa Rica. The purpose was to investigate how estimates of marine mammal density and detectability were affected by observer experience, sea state, glare, and cloud cover. Transect lines are illustrated in Figure 3.

1982 (April 13 - April 15): This flight was conducted from a Beechcraft E18S aircraft in the Southern California Bight. There were two purposes for this survey. The first was to duplicate the flight transects that were used by Dohl et al (1978). The second was to gather data on the relative abundance of the short-finned pilot whale. Transect lines are illustrated in Figure 4.

RESULTS

Aerial survey track lines and distributions of sightings of the common cetacean species are illustrated in Figures 1 to 14. Encounter rates of the number of groups seen and the estimated number of individuals seen of each species is given for each cruise in Tables 1 to 4.

ACKNOWLEDGEMENTS

I would like to give special thanks to Jim Carretta and Chuck Oliver for their help with understanding the data formats. Thanks also to Jay Barlow and Tim Gerrodette for their assistance with programming.
Table 1. Number of sightings and number of individuals seen while on effort during the 1977 aerial survey. Sighting rates per nautical mile are based on these numbers divided by the number of on-effort survey miles. SWFSC codes are in parentheses.

<table>
<thead>
<tr>
<th>Species</th>
<th>SIGHTING</th>
<th>ANIMALS</th>
<th>SIGHT/NM</th>
<th>ANMLS/NM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stenella attenuata A (02)*</td>
<td>15</td>
<td>3278</td>
<td>0.00046</td>
<td>0.09969</td>
</tr>
<tr>
<td>Stenella longirostris (03)</td>
<td>4</td>
<td>434</td>
<td>0.00012</td>
<td>0.01320</td>
</tr>
<tr>
<td>Unidentified Delphinus (05)</td>
<td>17</td>
<td>3028</td>
<td>0.00052</td>
<td>0.09208</td>
</tr>
<tr>
<td>Stenella attenuata g. (06)*</td>
<td>2</td>
<td>214</td>
<td>0.00006</td>
<td>0.00651</td>
</tr>
<tr>
<td>S. longirostris o. (10)*</td>
<td>5</td>
<td>760</td>
<td>0.00015</td>
<td>0.02311</td>
</tr>
<tr>
<td>S. coeruleoalba (13)</td>
<td>5</td>
<td>544</td>
<td>0.00015</td>
<td>0.01654</td>
</tr>
<tr>
<td>Tursiops truncatus (18)</td>
<td>16</td>
<td>302</td>
<td>0.00049</td>
<td>0.00918</td>
</tr>
<tr>
<td>Grampus griseus (21)</td>
<td>83</td>
<td>2229</td>
<td>0.00252</td>
<td>0.06779</td>
</tr>
<tr>
<td>Pseudorca crassidens (33)</td>
<td>2</td>
<td>4</td>
<td>0.00006</td>
<td>0.00012</td>
</tr>
<tr>
<td>Unident. pilot whale (34)</td>
<td>5</td>
<td>13</td>
<td>0.00015</td>
<td>0.00040</td>
</tr>
<tr>
<td>Physeter macrocephalus (46)</td>
<td>19</td>
<td>76</td>
<td>0.00058</td>
<td>0.00231</td>
</tr>
<tr>
<td>Unidentified zuphiid (49)</td>
<td>3</td>
<td>5</td>
<td>0.00009</td>
<td>0.00015</td>
</tr>
<tr>
<td>Unidentified dorqual (70)</td>
<td>3</td>
<td>3</td>
<td>0.00009</td>
<td>0.00009</td>
</tr>
<tr>
<td>B. acutorostrata (71)</td>
<td>1</td>
<td>1</td>
<td>0.00003</td>
<td>0.00003</td>
</tr>
<tr>
<td>B. edeni (72)</td>
<td>1</td>
<td>1</td>
<td>0.00003</td>
<td>0.00003</td>
</tr>
<tr>
<td>B. musculus (75)</td>
<td>1</td>
<td>1</td>
<td>0.00003</td>
<td>0.00003</td>
</tr>
<tr>
<td>M. novaeangliae (76)</td>
<td>1</td>
<td>1</td>
<td>0.00003</td>
<td>0.00003</td>
</tr>
<tr>
<td>Unidentified delfinid (77)</td>
<td>76</td>
<td>2983</td>
<td>0.00231</td>
<td>0.09072</td>
</tr>
<tr>
<td>Unidentified sm. whale (78)</td>
<td>36</td>
<td>923</td>
<td>0.00109</td>
<td>0.02807</td>
</tr>
<tr>
<td>Unidentified lg. whale (79)</td>
<td>17</td>
<td>23</td>
<td>0.00052</td>
<td>0.00070</td>
</tr>
<tr>
<td>S. longirostris c. (88)*</td>
<td>1</td>
<td>980</td>
<td>0.00003</td>
<td>0.02980</td>
</tr>
</tbody>
</table>

Total Distance On Effort: 32,883 NMI

* Stenella attenuata subsp. A (offshore spotted dolphin)
* Stenella attenuata graffmani
* S. longirostris orientals
* S. longirostris centroamericana
Table 2. Number of sightings and number of individuals seen while on effort during the 1979 aerial survey. Sighting rates per nautical mile are based on these numbers divided by the number of on-effort survey miles. SWFSC codes are in parentheses.

<table>
<thead>
<tr>
<th>Animal Code</th>
<th>Sighting</th>
<th>Animals</th>
<th>Sight/NM</th>
<th>Animals/Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stenella attenuata A (02)*</td>
<td>8</td>
<td>3470</td>
<td>0.00052</td>
<td>0.22585</td>
</tr>
<tr>
<td>Unidentified Delphinus (05)</td>
<td>31</td>
<td>6941</td>
<td>0.00202</td>
<td>0.45177</td>
</tr>
<tr>
<td>Stenella attenuata g. (06)*</td>
<td>5</td>
<td>837</td>
<td>0.00033</td>
<td>0.05448</td>
</tr>
<tr>
<td>S. longirostris o. (10)*</td>
<td>6</td>
<td>3584</td>
<td>0.00039</td>
<td>0.23327</td>
</tr>
<tr>
<td>S. coeruleoalba (13)</td>
<td>6</td>
<td>533</td>
<td>0.00039</td>
<td>0.03469</td>
</tr>
<tr>
<td>Steno bredanensis (15)</td>
<td>1</td>
<td>54</td>
<td>0.00007</td>
<td>0.00351</td>
</tr>
<tr>
<td>Tursiops truncatus (18)</td>
<td>10</td>
<td>121</td>
<td>0.00065</td>
<td>0.00788</td>
</tr>
<tr>
<td>Grampus griseus (21)</td>
<td>76</td>
<td>1162</td>
<td>0.00495</td>
<td>0.07563</td>
</tr>
<tr>
<td>Lagenodelphis hosei (26)</td>
<td>1</td>
<td>60</td>
<td>0.00007</td>
<td>0.00391</td>
</tr>
<tr>
<td>Pseudorca crassidens (33)</td>
<td>1</td>
<td>7</td>
<td>0.00007</td>
<td>0.00046</td>
</tr>
<tr>
<td>Unident. pilot whale (34)</td>
<td>6</td>
<td>68</td>
<td>0.00039</td>
<td>0.00443</td>
</tr>
<tr>
<td>Orcinus orca (37)</td>
<td>1</td>
<td>16</td>
<td>0.00007</td>
<td>0.00104</td>
</tr>
<tr>
<td>Physeter macrocephalus (46)</td>
<td>29</td>
<td>323</td>
<td>0.00189</td>
<td>0.02102</td>
</tr>
<tr>
<td>Unidentified ziphiid (49)</td>
<td>11</td>
<td>24</td>
<td>0.00072</td>
<td>0.00156</td>
</tr>
<tr>
<td>Mesoplodon sp. (51)</td>
<td>1</td>
<td>2</td>
<td>0.00007</td>
<td>0.00013</td>
</tr>
<tr>
<td>Ziphius cavirostris (61)</td>
<td>1</td>
<td>3</td>
<td>0.00007</td>
<td>0.00020</td>
</tr>
<tr>
<td>Unidentified rorqual (70)</td>
<td>8</td>
<td>11</td>
<td>0.00052</td>
<td>0.00072</td>
</tr>
<tr>
<td>B. edeni (72)</td>
<td>1</td>
<td>1</td>
<td>0.00007</td>
<td>0.00007</td>
</tr>
<tr>
<td>Unidentified delfinid (77)</td>
<td>142</td>
<td>5187</td>
<td>0.00924</td>
<td>0.33761</td>
</tr>
<tr>
<td>Unidentified sm. whale (78)</td>
<td>26</td>
<td>438</td>
<td>0.00169</td>
<td>0.02851</td>
</tr>
<tr>
<td>Unidentified lg. whale (79)</td>
<td>15</td>
<td>19</td>
<td>0.00098</td>
<td>0.00124</td>
</tr>
</tbody>
</table>

Total Distance On Effort: 15,364 NMI

* Stenella attenuata subsp. A (offshore spotted dolphin)
* Stenella attenuata graffmani
* S. longirostris orientalis
Table 3. Number of sightings and number of individuals seen while on effort during the 1981 aerial survey. Sighting rates per nautical mile are based on these numbers divided by the number of on-effort survey miles. SWFSC codes are in parentheses.

1981 AERIAL SURVEY

<table>
<thead>
<tr>
<th>SIGHTING</th>
<th>ANIMALS</th>
<th>SIGHT/NM</th>
<th>ANMLS/NM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stenella longirostris (03)</td>
<td>10</td>
<td>4583</td>
<td>0.00145</td>
</tr>
<tr>
<td>Stenella attenuata g. (06)*</td>
<td>6</td>
<td>1669</td>
<td>0.00087</td>
</tr>
<tr>
<td>S. coeruloc alla (13)</td>
<td>2</td>
<td>322</td>
<td>0.00029</td>
</tr>
<tr>
<td>Grampus griseus (21)</td>
<td>29</td>
<td>271</td>
<td>0.00419</td>
</tr>
<tr>
<td>Pseudorca crassidens (33)</td>
<td>3</td>
<td>96</td>
<td>0.00043</td>
</tr>
<tr>
<td>Unidentified ziphiid (49)</td>
<td>3</td>
<td>7</td>
<td>0.00043</td>
</tr>
<tr>
<td>Unidentified delfinid (77)</td>
<td>277</td>
<td>34367</td>
<td>0.04005</td>
</tr>
<tr>
<td>Unidentified sm. whale (78)</td>
<td>27</td>
<td>556</td>
<td>0.00390</td>
</tr>
<tr>
<td>Unidentified lg. whale (79)</td>
<td>1</td>
<td>1</td>
<td>0.00014</td>
</tr>
<tr>
<td>Unid S. attenuata (90)</td>
<td>16</td>
<td>4938</td>
<td>0.00231</td>
</tr>
<tr>
<td>Unidentified cetacean (96)</td>
<td>3</td>
<td>33</td>
<td>0.00043</td>
</tr>
</tbody>
</table>

Total Distance On Effort: 6,916 NMI

* Stenella attenuata graffmani
Table 4. Number of sightings and number of individuals seen while on effort during the 1982 aerial survey. Sighting rates per nautical mile are based on these numbers divided by the number of on-effort survey miles. SWFSC codes are in parentheses.

<table>
<thead>
<tr>
<th>SIGHTING</th>
<th>ANIMALS</th>
<th>SIGHT/NM</th>
<th>ANMLS/NM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tursiops truncatus (18)</td>
<td>6</td>
<td>19</td>
<td>0.00466</td>
</tr>
<tr>
<td>Grampus griseus (21)</td>
<td>10</td>
<td>65</td>
<td>0.00776</td>
</tr>
<tr>
<td>Phocoenoides dalli (44)</td>
<td>8</td>
<td>51</td>
<td>0.00621</td>
</tr>
<tr>
<td>Unidentified delfinid (77)</td>
<td>4</td>
<td>20</td>
<td>0.00311</td>
</tr>
<tr>
<td>Unidentified sm. whale (78)</td>
<td>3</td>
<td>10</td>
<td>0.00233</td>
</tr>
<tr>
<td>Zalophus californianus (91)</td>
<td>5</td>
<td>20</td>
<td>0.00388</td>
</tr>
<tr>
<td>Unidentified pinniped (97)</td>
<td>14</td>
<td>18</td>
<td>0.01087</td>
</tr>
<tr>
<td>Unidentified whale (98)</td>
<td>2</td>
<td>2</td>
<td>0.00155</td>
</tr>
<tr>
<td>Unidentified cetacean (99)</td>
<td>1</td>
<td>17</td>
<td>0.00078</td>
</tr>
</tbody>
</table>

Total Distance On Effort: 1,288 NMI

*This flight used a modified version of the standard SWFSC code table.*
AERIAL SURVEY 1977

Figure 1.
Figure 4.

AERIAL SURVEY 1982
Figure 5.

Marine Mammals

○ Eshrichtius robustus (sp. code 69)
△ Delphinus delphis (sp. code 5)
× Physeter macrocephalus (sp. code 46)
Figure 6.

AERIAL SURVEY 1974

- O Tursiops truncatus (sp. code 18)
- X Grampus griseus (sp. code 21)
- △ Stenella attenuata A. (sp. code 2)
Figure 7.

AERIAL SURVEY 1977

- Stenella coeruleoalba (sp. code 13)
- Stenella longirostris (sp. code 10)
- Tursiops truncatus (sp. code 18)
Figure 8.

AERIAL SURVEY 1977

- Grampus griseus (sp. code 21)
- Physeter macrocephalus (sp. code 46)
- Balaenoptera musculus (sp. code 75)
Figure 9.

AERIAL SURVEY 1977

○ Stenella attenuata (sp. code 2)
△ Stenella longirostris (sp. code 3)
× Delphinus delphis (sp. code 5)
Figure 10.

AERIAL SURVEY 1979

- O Stenella attenuata A (sp. code 2)
- △ Delphinus delphis (sp. code 5)
- × Stenella attenuata g. (sp. code 6)
Figure 11.

AERIAL SURVEY 1979

○ Grampus griseus (sp. code 21)
△ Physeter macrocephalus (sp. code 46)
× Tursiops truncatus (sp. code 18)
Figure 12.

AERIAL SURVEY 1979

○ Stenella longirostris o. (sp. code 10)
△ Stenella coeruleoalba (sp. code 13)
Figure 13.

AERIAL SURVEY 1981

○ Stenella longirostris (sp. code 3)
× Grampus griseus (sp. code 21)
△ Stenella attenuata g. (sp. code 6)
AERIAL SURVEY 1982

○ Tursiops truncatus (sp. code 18)
× Grampus griseus (sp. code 21)
△ Phocoenoides dalli (sp. code 44)
APPENDIX 1

This program takes the 1974 data and reformats into a data format similar to that used in the offshore surveys conducted currently (1993).

The effort data is unusable (I have been told) for several reasons:

- One is the lack of accurate positions. The second is the fact that they did not record when the plane was on or off effort. Instead they only recorded the total number of minutes spent circling during a leg.
- Because of this, it is not possible to determine which sightings were in fact on effort and which were off effort.

Date June 10, 1993
Programmer: Timothy Lee

**DECLARATIONS**
character pss*130,new*85,blankstring*85
integer line
logical MixSpp
common new,pss,blankstring,line,MixSpp

**INITIALIZING EVERYTHING**
write(new,10)
write(blankstring,10)
line=0

**FORMAT STATEMENTS LINE #'S 10-30**
10 format (l00(' '))
11 format (a15,i3)
15 format (a)

**OPENING FILES FOR PROCESS AND STORAGE**
OPEN(UNIT=1,FILE='as74sq01.dat',STATUS='OLD')
OPEN(UNIT=10,FILE='74.OUT', FORM='FORMATTED', STATUS='UNKNOWN')
open(unit=11,file='74.err', form='formatted', status='unknown')

**READING IN DATA AND STORING IT IN VARIABLES**
50 new(1:85)=blankstring(1:85)
mixspp=.false.
read(1,15, end=150) pss
line=line+1

**PUTTING THE DATE AND TIME INTO THE HEAD OF STRING**
new(6:9)=pss(13:16)
new(13:18)=pss(7:12)
***Position
if (pss(22:22).eq.'1') new(20:20)='N'

Date June 10, 1993
Programmer: Timothy Lee

Program Air74_for
if (pss(22:22).eq.'2') new(20:20)= 'S'
if (pss(29:29).eq.'1') new(30:30)= 'E'
if (pss(29:29).eq.'2') new(30:30)= 'W'

new(21:22)=pss(17:18)
new(23:23)=:' '
new(24:25)=pss(19:20)
new(26:26)=:' '
new(27:27)=pss(21:21)

new(31:33)=pss(23:25)
new(34:34)=:' '
new(35:36)=pss(26:27)
new(37:37)=:' '
new(38:38)=pss(28:28)

*CHECKING TO SEE IF ANY OF THE CODES ARE MIXED SPECIES CODES
  if(pss(55:56).eq.'4' .or. pss(55:56).eq.'7' .or.
  if(mixspp) write(11,ll)'Mixspp line: ',line
  * THIS IS A TEST TO SEE WHETHER ANY SPP CODE WAS RECORDED. IF NO SPP CODE
  * WAS RECORDED -> FLAG AN ERROR AND SKIP THE LINE
  if(pss(55:56).eq.' ') then
    write(11,ll)'No Spp code line ',line
    goto 50
  endif

call sight
  call length (new,lenth)
  write(10,15) new(1:lenth)

call one
  call length (new,lenth)
  write (10,15) new(1:lerrth)

goto 50

150 end

*****************************************************************************

subroutine sight

** THIS SUBROUTINE CREATES AN S EVENT
character pss*130,new*85,blankstring*85
integer line
logical MixSpp
common new,pss,blankstring,line,MixSpp

*INITIALIZING THE END OF THE STRING
new(41:85)=blankstring(41:85)

new(4:4)=:'S'

*SIGHT #
new(41:44)= ' ' /pss(5:6)

* OBSERVER CODE
new(46:49)= ' ' /pss(30:31)
DISTANCE
new(51:54)=pss(34:35)//'.'//pss(36:36)

*PRIMARY OBSERVER Y/N
new(56:59)= Y

if (pss(65:66).eq. ' 1' .and. .not.MixSpp) then
*SPP CODE 1 = OBJECT SIGHTED
new(61:64)= ' 1' //pss(55:56)
else if(MixSpp .and. pss(55:56).eq. ' 4' .and. (pss(65:66)
* .ne. ' 2' .and. pss(65:66).ne. ' 3') ) then
*SPP CODE 1 = 3 : UNID SPINNER
new(61:64)= ' 3'
*SPP CODE 2 = 2 : OFFSHORE SPOTTER
new(66:69)= ' 2'
*SPP CODE 3
new(73:74)=pss(65:66)
else if(MixSpp .and. pss(55:56).eq. ' 8') then
*SPP CODE 1 = White Belly
new(61:64)= ' 5'
*SPP CODE 2 = 2 : OFFSHORE SPOTTER
new(66:69)= ' 2'
*SPP CODE 3
new(73:74)=pss(65:66)
else if(MixSpp .and. pss(55:56).eq. ' 9') then
*SPP CODE 1 = 3 : UNID SPINNER
new(61:64)= ' 3'
*SPP CODE 2 = White Belly Spinner
new(66:69)= ' 11'
*SPP CODE 3
new(73:74)=pss(65:66)
else
*SPP CODE 1 = DOMINANT SPECIES
new(61:64)= ''//pss(65:66)
*SPP CODE 2 = SECOND SPECIES
new(66:69)= ''//pss(75:76)
*SPP CODE 3 = THIRD SPECIES
new(71:74)= ''//pss(86:87)
endif

return
end
**THIS SUBROUTINE CREATES AN 'S' EVENT. THIS TYPE OF EVENT WAS CREATED TO FACILITATE INFORMATION THAT IS NOT FOUND IN THE NEW OFFSHORE AERIAL FORMAT**

```fortran
subroutine one
character pss*130,new*85,blankstring*85
real Percnt1,Percnt2,Percnt3
logical MixSpp
integer line
common new,pss,blankstring,line,MixSpp

*INITIALIZING NEW PART OF STRING*
new(41:80)=blankstring(41:80)
NumSpp=0

*CHECKING THE NUMBER OF SPECIES SIGHTED*
if(pss(55:56).ne.' ') NumSpp=NumSpp+1
if(pss(65:66).ne.' ') NumSpp=NumSpp+1
if(pss(75:76).ne.' ') NumSpp=NumSpp+1
if(pss(86:87).ne.' ') NumSpp=NumSpp+1

new(4:4)="1"

*OBS CODE*
new(41:44)="//pss(30:31)

if (pss(65:66).eq."" .and. .not.MixSpp) then
new(46:49)=pss(47:50)
new(61:64)="100"
else if ((pss(65:66).ne." ").and. .not.MixSpp) .and. (pss(65:66)
* .eq. "2" .or. pss(65:66).eq."3" .or. pss(65:66).eq."5") ) then
read(pss(47:50),'(f4.0)')total
read(pss(57:60),'(f4.0)')SppCount1
read(pss(67:70),'(f4.0)')SppCount2
read(pss(77:80),'(f4.0)')SppCount3

Percnt1=(SppCount1/total)*100
Percnt2=(SppCount2/total)*100
Percnt3=(SppCount3/total)*100
tprcnt=Percnt1+Percnt2+Percnt3
if(tprcnt.ge.99) then
new(46:49)=pss(47:50)
write(new(61:64),'(f4.1)')Percnt1
write(new(66:69),'(f4.1)')Percnt2
if (Percnt3.gt.0) write(new(71:74),'(f4.1)')Percnt3
endif
else if ((pss(65:66).ne." ").and. (MixSpp)) then
read(pss(47:50),'(f4.0)')total
read(pss(57:60),'(f4.0)')SppCount1

Percnt1=(SppCount1/total)*100
new(46:49)=pss(47:50)
if(Percnt1.ge.1) then
write(new(71:74),'(f4.1)')Percnt1
```

25
else
  write(new(71:74),'(f4.3)') Percnt1
endif

else
  new(46:49)=pss(47:50)
  new(63:64)='??'
  new(68:69)='??'
endif

return
end

***************************************************************
SUBROUTINE LENGTH(NEW,LENTH)
*
* This subroutine estimates the length of a character string excluding
* the trailing blanks
CHARACTER*85 NEW
LENTH= 85
DO 10 I=85,1,-1
  IF(NEW(I:1).EQ. ' ')THEN
    LENTH=I-1
  ELSE
    RETURN
  ENDIF
10 CONTINUE
RETURN
END
This program takes aerial survey data from the years of 1977, 79, 81, 82, and converts them into the format that is being used for the offshore aerial surveys currently (1993).

Written by Timothy Lee
March 30, 1993

Program AIRm-FOR

character NEW*90, BLANKSTRING*90, PREVC*1, NEW1*90, NEW2*90, CD2*1
character OLD_SIGHT, OLD_EFF, NEW_COMB, ERROR_OUT
character PSS*500, PSS*250, TIME_S*5, BS*2, DATE1*6, DATE2*6, CD1*1
character 90 PLINE, OLDP, OLDPW, OLDA, OLGD
character PREVSYN*1, SYN*1
logical NEWEFF, EFFORT
integer SNUM_S, SNUM_E, RO, COUNT
common NEW, BS, PSS, BLANKSTRING

B$=" 
WRITE(BLANKSTRING, 17)
COUNT=0
DATE1='0'
SYN='0'
PREVSYN='0'
EFFORT=.FALSE.

*MODULE FOR OPENING FILES************************************************************************
OPEN(UNIT=10, FILE='AIRYR.INP', FORM='FORMATTED', STATUS='OLD')
PRINT*, 'OPEN'

2 READ (10, '(A30)') OLD_SIGHT
PRINT*, 'OLDSIGHT READ ' // OLD_SIGHT
READ (10, '(A30)') OLD_EFF
PRINT*, 'OLDEFF READ ' // OLD_EFF
READ(10, '(A30)') ERROR_OUT
PRINT*, 'ERROR_FILE READ: ' // ERROR_OUT
READ (10, '(A30)') NEW_COMB
PRINT*, 'NEWCOMB READ ' // NEW_COMB

OPEN(UNIT=1, FILE=OLD_SIGHT, STATUS='OLD')
OPEN(UNIT=2, FILE=OLD_EFF, STATUS='OLD')
OPEN(UNIT=11, FILE=ERROR_OUT, FORM='FORMATTED',
* STATUS='UNKNOWN')
OPEN(UNIT=12, FILE=NEW_EFF.OUT, FORM='FORMATTED',
* STATUS='UNKNOWN')
OPEN(UNIT=13, FILE=NEW_COMB, FORM='FORMATTED', STATUS='UNKNOWN')

WRITE(11, 15) ERROR_OUT

**Format statements
**
10 FORMAT(I3)
15 FORMAT(A)
17 FORMAT(90(' '))
*initializing the 'new' string

**

NEW(1:90)=BLANKSTRING(1:90)
PLINE(1:90)=BLANKSTRING(1:90)

READ(1,15,END=500) PSS
READ(2,15,END=500) PES
DATE2=PES(8:13)

* comparing the dates. When date changes set sequence number (count) back to zero.

IF(DATE2.NE.DATE1)THEN
  COUNT=0
  DATE1=DATE2
  EFFORT=.FALSE.
ENDIF

*reading the sighting number from the sight string
READ(PSS(5:7),10) SNUM_S
  If (SNUM_S.EQ.0) SNUM_S=-1
  * print'(1X,A3)' ,"SIGHTFILE SIGHT NUMBER",snum_s

*reading the number of Repeat Occurences from the effort string
READ(PES(36:37),'(12)') RO

C
  * this part of the program checks the searching yes/no data field in the effort record. If the previous search yes/no was 'no' and the next is 'yes' -> call R
  * This had to be added to the program because frequently there were cases where team stopped searching without 'diverting' or 'ENDING LEG'

C

PREVSYN=SYN
SYN=PES(57+P$:57+P$)
IF(SYN.EQ.' ') SYN=PREVSYN

IF ( (PREVSYN.EQ.'1') .AND. (SYN.EQ.'2') .AND. (EFFORT))
  THEN
    CALL E(PES,P$)
    IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
      COUNT=COUNT+1
      WRITE(NEW(1:3),'(I3)') COUNT
      PLINE=NEW
      EFFORT=.FALSE.
  */) THEN
PLINE=BLANKSTRING
count=count-1
EFFORT=.FALSE.
ELSE
COUNT=COUNT+1
WRITE(NEW(1:3),'(I3)') COUNT
CALL LENGTH(PLINE,LENGTH)
WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENGTH)
IF(IERR30.NE.0) PRINT*,"ERROR IN WRITING TO'/NEW_COMB"
PLINE=NEW
EFFORT=.FALSE.
ENDIF
PREVC='E'
ENDIF

IF (PREVSYN.EQ.'2' .AND. SYN.EQ.'1' .AND. (.NOT.EFFORT)) THEN
CALL R(PES,P$)
IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
COUNT=COUNT+1
WRITE(NEW(1:3),'(I3)') COUNT
PLINE=NEW
EFFORT=.TRUE.
PLINE=BLANKSTRING
EFFORT=.TRUE.
COUNT=COUNT+1
WRITE(NEW(1:3),'(I3)') COUNT
CALL LENGTH(PLINE,LENGTH)
WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENGTH)
IF(IERR30.NE.0) PRINT*,"ERROR IN WRITING TO'/NEW_COMB"
PLINE=NEW
NEWEFF=.TRUE.
EFFORT=.TRUE.
ENDIF
PREVC='R'
ENDIF

*checking the 'reason for position field'.
*In this data format a 1=begin leg, a 2=track check, a 3=divert,
a 4=overschool, a 5=return, a 6=end leg.
IF((PES(56+P$):56+P$).EQ.' 1 ').AND.(PES(57+P$):57+P$).EQ.' 1 
*.(.NOT.EFFORT)) THEN
CALL R(PES,P$)
*
* This IF, ELSE-IF, ELSE block tests to see whether the previous line is an 'E'
* (end effort line) with the same time as this 'R' (resume effort). If so don’t
* write either of them to the file. This eliminates the paradox of ending and
* resuming effort simultaneously.
*
IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
COUNT=COUNT+1
WRITE(NEW(1:3),'(I3)') COUNT

29
PLINE=NEW
EFFORT=.TRUE.
ELSE IF((PLINE(4:4).EQ.'E').AND.(PLINE(6:18).EQ.
* NEW(6:18))) THEN
   PLINE=BLANKSTRING
   COUNT=COUNT+1
   EFFORT=.TRUE.
   ELSE
      COUNT=COUNT+1
      WRITE(NEW(1:3),'(I3)') COUNT
      CALL LENGTH(PLINE,LENTH)
      WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
      IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
         PLINE=NEW
         NEWEFF=.TRUE.
         EFFORT=.TRUE.
      ENDIF
      PREVC='R'
end goto 60
ELSE IF((PES(56+P$:56+P$).EQ.'1').AND.(PES(57+P$:57+P$)
*.'2')) then
      CALL L(PES,P$)
      NEWEFF=.TRUE.
      COUNT=COUNT+1
      WRITE(NEW(1:3),'(I3)') COUNT
      PREVC='L'
      IF(PLINE.NE.BLANKSTRING) THEN
         CALL LENGTH(PLINE,LENTH)
         WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
         IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
         PLINE=NEW
      ENDIF
      *checking the search yes/no
      *if there is no begin leg indicator with a search =no indicator, flag an error.
60   CALL P(PES,NEWEFF,OLDP)
*      PRINT*,NEW
      PREVC='P'
      CALL LENGTH(NEW,LENTH)
      IF(LENTH.GT.40) THEN
         COUNT=COUNT+1
         WRITE(NEW(1:3),'(I3)') COUNT
         CALL LENGTH(PLINE,LENTH)
         WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
         IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
         PLINE=NEW
      ENDIF
      CALL A(PES,NEWEFF,OLDA)
*      PRINT*,NEW
      PREVC='A'
      CALL LENGTH(NEW,LENTH)
      IF(LENTH.GT.40) THEN
         COUNT=COUNT+1
      ENDIF
WRITE(NEW(1:3),'(13)') COUNT
IF(PLINE.NE.BLANKSTRING) THEN
  CALL LENGTH(PLINE,LENTH)
  WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'/NEW_COMB
ENDIF
PLINE=NEW
ENDIF

CALL W(PES,NEWEFF,OLDW)
  PRINT*,NEW
  PREVC='W'
CALL LENGTH(NEW,LENTH)
IF(LENTH.GT.40) THEN
  COUNT=COUNT+1
  WRITE(NEW(1:3),'(13)') COUNT
IF(PLINE.NE.BLANKSTRING) THEN
  CALL LENGTH(PLINE,LENTH)
  WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'/NEW_COMB
ENDIF
PLINE=NEW
ENDIF

CALL G(PES,NEWEFF,OLDG)
  PRINT*,NEW
  PREVC='G'
CALL LENGTH(NEW,LENTH)
IF(LENTH.GT.40) THEN
  COUNT=COUNT+1
  WRITE(NEW(1:3),'(13)') COUNT
IF(PLINE.NE.BLANKSTRING) THEN
  CALL LENGTH(PLINE,LENTH)
  WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'/NEW_COMB
ENDIF
PLINE=NEW
ENDIF

ENDIF

IF(PES(56+P$:56+P$).EQ.'2') THEN
  CALL POS(PES,P$)
  PREVC='*'
  COUNT=COUNT+1
  WRITE(NEW(1:3),'(13)') COUNT
CALL LENGTH(NEW,LENTH)
IF(PLINE.NE.BLANKSTRING) THEN
  CALL LENGTH(PLINE,LENTH)
  WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'/NEW_COMB
ENDIF
PLINE=NEW
ENDIF

IF(PES(56+P$:56+P$).EQ.'5' .AND. (.NOT.EFFORT)) THEN
  CALL R(PES,P$)
ENDIF
IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
  COUNT=COUNT+1
  WRITE(NEW(1:3),'(13)') COUNT
  PLINE=NEW
  EFFORT=.TRUE.
* THEN
  PLINE=BLANKSTRING
  count=count-1
  EFFORT=.TRUE.
ELSE
  COUNT=COUNT+1
  WRITE(NEW(1:3),'(13)') COUNT
  CALL LENGTH(PLINE,LENTH)
  WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'/\NEWComb
  PLINE=NEW
  NEWEFF=.TRUE.
  EFFORT=.TRUE.
ENDIF

PREVC='R'
ENDIF

READ(PES(58+PS:60+PS),10) SNUM_E
*
  print'(1X,A30,13)', "EFFORT SIGHT NUMBER ",SNUM_E
*checking to see if sight # on sight string matches sight # on effort string.
*if they match, use the time recorded in effort data as time of sighting.
*this had to be done because no times were recorded on the sighting strings
IF (SNUM_S.EQ.SNUM_E) THEN
  TIME_S=PES(S1+PS:55+PS)
*before listing the sighting information. Must determine whether or not the
*sighting was on effort. Since the effort data is not a reliable indicator
*use the search yes/no indicator.
  PREVSYN=SYN
  SYN=PSS(208:208)
  IF(SYN.EQ.' ') SYN=PREVSYN

  IF ((PREVSYN.EQ.'1') .AND. (SYN.EQ.'2').AND.(EFFORT))
* THEN
    CALL E(PES,PS)
    IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
      COUNT=COUNT+1
      WRITE(NEW(1:3),'(13)') COUNT
      PLINE=NEW
      EFFORT=.FALSE.
*) THEN
    PLINE=BLANKSTRING
    count=count-1
    EFFORT=.FALSE.
ELSE
    COUNT=COUNT+1
    WRITE(NEW(1:3),'(13)') COUNT
    CALL LENGTH(PLINE,LENTH)
    WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
    IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEWComb
PLINE=NEW
EFFORT=.FALSE.
ENDIF
PREVC='E'
ENDIF

IF(PREVSYN.EQ.'2' .AND. SYN.EQ.'1' .AND. (.NOT.EFFORT)) THEN
  CALL R(PES,P$)
  IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
    COUNT=COUNT+1
    WRITE(NEW(1:3),'(13)') COUNT
    PLINE=NEW
    EFFORT=.TRUE.
  ELSE IF((PLINE(4:4).EQ.'E7').AND.(PLINE(6:18).EQ.
    * NEW(6:18)))) THEN
    PLINE=BLANKSTRING
    COUNT=COUNT+1
    EFFORT=.TRUE.
  ELSE
    COUNT=COUNT+1
    WRITE(NEW(1:3),'(13)') COUNT
    CALL LENGTH(PLINE,LENTH)
    WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
    IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
    PLINE=NEW
    NEWEFF=.TRUE.
    EFFORT=.TRUE.
  ENDIF
  PREVC='R'
ENDIF

CALL SIGHT(TIME_S)
PRINT*,NEW
COUNT=COUNT+1
WRITE(NEW(1:3),'(13)') COUNT
PREVC='S'

IF(PLINE.NE.BLANKSTRING) THEN
  CALL LENGTH(PLINE,LENTH)
  WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
  IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
ENDIF
PLINE=NEW

CALL ONE
PRINT*,NEW
PREVC='#'

CALL LENGTH(NEW,LENTH)
IF(LENTH.GT.10) THEN
  CALL LENGTH(NEW,LENTH)
  WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
  IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
ENDIF
PLINE=NEW
ENDIF

DO 100 J=2,5
  CALL NUM(J)
  CALL
PREVC='#'
PRINT*,NEW
CALL LENGTH(NEW,LNGTH)
IF(LNGTH.GT.10) THEN
IF(PLINE.NE.BLANKSTRING) THEN
CALL LENGTH(PLINE,LNGTH)
WRITEUNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LNGTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
ENDIF
PLINE=NEW
ENDIF
100 CONTINUE

CALL WEATHER(TIME_S)
PRINT*,NEW
COUNT=COUNT+1
WRITE(NEW(1:3),'(13)') COUNT
PREVC='W'
CALL LENGTH(NEW,LNGTH)
IF(LNGTH.GT.40) THEN
IF(PLINE.NE.BLANKSTRING) THEN
CALL LENGTH(PLINE,LNGTH)
WRITEUNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LNGTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
ENDIF
PLINE=NEW
ENDIF

CALL GLARE(TIME_S)
PRINT*,NEW
PREVC='G'
COUNT=COUNT+1
WRITE(NEW(1:3),'(13)') COUNT
CALL LENGTH(NEW,LNGTH)
IF(LNGTH.GT.40) THEN
IF(PLINE.NE.BLANKSTRING) THEN
CALL LENGTH(PLINE,LNGTH)
WRITEUNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LNGTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
ENDIF
PLINE=NEW
ENDIF

READ(1,15,END=125) PSS
READ(PSS(5:7),10) SNUM_S
IF(SNUM_S.EQ.0) SNUM_S=-1

PREVSYN=SYN
SYN=PES(57+PS:57+PS)
IF(SYN.EQ. ' ') SYN=PREVSYN

IF ((PREVSYN.EQ.'1') .AND.( SYN.EQ.'2').AND.(EFFORT)) THEN
CALL E(PES,P$)
IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
COUNT=COUNT+1
ENDIF
WRITE(NEW(1:3),'(13)') COUNT
PLINE=NEW
EFFORT=.FALSE.
*) THEN
PLINE=BLANKSTRING
count=count+1
EFFORT=.FALSE.
ELSE
COUNT=COUNT+1
WRITE(NEW(1:3),'(13)') COUNT
CALL LENGTH(PLINE,LENTH)
WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'/NEW_COMB
PLINE=NEW
EFFORT=.FALSE.
ENDIF
PREVC='E'
ENDIF

IF(PREVSYNEQ.'2' .AND. SYNEQ.'1' .AND. (.NOT.EFFORT)) THEN
CALL R(PES,PS)
IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
COUNT=COUNT+1
WRITE(NEW(1:3),'(13)') COUNT
PLINE=NEW
EFFORT=.TRUE.
ELSE IF ((PLINE(4:4).EQ.'E') .AND. (PLINE(6:18).EQ. NEW(6:18))) THEN
PLINE=BLANKSTRING
COUNT=COUNT+1
EFFORT=.TRUE.
ELSE
COUNT=COUNT+1
WRITE(NEW(1:3),'(13)') COUNT
CALL LENGTH(PLINE,LENTH)
WRITE(UNIT=13,FMT=15,IOSTAT=IERR30) PLINE(1:LENTH)
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'/NEW_COMB
PLINE=NEW
NEWEFF=.TRUE.
EFFORT=.TRUE.
ENDIF
PREVC='R'
ENDIF

ENDIF

125 CONTINUE

IF(EFFORT) THEN
IF((PES(56+PS:56+PS).EQ.'3') .OR. (PES(56+PS:56+PS).EQ.'6'))
* THEN
CALL E(PES,PS)
IF(PLINE(1:90).EQ.BLANKSTRING(1:90)) THEN
COUNT = COUNT + 1
WRITE(NEW(1:3),'(I3)') COUNT
PLINE = NEW
EFFORT = .FALSE.
ELSE IF(PLINE(4:4).EQ.'R' .AND. PLINE(6:18).EQ.NEW(6:18))
  THEN
    PLINE = BLANKSTRING
    count = count - 1
    EFFORT = .FALSE.
  ELSE
    COUNT = COUNT + 1
    WRITE(NEW(1:3),'(I3)') COUNT
    CALL LENGTH(PLINE, LENTH)
    WRITE(UNIT=13, FMT=15, IOSTAT=IERR30) PLINE(1:LENTH)
    IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
    PLINE = NEW
    EFFORT = .FALSE.
ENDIF
PREVC = "E"
ENDIF
ENDIF

IF(PES(56+PS:56+PS).EQ.'4') THEN
  CALL POS(PES, PS)
  PREVC = "*"
  COUNT = COUNT + 1
  WRITE(NEW(1:3),'(I3)') COUNT
  CALL LENGTH(NEW, LENTH)
  IF(PLINE .NE. BLANKSTRING) THEN
    CALL LENGTH(PLINE, LENTH)
    WRITE(UNIT=13, FMT=15, IOSTAT=IERR30) PLINE(1:LENTH)
    IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB
    PLINE = NEW
  ENDIF
ENDIF
NEWEFF = .FALSE.
CONTINUE
50     goto 25

500   WRITE(UNIT=13, FMT=15, IOSTAT=IERR30) PLINE
IF(IERR30.NE.0) PRINT*, 'ERROR IN WRITING TO'//NEW_COMB

850   REWIND(13)
851   I = 0
READ(13, 15) NEW1
  I = I + 1
READ(NEW1(13:18), 15) DATE1
new1(4:4) = cd1
  if ((cd1.eq.'1') .or. (cd1.eq.'2') .or. (cd1.eq.'3') .or. (cd1
  .eq.'4') .or. (cd1.eq.'5') .or. (cd1.eq.'6')) goto 851
* reading the minutes & degrees, converting them to degrees & decimal
* degrees
READ(NEW1(24:35),'(I2)')MINLAT
READ(NEW1(35:36),'(I2)')MINLONG
READ(NEW1(21:22),'(I2)')DGLAT
READ(NEW1(31:33),'(I3)')DGLONG

DECLAT=(FLOAT(MINLAT))/60
DECLONG=(FLOAT(MINLONG))/60
RLAT1=FLOAT(DGLAT) + DECLAT
RLONG1=FLOAT(DGLONG)+ DECLONG
IF (NEW1(20:20).EQ.'S') RLAT1=-1*RLAT1
IF (NEW1(30:30).EQ.'E')RLONG1=-1*RLONG1

READ(NEW1(6:7),'(I2)')HR1
READ(NEW1(8:9),'(I2)')MIN1
DECTIME1=(FLOAT(MIN1))/60
TIME1=FLOAT(HR1)+DECTIME1

855 read(UNIT=13,FMT=15,END=800)NEW2
I=I+1

*checking to see if any position was recorded
CD2=new2(4:4)
if ((cd2.eq.'1') .or. (cd2.eq.'2') .or. (cd2.eq.'3') .or. (cd2
*.'4') .or. (cd2.eq.'5') .or. (cd2.eq.'6')) goto 855

* calculating the time in hrs and decimal hours
READ(new2(6:7),'(I2)')HR2
READ(new2(8:9),'(I2)')MIN2
DECTIME2=(FLOAT(MIN2))/60
TIME2=FLOAT(HR2)+DECTIME2

* checking for a time change (no time change, no need to calculate dist.)
IF(TIME2.EQ.TIME1) GOTO 855

READ(new2(24:35),'(I2)')MINLAT
READ(new2(35:36),'(I2)')MINLONG
READ(new2(21:22),'(I2)')DGLAT
READ(new2(31:33),'(I3)')DGLONG

DECLAT=(FLOAT(MINLAT))/60
DECLONG=(FLOAT(MINLONG))/60
RLAT2=FLOAT(DGLAT) + DECLAT
RLONG2=FLOAT(DGLONG)+ DECLONG
IF (new2(20:20).EQ.'S') RLAT2=-1*RLAT2
IF (new2(30:30).EQ.'E')RLONG2=-1*RLONG2

*checking the dates. if different days dont calculate speed
READ(new2(13:18),15)DATE2
IF (DATE1.NE.DATE2) THEN
TIME1=TIME2
DATE1=DATE2
RLAT1=RLAT2
RLONG1=RLONG2
cd1=cd2
new1=new2
GOTO 855
ENDIF

*using the grcirc subroutine to calculate distance between points
CALL GRCIRC(RLAT1,RLONG1,RLAT2,RLONG2,DIST)
IF (DIST.GT.20) THEN
VEL=DIST/(TIME2-TIME1)
DTIME=(TIME2-TIME1)
IF((VEL.GT.200).OR.(VEL.LT.0)) THEN
PRINT*, 'POSSIBLE ERROR IN LINE.' ,I,' UNLIKELY VEL'
WRITE(11,15)' ',
WRITE(11,18)'POSSIBLE ERROR IN LINE.' ,I,' UNLIKELY VEL'
WRITE(11,19)'VEL=',VEL
WRITE(11,14)'DTIME=',DTIME
ENDIF
ENDIF
TIME1=TIME2
DATE1=DATE2
RLAT1=RLAT2
RLONG1=RLONG2
cd1=cd2
new1=new2
GOTO 855

800 END

SUBROUTINE E(PES,P$)
*
*CHARACTER PES*500,NEW*90,PSS*250,BS*2,BLANKSTRING*90
CHARACTER TIME_E*5
COMMON NEW,BS,PSS,BLANKSTRING

*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)
*Event code
NEW(4:4)='E'

*on or off effort
IF(PES(57+P$:57+P$).EQ.'1')NEW(5:5)=',

*Converting the decimal minutes into seconds
TIME_E=PES(51+P$:55+P$)
READ(TIME_E(5:5),(F2.1)) DECMIN
ISEC=DECMIN*60

*Time
NEW(6:9)=TIME_E(1:4)
WRITE(NEW(10:11),(I2)*)ISEC
IF(NEW(10:10).EQ.0') NEW(10:10)='0'

*date
NEW(13:18)=PES(10:13)//PES(8:9)

*position
IF(pes(43+P$:43+P$).eq.'1') NEW(20:20)='N'
IF(pes(43+P$:43+P$).eq.'2') NEW(20:20)='S'
IF(pes(50+P$:50+P$).eq.'1') NEW(30:30)='E'
IF(pes(50+P$:50+P$).eq.'2') NEW(30:30)='W'

RETURN
END

******************************************************************************
SUBROUTINE R(PES,P$)
******************************************************************************

* CHARACTER PES*500,NEW*90,PSS*250,B$*2,BLANKSTRING*90
CHARACTER TIME_E*5
COMMON NEW,B$,PSS,BLANKSTRING

*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)

*Event code
NEW(4:4)='R'

*on or off effort
IF(PES(57+P$:57+P$).EQ.0)NEW(5:5)='.'

*Converting the decimal minutes into seconds
TIME_E=PES(51+P$:55+P$)
READ(TIME_E(5:5),(F2.1)) DECMIN
ISEC=DECMIN*60

*Time
NEW(6:9)=TIME_E(1:4)
WRITE(NEW(10:11),(I2)*)ISEC
IF(NEW(10:10).EQ.0') NEW(10:10)='0'

*date
NEW(13:18)=PES(10:13)//PES(8:9)

*position
IF(pes(43+P$:43+P$).eq.'1') NEW(20:20)='N'
IF(pes(43+P$:43+P$).eq.'2') NEW(20:20)='S'
IF(pes(50+P$:50+P$).eq.'1') NEW(30:30)='E'
IF(pes(50+P$:50+P$).eq.'2') NEW(30:30)='W'
SUBROUTINE L(PES,P$)

*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)
*Event code
NEW(4:4)="L"
*on or off effort
IF(PES(57+P$:57+P$).EQ."1")NEW(S:S)=".
*Converting the decimal minutes into seconds
TIME_E=PES(51+P$:55+P$)
READ(TIM_E(5:5),'(F2.1)') DECMIN
ISEC=DECMIN*60
*Time
NEW(6:9)=TIME_E(1:4)
WRITE(NEW(10:11),(12)') ISEC
IF(NEW(10:10).EQ."0") NEW(10:10)="0"
*date
NEW(13:18)=PES(10:13)/PES(8:9)
*position
IF(pes(43+p$:43+p$).eq."1") NEW(20:20)="N"
IF(pes(43+p$:43+p$).eq."2") NEW(20:20)="S"
IF(pes(50+p$:50+p$).eq."1") NEW(30:30)="E"
IF(pes(50+p$:50+p$).eq."2") NEW(30:30)="W"

SUBROUTINE W(PES,NEWEFF,OLDW)
*this subroutine creates a 'W' event
* Initializing the string  
NEW(1:90)=BLANKSTRING(1:90)

* Event code
NEW(4:4)='W'

* on or off effort
IF(PES(57:57).EQ.'1') NEW(5:5)='

* Converting the decimal minutes into seconds
TIME_E=PES(51:55)
READ(TIME_E(5:5),'(F2.1)') DECMIN
ISEC=DECMIN*60

* Time
NEW(6:9)=TIME_E(1:4)
WRITE(NEW(10:11),'(12)') ISEC
IF(NEW(10:10).EQ. ') NEW(10:10)='0'

* Date
NEW(13:18)=PES(10:13)//PES(8:9)

* Position
IF(pes(43:43).eq.'1') NEW(20:20)='N'
IF(pes(43:43).eq.'2') NEW(20:20)='S'
IF(pes(50:50).eq.'1') NEW(30:30)='E'
IF(pes(50:50).eq.'2') NEW(30:30)='W'

NEW(21:28)=PES(38:39)//':'//PES(40:41)//'.//'
NEW(31:39)=PES(44:46)//':'//PES(47:48)//'.//'

* Beaufort
NEW(51:54)= //PES(35:35)

IF (((NEW(41:80) .NE. OLDW(41:80)).OR.(NEWEFF))) THEN
  OLDW(41:80)= NEW(41:80)
ELSE
  NEW= NEW(1:40)
ENDIF

RETURN
END
*Initializing the string
   NEW(1:90)=BLANKSTRING(1:90)
*Event code
   NEW(4:4)='G'

*on or off effort
   IF(PES(57:57).EQ.'1')NEW(5:5)="."

*Converting the decimal minutes into seconds
   TIME_E=PES(51:55)
   READ(TIME_E(5:5),'(F2.1)') DECMIN
   ISEC=DECMIN*60
*Time
   NEW(6:9)=TIME_E(1:4)
   WRITE(NEW(10:11),'(12)') ISEC
   IF(NEW(10:10).EQ.' ') NEW(10:10)="0"
*date
   NEW(13:18)=PES(10:13)//PES(8:9)
*position
   IF(pes(43:43).eq.'1') NEW(20:20)="N"
   IF(pes(43:43).eq.'2') NEW(20:20)="S"
   IF(pes(50:50).eq.'1') NEW(30:30)="E"
   IF(pes(50:50).eq.'2') NEW(30:30)="W"

   NEW(21:28)=PES(38:39)//""//PES(40:41)//""//
   * PES(42:42)//""
   NEW(31:39)=PES(44:46)//""//PES(47:48)//""//
   * PES(49:49)//""
*horizontal sun position
   NEW(43:44)=PES(31:32)
*vertical sun position
   NEW(48:49)=PES(33:34)

IF (((NEW(41:80).NE. OLDG(41:80)).OR.(NEWEFF))
    THEN
    OLDG(41:80)= NEW(41:80)
ELSE
    NEW= NEW(1:40)
ENDIF

RETURN
END

***********************************************************************
* SUBROUTINE A(PES,NEWEFF,OLDA)
*
*this subroutine creates an 'A' event
*
CHARACTER PES*500,NEW*90,PSS*250,BS*2,BLANKSTRING*90
CHARACTER TIME_E*5,OLDA*90
LOGICAL NEWEFF
COMMON NEW,BS,PSS,BLANKSTRING

42
*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)

*Event code
NEW(4:4)='A'

*on or off effort
IF(PES(57:57).EQ. '1')NEW(5:5)=='.

*Converting the decimal minutes into seconds
TIME_E=PES(51:55)
READ(TIME_E(5:5),'(F2.1)') DEC MIN
ISEC=DEC MIN*60

*Time
NEW(6:9)=TIME_E(1:4)
WRITE(NEW(10:11),'(I2)') I SEC
IF(NEW(10:10).EQ. ' ') NEW(10:10)==0'

*date
NEW(13:18)=PES(10:13)//PES(8:9)

*position
IF(pes(43:43).EQ. '1') NEW(20:20)== 'N'
IF(pes(43:43).EQ. '2') NEW(20:20)== 'S'
IF(pes(50:50).EQ. '1') NEW(30:30)== 'E'
IF(pes(50:50).EQ. '2') NEW(30:30)== 'W'

NEW(21:28)=PES(38:39)// PES(40:41)// PES(42:42)//'

NEW(31:39)=PES(44:46)// PES(47:48)// PES(49:49)//'

* altitude
NEW(41:44)=PES(14:17)

* speed
NEW(46:49)== '/PES(18:20)

IF (((NEW(41:80).NE. OLDA(41:80)).OR.(NEWEFF))) THEN
OLDA(41:80)= NEW(41:80)
ELSE
NEW= NEW(1:40)
ENDIF

RETURN
END

******************************************************************************************
SUBROUTINE P(PES,NEWEFF,OLDP)
*
*
CHARACTER PES*500,NEW*90,PSS*250,BS*2, BLANK STRING*90
CHARACTER TIME_E*5,OLDP*90
LOGICAL NEWEFF
COMMON NEW,B$,PSS,BLANK STRING

*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)
*Event code
   NEW(4:4)='P'

*on or off effort
   IF(PES(57:57).EQ.'1')NEW(5:5)='.'

*Converting the decimal minutes into seconds
   TIME_E=PES(51:55)
   READ(TIME_E(5:5),'(F2.1)') DECMIN
   ISEC=DECMIN*60

*Time
   NEW(6:9)=TIME_E(1:4)
   WRITE(NEW(10:11),'(I2)') ISEC
   IF(NEW(10:10).EQ.' ') NEW(10:10)='0'

*date
   NEW(13:18)=PES(10:13)//PES(8:9)

*position
   IF(pes(43:43).eq.'1') NEW(20:20)='N'
   IF(pes(43:43).eq.'2') NEW(20:20)='S'
   IF(pes(50:50).eq.'1') NEW(30:30)='E'
   IF(pes(50:50).eq.'2') NEW(30:30)='W'

   NEW(21:28)=PES(38:39)//':'//PES(40:41)//'.//
       * PES(42:42)/' '

   NEW(31:39)=PES(44:46)//':'//PES(47:48)//'.//
       * PES(49:49)/' '

*It obs
   NEW(41:44)=B$//PES(25:26)
*bow obs
   NEW(46:49)=B$//PES(21:22)
*rt obs
   NEW(51:54)=B$//PES(27:28)

*field 4: off effort observer (not recorded)
*field 5: off effort observer (not recorded)

*recorder
   NEW(66:69)=B$//PES(29:30)

*checking for duplication. if no change, dont write it to file.
   IF (((NEW(41:80) .NE. OLDP(41:80)).OR.(NEWEFF))
   THEN
      OLDP(41:80)= NEW(41:80)
   ELSE
      NEW= NEW(1:40)
   ENDIF

   RETURN
END
**************************************************************************************************************
SUBROUTINE POS(PES,P$)
*
*
   CHARACTER PES*500,NEW*90,PSS*250,B$*2,BLANKSTRING*90
CHARACTER TIME_E*5
COMMON NEW,B$,PSS,BLANKSTRING

*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)
*Event code
NEW(4:4)='*

*on or off effort
IF(PES(57+P$:57+P$).EQ.' 1 ')NEW(5:5)='.'

*Converting the decimal minutes into seconds
TIME_E=PES(51+P$:55+P$)
READ(TIME_E(5:5),'(F2.1)') DECMIN
ISEC=DECMIN*60
*Time
NEW(6:9)=TIME_E(1:4)
WRITE(NEW(10:11),'(12)') ISEC
IF(NEW(10:10).EQ.' ') NEW(10:10)="0"
*date
NEW(13:18)=PES(10:13)/PES(8:9)

*position
IF(pes(43+p$:43+p$).eq.'1') NEW(20:20)="N"
IF(pes(43+p$:43+p$).eq.'2') NEW(20:20)="S"
IF(pes(50+p$:50+p$).eq.'1') NEW(30:30)="E"
IF(pes(50+p$:50+p$).eq.'2') NEW(30:30)="W"

NEW(21:28)=PES(38+P$:39+P$)/."//PES(40+P$:41+P$)/"//
   PES(42+P$:42+P$)/"  
NEW(31:39)=PES(44+P$:46+P$)/."//PES(47+P$:48+P$)/"//
   PES(49+P$:49+P$)/"  

RETURN
END

SUBROUTINE SIGHT (TIME_S)
*
*This subroutine creates a sighting event 's'
*
CHARACTER TIME_S*5,NEW*90,PSS*250,B$*2,BLANKSTRING*90
COMMON NEW,B$,PSS,BLANKSTRING

*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)
*Converting the decimal minutes into seconds
READ(TIME_S(5:5),'(F2.1)') DECMIN
ISEC=DECMIN*60
*Event code
NEW(4:4)='S'
*On or off effort
IF(PSS(208:208).EQ.'1') NEW(5:5)=".
*Time
NEW(6:9)=TIME_S(1:4)
WRITE(NEW(10:11),'(12)') ISEC
IF(NEW(10:10).EQ.' ') NEW(10:10)="0"
*date
NEW(13:18)=PSS(11:14)//PSS(9:10)

*Position
IF (PSS(41:41).EQ.'1') NEW(20:20)="N"
IF (PSS(41:41).EQ.'2') NEW(20:20)="S"
IF (PSS(47:47).EQ.'1') NEW(30:30)="E"
IF (PSS(47:47).EQ.'2') NEW(30:30)="W"

NEW(21:28)=PSS(37:38)//":"//PSS(39:40)//":"//B$
NEW(31:39)=PSS(42:44)//":"//PSS(45:46)//":"//B$

*Sight number
IF((PSS(5:7).NE.' ').AND.(PSS(6:6).EQ.'7'))
  NEW(41:44)=" //PSS(5:7)
NEW(46:49)=B$/PSS(31:32)
*Obs number
NEW(61:64)=B$/PSS(65:66)
*Declination angle is not recorded
*For simplicity Perpendicular distance has been placed in the data field
* that declination angle should occupy.
NEW(51:54)=PSS(33:34)//":"//PSS(35:35)

*Primary observer y/n? all observers considered primary
NEW(56:59)=" ///Y"
*Spp 1 code
IF((PSS(65:66).NE.' ').AND.(PSS(65:65).EQ.' '))
  PSS(65:65)="0"
NEW(61:64)=B$/PSS(65:66)
*Spp 2 code
IF((PSS(99:100).NE.' ').AND.(PSS(99:99).EQ.' '))
  PSS(99:99)="0"
NEW(66:69)=B$/PSS(99:100)
*Spp 3 code
IF((PSS(118:119).NE.' ').AND.(PSS(118:118).EQ.' '))
  PSS(118:118)="0"
NEW(71:74)=B$/PSS(118:119)
*Spp 4 code
IF((PSS(137:138).NE.' ').AND.(PSS(137:137).EQ.' '))
  PSS(137:137)="0"
NEW(76:79)=B$/PSS(137:138)
*Spp 5 code
IF((PSS(156:157).NE.' ').AND.(PSS(156:156).EQ.' '))
  PSS(156:156)="0"
NEW(81:84)=B$/PSS(156:157)
*Perpendicular distance
NEW(86:90)=PSS(33:34)//":"//PSS(35:35)
* PRINT*,NEW(86:90)
RETURN
END

******************************************************************************************

SUBROUTINE GLARE (TIME_S)
*
*This subroutine creates a sun event. code 'g'
*
CHARACTER TIME_S*5,NEW*90,PSS*250,BS*2,BLANKSTRING*90
COMMON NEW,B$,PSS,BLANKSTRING

*Initializing the string
NEW(1:90)=BLANKSTRING(1:90)
*Converting the decimal minutes into seconds
READ(TIME_S(5:5),'(F2.1)') DECMIN
ISEC=DECMIN*60
*Event code
NEW(4:4)="G"
*On or off effort
IF(PSS(208:208).EQ.'1') NEW(5:5)='. '
*Time
NEW(6:9)=TIME_S(1:4)
WRITE(NEW(10:11),'(I2)')?>ISEC
IF(NEW(10:10).EQ.' ') NEW(10:10)=0
*date
NEW(13:18)=PSS(11:14)//PSS(9:10)
*Position
IF (PSS(41:41).EQ.'1') NEW(20:20)="N"
IF (PSS(41:41).EQ.'2') NEW(20:20)="S"
IF (PSS(47:47).EQ.'1') NEW(30:30)="E"
IF (PSS(47:47).EQ.'2') NEW(30:30)="W"
NEW(21:28)=PSS(37:38)//'://'PSS(30:30)//'://'B$
NEW(31:39)=PSS(42:44)//'://'PSS(45:46)//'://'B$
*horizontal sun
NEW(43:44)=PSS(23:24)
*vertical sun
NEW(48:49)=PSS(25:26)
* field 3, perpendicular distance, was moved to the sighting line to
* facilitate easy processing of the data.
* perpendicular distance
* NEW(51:54)=PSS(33:34)//'://'PSS(35:35)
*distance determined using what method
NEW(59:59)=PSS(36:36)
*birds(y/n)
IF(PSS(174:174).EQ.'1') NEW(64:64)="Y"
IF(PSS(174:174).EQ.'2') NEW(64:64)="N"
*sea surface temperature
RETURN
END
************************************************************
SUBROUTINE WEATHER (TIME_S)
*
*This subroutine creates a weather event. code 'W'
*
CHARACTER TIME_S*5,NEW*90,PSS*250,B$*2,BLANKSTRING*90
COMMON NEW,B$,PSS,BLANKSTRING
*Initializing the string
NEW(1:80)=BLANKSTRING(1:80)
*Converting the decimal minutes into seconds
READ(TIME_S(5:5),'(F2.1)') DECMIN
ISEC=DECMIN*60
*Event code
  NEW(4:4)= 'W'
*On or off effort
  IF(PSS(208:208).EQ.'1') NEW(5:5)= ', '
*Time
  NEW(6:9)= TIME_S(1:4)
  WRITE(NEW(10:11),'(I2)') ISEC
  IF(NEW(10:10).EQ. ' ') NEW(10:10)= '0'
*date
  NEW(13:18)= PSS(11:14)//PSS(9:10)
*Position
  IF (PSS(41:41).EQ. '1') NEW(20:20)= 'N'
  IF (PSS(41:41).EQ. '2') NEW(20:20)= 'S'
  IF (PSS(47:47).EQ. '1') NEW(30:30)= 'E'
  IF (PSS(47:47).EQ. '2') NEW(30:30)= 'W'
  NEW(21:28)= PSS(37:38)//':'//PSS(39:40)//'. //B$
  NEW(31:39)= PSS(42:44)//': //PSS(45:46)//'. //B$
*Beaufort sea state
  NEW(51:54)= ' //pss(30:30)

return
end

SUBROUTINE ONE
*This subroutine creates a ONE event codes 1
*CHARACTER NEW*90,PSS*250,B$*2,BLANKSTRING*90
COMMON NEW,B$,PSS,BLANKSTRING
INTEGER PS$

*Initializing the string
  NEW(1:90)= BLANKSTRING(1:90)
*Event code
  NEW(4:4)= '1'
*On or off effort
  IF(PSS(208:208).EQ.'1') NEW(5:5)= ', '
*observer code
  NEW(41:44)= B$//PSS(48:49)
*best estimate of school size
  NEW(46:49)= PSS(50:53)
*high estimate of school size
  NEW(51:54)= PSS(54:57)
*low estimate of school size
  NEW(56:59)= PSS(58:61)
*%SPP1
  NEW(61:64)= ' //PSS(62:64)
*%SPP 1
  DO 50 I=2,5
    PS$=(I-2)*19
    NEW(66+5*(I-2):69+5*(I-2))= ' //PSS(96+P$:98+P$)

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SUBROUTINE NUM(I)

*This subroutine creates a NUMBER event codes 2-6

CHARACTER NEW*90,PSS*250,BS*2,BLANKSTRING*90
COMMON NEW,B$,PSS,BLANKSTRING

* Initializing the string
NEW(1:90)=BLANKSTRING(1:90)

PS=(I-2)*19
IF(PSS(82+PS:83+PS).NE.' ') THEN
* event code
WRITE(NEW(4:4),'(11)') I
* on or off effort
IF(PSS(208:208).EQ.' I') NEW(5:5)='. '
* observer code
NEW(41:44)=BS//PSS(82+PS:83+PS)

* best estimate of school size
NEW(46:49)=PSS(84+PS:87+PS)

* high estimate of school size
NEW(51:54)=PSS(88+PS:91+PS)

* low estimate of school size
NEW(56:59)=PSS(92+PS:95+PS)

ENDIF
10 CONTINUE
RETURN
END

SUBROUTINE LENGTH(NEW,LENTH)

* This subroutine estimates the length of a character string excluding
* the trailing blanks
CHARACTER*90 NEW
LENTH= 80
DO 10 I=90,1,-1
IF(NEW(I:I).EQ.' ') THEN
LENTH=I-1
ELSE
RETURN
ENDIF
10 CONTINUE
RETURN
END

SUBROUTINE GRCIRC(RLAT1,RJdONG1,RLAT2,RLDNG2,DIST)
C
C...THIS PROGRAM COMPUTES GREAT CIRCLE DISTANCES BETWEEN TWO COORDINATES
C USING ALGORITHM TAKEN FROM KEN WALLACE'S PROGRAM (REPUTED TO HAVE
C BEEN LIFTED FROM H.P. PROGRAM MANUAL). COORDINATES ARE EXPRESSED
C AS DEGREES, AND ARE ASSUMED TO BE IN NORTHERN HEMISPHERE, WEST
C LONGITUDE IF POSITIVE.
C
IMPLICIT DOUBLE PRECISION (B-H, O-Z)
DOUBLE PRECISION LAS,LAC,LAF
REAL*4 RLAT1,RLONG1,RLAT2,RLONG2,DIST
DACOS(X)= (3.1415926535 / 2.0) - DATAN( X / DSQRT(1.0 - X*X) )
DIST= 0.0
PI= 3.141592653589793
R= PI / 180.0
D= 180.0 / PI

C...COMPUTE GREAT CIRCLE DISTANCE
LAS= (DSIN(RLAT1*R)) * (DSIN(RLAT2*R))
LAC= (DCOS(RLAT1*R)) * (DCOS(RLAT2*R)) *
LAF= LAS + LAC
IF (LAF .GT. 1.0) LAF= 1.0
IF (LAF .LT.-1.0) LAF= -1.0
IF (LAF .EQ. 1.0) GO TO 999
DIST= (DACOS(LAF)) * D * 60.0
999 CONTINUE
RETURN
END

******************************************************************************

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### Format of AE74DB

#### version 1

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### Appendix 4

---------- Format of AEyrdb ----------

version 2

---------- 1 of 2 --

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(Total # of repeat groups = # of 'repeat occurrences')
(Reference element at position 36, size 2.)

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58
Key to aerial survey raw data format

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Key to entry type codes:

* = position and time update (taken every minute)
T = Transect start, automatically followed by V,P,A,W.
V = Viewing conditions for all 3 observer positions. Recorded as percentage of viewing area obscured by glare.
P = Observer positions (order: left front, belly, right front, recorder).
A = Altitude and speed information.
W = Weather information:
H/K/N Haze or kelp presence
0-100 % cloud cover
0-5 Beaufort sea state
G/L/D/R Water color (green, light blue, dark blue, red tide)
O = End of transect
E = Ending effort on transect (i.e. to circle, transit, ...).
R = Resuming effort.
S = Sighting information:
- Sighting #
- Observer initials
- Declination angle (left side recorded as negative, right, positive)
- Primary sighting? (Y/N) (Note: Belly observer sightings are secondary, because only sightings missed by primary (side) observers may be called by this observer).
- 1-3 fields with IDs for species in sightings
1-6 Individual observer estimates of school size and species proportions. Order: Best, High, Low, SP1 %, SP2 %, SP3 %
C = Comments - can be entered in any format to add information, point out errors in previous entries, etc.
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<td><em>Hyperoodon planifrons</em></td>
<td>Southern bottlenose whale, flathead bottlenose whale</td>
</tr>
</tbody>
</table>
## Appendix 6

### CODE TABLE 4b

**Research Vessel / Life History**

**Cetacean Species Codes**

<table>
<thead>
<tr>
<th>SPEC</th>
<th>CODE</th>
<th>SCIENTIFIC NAME</th>
<th>STANDARD COMMON NAME, OTHER COMMON NAMES</th>
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</thead>
<tbody>
<tr>
<td>51</td>
<td>Mesoplodon sp.?</td>
<td>Unidentified Mesoplodon</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td><em>Mesoplodon carlhubbsi</em></td>
<td>Hubbs’ beaked whale, archbeak whale</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td><em>Mesoplodon hectori</em></td>
<td>Hector’s beaked whale</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td><em>Mesoplodon bowdoini</em></td>
<td>Andrew’s beaked whale, deepcrest whale</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td><em>Mesoplodon europaeus</em></td>
<td>Gervais’ beaked whale, Antillean beaked whale</td>
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</tr>
<tr>
<td>56</td>
<td><em>Mesoplodon bidens</em></td>
<td>Sowerby’s beaked whale</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td><em>Mesoplodon ginkgodens</em></td>
<td>Ginkgo-toothed beaked whale</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td><em>Mesoplodon grayi</em></td>
<td>Gray’s beaked whale</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td><em>Mesoplodon densirostris</em></td>
<td>Blainville’s beaked whale, dense-beaked, tropical beaked whale</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td><em>Mesoplodon lavgardi</em></td>
<td>Strap-toothed whale</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td><em>Ziphius cavirostris</em></td>
<td>Cuvier’s beaked whale, goose-beaked whale</td>
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<tr>
<td>62</td>
<td><em>Berardius arnuxii</em></td>
<td>Arnoux’s beaked whale, southern giant bottlenose whale</td>
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</tr>
<tr>
<td>63</td>
<td><em>Berardius haidii</em></td>
<td>Baird’s beaked whale, southern giant bottlenose whale</td>
<td></td>
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<tr>
<td>64</td>
<td><em>Tasmacetus shepherdii</em></td>
<td>Shepherd’s beaked whale</td>
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</tr>
<tr>
<td>65</td>
<td><em>Mesoplodon pacificus</em></td>
<td>Longman’s beaked whale, Indo-Pacific beaked whale</td>
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</tr>
<tr>
<td>66</td>
<td><em>Eubalaena glacialis</em></td>
<td>Northern right whale</td>
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</tr>
<tr>
<td>67</td>
<td><em>Balaena mysticetus</em></td>
<td>Bowhead whale</td>
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<tr>
<td>68</td>
<td><em>Caperea marginata</em></td>
<td>Pygmy right whale</td>
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</tr>
<tr>
<td>69</td>
<td><em>Eschrichtius robustus</em></td>
<td>Gray whale</td>
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<tr>
<td>70</td>
<td><em>Balaenoptera sp.?</em></td>
<td>Unidentified Rorqual</td>
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</tr>
<tr>
<td>71</td>
<td><em>Balaenoptera acutorostrata</em></td>
<td>Minke whale</td>
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</tr>
<tr>
<td>72</td>
<td><em>Balaenoptera edeni</em></td>
<td>Bryde’s whale</td>
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</tr>
<tr>
<td>73</td>
<td><em>Balaenoptera borealis</em></td>
<td>Sei whale</td>
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</tr>
<tr>
<td>74</td>
<td><em>Balaenoptera physalus</em></td>
<td>Fin whale</td>
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<tr>
<td>75</td>
<td><em>Balaenoptera musculus</em></td>
<td>Blue whale</td>
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<tr>
<td>76</td>
<td><em>Megaptera novacangliae</em></td>
<td>Humpback whale</td>
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<tr>
<td>77</td>
<td><em>Kogia simus/brevicoda</em></td>
<td>Unidentified dolphin or porpoise</td>
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</tr>
<tr>
<td>78</td>
<td><em>Kogia simus/brevicoda</em></td>
<td>Unidentified small whale</td>
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</tr>
<tr>
<td>79</td>
<td><em>Kogia simus/brevicoda</em></td>
<td>Unidentified large whale</td>
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<tr>
<td>80</td>
<td><em>Kogia simus/brevicoda</em></td>
<td>Unidentified <em>Kogia</em> - dwarf or pygmy sperm whale</td>
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<tr>
<td>81</td>
<td><em>Mesoplodon steinergieri</em></td>
<td>Steinger’s beaked whale, sabertooth, Bering Sea beaked whale</td>
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<tr>
<td>82</td>
<td><em>Mesoplodon mirus</em></td>
<td>True’s Beaked Whale</td>
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<tr>
<td>83</td>
<td><em>Mesoplodon sp.</em></td>
<td>Unnamed beaked whale</td>
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<tr>
<td>84</td>
<td><em>Hyperoodon ampullatus</em></td>
<td>Northern Bottlenose, North Atlantic bottlenose whale</td>
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<tr>
<td>85</td>
<td><em>Monodon monoceros</em></td>
<td>Narwhal, sea unicorn</td>
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<tr>
<td>86</td>
<td><em>Eubalaena australis</em></td>
<td>Southern right whale</td>
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<tr>
<td>87</td>
<td><em>Pantropical australis</em></td>
<td>Francisca, La Plata dolphin</td>
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<tr>
<td>88</td>
<td><em>S. longirostris centroamericanus</em></td>
<td>Central American spinner dolphin, Costa Rican spinner dolphin</td>
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<td>89</td>
<td><em>Stenella attenuata/platodon</em></td>
<td>Unidentified spotted dolphin in Atlantic</td>
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<tr>
<td>90</td>
<td><em>Stenella attenuata subsp.?</em></td>
<td>Unidentified pantropical spotted dolphin, spotter porpoise</td>
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<tr>
<td>91</td>
<td><em>Stenella frontalis</em></td>
<td>Atlantic spotted dolphin, spotter porpoise</td>
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<tr>
<td>92</td>
<td><em>Platanista gangetica</em></td>
<td>Ganges susu, Ganges dolphin</td>
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<tr>
<td>93</td>
<td><em>Platanista minor</em></td>
<td>Indus susu, Indus dolphin</td>
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<td>94</td>
<td><em>Haijus geoffrensis</em></td>
<td>Muto, Amazon river dolphin</td>
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<tr>
<td>95</td>
<td><em>Lipotes vexillifer</em></td>
<td>Haiji, Chinese river dolphin, whitefin dolphin</td>
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<td>96</td>
<td><em>Unidentified cetacean</em></td>
<td>Unidentified cetacean</td>
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<td>97</td>
<td><em>Unidentified object, possible marine mammal</em></td>
<td>Unidentified object, possible marine mammal</td>
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<td>98</td>
<td><em>Unidentified whale</em></td>
<td>Unidentified whale</td>
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<tr>
<td>99</td>
<td><em>Balaenoptera borealis/edeni</em></td>
<td>Rorqual identified as a Sei or Bryde’s whale</td>
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<tr>
<td>CODE</td>
<td>SCIENTIFIC NAME</td>
<td>STANDARD COMMON NAME, OTHER COMMON NAMES</td>
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<td>PU</td>
<td>Pinnipedia</td>
<td>Unidentified Pinniped</td>
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<tr>
<td>DD</td>
<td>Otariinae</td>
<td>Unidentified Sea Lion</td>
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<tr>
<td>E3</td>
<td><em>Eumetopias jubatus</em></td>
<td>Stellar Sea Lion</td>
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<tr>
<td>ZC</td>
<td><em>Zalophus californianus</em></td>
<td>California Sea Lion</td>
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<tr>
<td>UA</td>
<td>Arctocephalinae</td>
<td>Unidentified Fur Seal</td>
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<tr>
<td>AT</td>
<td><em>Arctocephalus townsendi</em></td>
<td>Guadalupe Fur Seal</td>
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<tr>
<td>CU</td>
<td><em>Callorhinus ursinus</em></td>
<td>Northern Fur Seal</td>
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<tr>
<td>US</td>
<td>Phocidae</td>
<td>Unidentified Seal</td>
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<tr>
<td>MA</td>
<td><em>Mirounga angustirostris</em></td>
<td>Northern Elephant Seal</td>
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<tr>
<td>PV</td>
<td><em>Phoca vitulina</em></td>
<td>Harbor Seal</td>
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</tr>
</tbody>
</table>

Appendix 6

CODE TABLE 4b

Pinniped Species Codes
RECENT TECHNICAL MEMORANDUMS

Copies of this and other NOAA Technical Memorandums are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22167. Paper copies vary in price. Microfiche copies cost $4.50. Recent issues of NOAA Technical Memorandums from the NMFS Southwest Fisheries Science Center are listed below:

J.V. CARRETTA and K.A. FORNEY (September 1993)

186 The biology and population status of marine turtles in the North Pacific Ocean.
K.L. ECKERT (September 1993)

J.J. ELIASON, J.R. HENDERSON, and M.A. WEBBER (September 1993)

188 "Best" abundance estimates and best management: Why they are not the same.
B.L. TAYLOR (October 1993)

189 Fishery interaction between the tuna longline and other pelagic fisheries of Hawaii.

190 Statistical guidelines for a pilot observer program to estimate turtle takes in the Hawaii longline fishery.
G.T. DINARDO (November 1993)

191 The Hawaiian monk seal on Laysan Island.
D.J. ALCORN and R.L. WESTLAKE (December 1993)

192 Techniques for the preparation and examination of reproductive samples collected from dolphins in the eastern tropical Pacific.
P.A. AKIN, K.M. PELTIER, and R.B. MILLER (December 1993)

193 A comparison of the recreational and commercial fisheries for lingcod (Ophiodon elongatus) off the Pacific coast of the United States, Along with a description of the recreational lingcod fishery.
K.R. SILBERBERG and P.B. ADAMS (December 1993)

194 Economic effects of the United Nations moratorium on high seas driftnet fishing.
D.D. HUPPERT and T.W. MITTLEMAN (December 1994)