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Instructions for Conducting a Census of Bowhead Whales from Ice-Based Observation Sites Near Point Barrow, Alaska

by
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INSTRUCTIONS FOR

CONDUCTING A CENSUS OF BOWHEAD WHALES

FROM ICE-BASED OBSERVATION SITES NEAR POINT BARROW, ALASKA

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INTRODUCTION

This document is a compilation and augmentation of unpublished manuals and memoranda written by the authors as well as by Geoffrey Carroll, Steven Savage, Ronald Sonntag, and Howard Braham, all of the National' Marine Fisheries Service (NMFS), National Marine Mammal Laboratory,(NMML). Its objectives are to provide an overview and explicit instructions for conducting an ice-based census of bowhead whales (Balaena mysticetus) near Point Barrow, Alaska.

Since 1961, NMFS has supported field research on bowhead whales at villages along the Alaskan coast, primarily at Barrow. In 1976, this effort was expanded from a study of harvested whales to include a count of bowheads as they migrated past whaling camps in the spring. Typically, these whales follow breaks in the sea ice (leads) during their-annual migration from the Bering Sea to the Beaufort Sea. Shorefast ice, attached to shallow coastal areas, has provided Eskimo whalers with a platform from which to launch their boats (umiaks) and make close approaches to these whales. Accordingly, observers were stationed near the lead edge, preferably on top of solidified ice upthrusts (pressure ridges) that were formed during winter storms. These elevated perches, which are occasionally as high as 10 m, maximize the effective viewing area.

Following feasibility studies in 1976 and 1977, systematic censuses were conducted each year by NMFS until 1982 when the Alaska Eskimo Whaling Commission and North Slope Borough took over sponsorship of this effort. Explanation of procedures developed during these years is provided here.

FIELD SCHEDULING

Based on our records, bowheads do not generally appear in the Barrow area until mid-April, and by early June most have passed to the east. Accordingly, a team of biologists should be present throughout this period for conducting the census. Observations prior to and following the typical census period may have to rely on logistic techniques other than those described in this manual. Our ice-based efforts have been confined to dates where the research is productive and relatively safe based on advice from Eskimo guides.

In consideration of the harshness of the arctic environment, the size of the counting crews, and complexity of the research endeavor, preparations need to be under way well in advance of the commencement of field work. Aside from acquiring necessary permits (such as MMPA #l13 and ESA Permit #E5), contacting relevant officials for supportive projects. (such as satellite imagery, aerial surveys, or acoustic studies), and hiring a crew of experienced observers (see Appendix I for recommended characteristics), there remains the acquisition and preparation of equipment. A list of suggested camp gear and basic research materials is provided in Appendix II.

A training program should be conducted prior to the research effort to introduce new personnel to the biology of the bowhead whale and its legal and social ramifications, particularly in regard to the recent

history of Eskimo whaling and research. Suggested material to read is included in Appendix III. The objectives and methods of this study should be clearly stated and emphasis placed on the pertinence and value of the data to be collected. A training and orientation period is advisable prior to the initiation of field work. This should primarily focus on developing inter- and intra-year consistency in data collection procedures, and should also include relevant matters of safety and appropriate conduct when working at the ice camps (see "Camp Logistics"). The best plan would involve the entire research team in a single workshop just prior to going out on the ice; however, for cost efficiency reasons, teams have generally not been assembled at one time. Not everyone is needed during the first week or two; therefore, expense has been saved by bringing on people when needed. The final assembly of gear and its preparation for transportation onto the ice may take 2 to 5 days and is best done by a small crew familiar with all aspects of the ice camp operation. Disassembly, cleaning, inventory, and packaging of equipment may take a similar period at the end of the season, and is also best accomplished by a small crew. Due to the vicissitudes of arctic weather, sea ice, and whale movements, personnel should be advised that termination dates of this assignment are highly flexible.

Research strategies have been developed whereby several teams of observers are in the field simultaneously. A primary and secondary (South and North) camp operation is explained later in this manual; but for establishing a work schedule, let us here consider only the primary camp whose purpose it is to maintain a search for whales whenever possible throughout the season. A major objective is to have two people at the observation site at any given moment: one serves as a primary observer, while the other records data and acts as a secondary observer. This calls for a crew of eight to maintain a continuous watch indefinitely.

The best work schedule yet developed without overlap between watches is to have pairs of people stand watch for four hours followed by a 4-hour break then another 4-hour watch and a 12-hour break. This cycle is repeated for 3 days until a day of rest or a day of camp maintenance responsibilities which come alternately every fourth day. Therefore, the schedule calls for seven work days followed by a day off. Of the six people in an ice camp at any one time, two pairs will be on the above schedule while the third pair works 4 hours on and 8 off, continuously After a day off, this pair may switch with others as the latter work schedule has proven to be more grueling than the schedule with a daily 12-hour break.

Individual watch schedules may be staggered so that, even though everyone is working 4-hour watches, changes in shifts are occurring every 2 hours. This is accomplished by one team member going on watch 2 hours before the other. Therefore a fresh observer arrives on watch every 2 hours and better continuity is provided among watches (Fig. 1). Note that in all cases the people on watch do not leave the perch until the relief team has arrived and is ready to work.

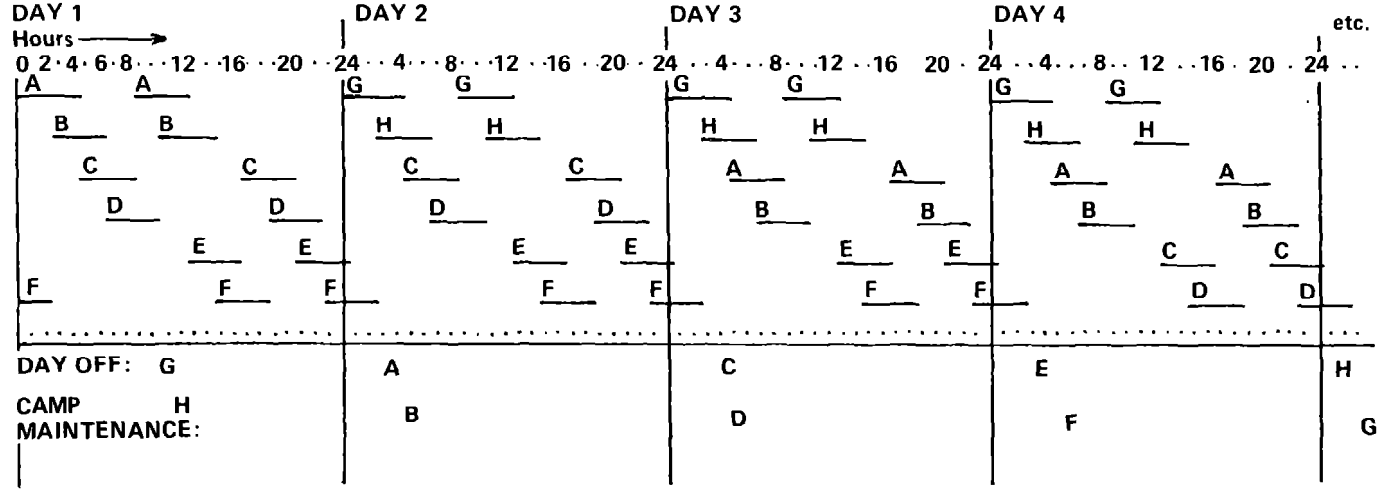

Figure 1. --Sample watch schedule with eight people, two on a watch at a time for 4 hours each, overlapping so that every 2 hours there is a shift in observers.

CAMP LOGISTICS

The Field Leader should try to locate the research camp northwest of the northernmost tip of Point Barrow. We have ascertained that the whale migration passes closest to the edge of the shorefast ice northwest of the Point. Observers should be stationed on the highest piece of ice (perch) available near the edge of the lead from which whales can be counted safely. Since there may be additional counting experiments conducted from a perch located about 1 km north of the primary counting station, the latter site should be located in an area where the ice edge lies roughly parallel to the general direction of the nearshore lead. Two camps are deployed for the purpose of determining the number of whales not counted at the primary site.

The terms camp and perch are occasionally mixed. Camp may refer to both living quarters on the ice and to the observation site, but more explicitly refers to the former. Perches are usually located far enough away from camps to reduce noise associated with camp activity and the coming and going of snowmobiles, but not so far as to make walking impractical. Sometimes one camp serves two perches. Out of respect for whalers, who frequently station themselves in the proximity of the census perch, and to reduce potential bias problems with noises alarming whales, it is best to minimize traffic to the lead edge.

Ice camps generally consist of a cook tent, where most equipment is stored, and a sleeping tent restricted to that purpose (because of the constant watch effort, there is almost always someone needing a place to rest). These tents are of heavyweight canvas tarp and provide living standards similar to those endured by Eskimo whalers during the whaling season. Essential and recommended camping equipment is listed in Appendix II. The selection, maintenance, and use of this equipment and the conduct of personnel on the ice are issues beyond the scope of this manual. There is an apparent need for considerable continuity of personnel between years to maintain the skills and knowledge gained from previous seasons.

Camp provisions should be sufficient for safe conduct of the research effort without an excess of equipment. When ice conditions become hazardous, the camp may have to be moved promptly and therefore must be kept light. Camp equipment is transported on wooden sleds hauled behind snowmobiles which are often forced to cross rough terrain. It is advisable that the entire camp be compact enough to be hauled in one trip with available machines and sleds.

Observation perches are platforms cut as high as possible on pressure ridges in such a manner that safe approach and quick evacuations are possible. Space should be available for at least four people to stand upright and include a solid position on which a theodolite tripod can be planted, and room for a comfortable seat with ensolite pads for the data recorder. It is imperative that the tripod legs not be touched during survey periods.

No one should block the view or hamper the efforts of the primary observer. For these reasons, visitation to the observation perch should be minimized. In fact, a separate, nearby stage may be cut on which visitors may stand to observe the census operation. Besides the theodolite and data recording facilities, the observation perch should have a CB radio, spare batteries, spare antennae, a windbreak, and sufficient safety gear to sustain a team if they are separated from shore. (See "Research" and "Safety" sections in Appendix II for a listing of suggested equipment.) Survival suits, a raft, guns, and bivouac supplies including spare food are important to have at the perch when not in direct conjunction with an Eskimo whaling camp. Sufficient snowmobiles and sleds must always be available at the perch to allow for immediate evacuation.

Prior to going out on the ice, all personnel should be familiar with the research site as to its location, terrain features, climate, and hazards. Accident prevention can be encouraged through high health standards, specifically regarding the cardiovascular system, overall muscle tone, acclimatization, and avoidance of drugs and smoking. Adequate first aid supplies and communication systems must be maintained in anticipation of accidents or illnesses. Strategies should be developed to cope with survival situations. The following hazards are of special consideration: fire, careless use of weapons, polar bears, exposure (hypothermia, frostbite, sunburn), reckless use of snowmobiles, carbon monoxide poisoning, snow blindness, getting lost, drowning, and diseases (complicated by malnutrition, communicable ailments, and intestinal malaise). Buddy systems and communication between parties is pertinent to the safe conduct of the research. Proper snowmobile operation and understanding basic maintenance procedures may be vital to safe escape from some hazardous situations.

In order to properly respond to an accident, first aid supplies must be readily accessible. Provisions should allow for care of burns, lacerations, punctures,broken limbs, and minor ailments as well as providing treatment for hypothermia, frostbite, snow blindness, and ailments which require more than rest, comfort, and reassurance. Evacuation procedures should be familiar to each member of the team. Monitored CB radio frequencies and emergency phone numbers should be posted at the field camp and at the base station. In case of an emergency, needs can be communicated to any who may help: 1) initially contact all members of the team and coordinate a rescue plan; 2) a CB radio should be used to contact local sources of help (specify location, accident description, victim identification, needs, plan of action, and schedule of later radio check-in times); 3) if no contact can be made by radio (all monitored frequencies should be tried), assistance may be sought carrying a written description of the accident in hand; 4) flares, smoke dyes, or marks on the snow will attract attention; and 5) an Emergency Locating Transmitter (ELT) may be used for incidences when no assistance can be found otherwise.

DATA COLLECTION PROCEDURES

Printed forms and this instruction manual should be available to all personnel collecting field data. Examples of two field forms are included as Appendices VII and VIII. The form entitled "PRIMARY CAMP" should be used for recording all data associated with the primary census at South Perch. The form with "PRIMARY CAMP" and "SECONDARY CAMP" is used only when conducting experiments for counting missed whales at North Perch. Both forms ask for essentially the same data but in different formats. Below is an overview of data collection procedures.

Most data requested on the banner heading (at the top of each data sheet) should be recorded at least at the beginning of each new day. The date must appear on each page. Each perch should be specified as either North or South as well as being identified with a unique name. Detailed descriptions should be written out elsewhere. These notes should include perch location, and a description should be made of general ice conditions, width of the shorefast ice apron, character of the shear zone, lead width and orientation, plus any other aspects of the site which may have an influence on whale activity or observation effort, including the presence of whaling camps. These notes should be updated whenever significant changes occur. Note that perch height should be recorded only when it is surveyed; instrument height is recorded every time it is measured.

Perch height must be measured precisely (as with the theodolite). Perch height is the vertical distance from sea level to the top of the platform on which observers stand. Instrument height is measured from the platform to the appropriate mark on the scope of the theodolite. See Appendix IV for a description of calculation procedures. It is necessary to determine the exact height of the theodolite because it will be the primary instrument used for determining the location of whales relative to the perch. The NMML has developed a computer program to recount the field data by relying on observation times and whale positions ascertained by digital watches and theodolite readings. It is expected that these "recounts" will serve as the primary basis for detecting population trends over the years.

Please note that the banner heading of the North Camp form requests eye height. If observers have access to a theodolite at North Perch, eye height should be perch height plus instrument height and so noted. Otherwise, eye height is the approximate average distance between sea level and the observer's eyes (observer height may be considered 1.5 m).

Count data are collected as daily units on a 24-hour clock. Date should be identified as day, month (spelled out), and year on each page. Beginning at 00:00:00 hours (midnight), the field form pages are numbered consecutively from 1 through the last page with midnight of that day. Always start a new page with each new day. Be sure to fill in the number of pages for the day that was just completed too, and record this number on each page.

Each page has line numbers to identify data entries. These page and line numbers are used as reference guides when comparing one whale sighting with another. When comments are made by observers, they should be written on the reverse side of the page, referencing the data on the front side by line number.

Since there will almost always be at least two observers on watch at the same time, one person will be assigned the duty of being the data recorder and the other will be assigned the duty of primary observer. When both are searching for whales, divide the field of view in order to increase the concentration of search. In any case, maintain a systematic scanning search; do not focus only in areas where whales were last seen. The recorder is responsible for logging all count and environmental data while on watch. The recorder will enter initials of the observer for every sighting being made. In the event that the recorder sees a whale first, the recorder will point the whale out to the observer so that the observer can make counting decisions and take measurements of the whale's location relative to the perch. When this teamwork is done properly, it results in most data being scored as having been acquired by the observer, with recorder's initials rarely entered in the observer column. Therefore it is the recorder's job to "coordinate" all counting activities and to assure data is recorded in an accurate and consistent manner. The observer has the primary duty of calling out whale sightings and using available research equipment to determine positions of whales relative to the perch.

At this point, it is important to define what is meant by a sighting. Each visible surfacing of a whale is a sighting, and occasionally even incomplete surfacings, such as a swirl in the water, may serve as sufficient evidence of a whale's presence and therefore constitute a sighting. In foggy conditions or with ice blocking the view, whales will sometimes be heard without being seen. Make special note of these instances and provide approximate bearings. Typical cues are white puffs (blows) or black streaks (whale's heads or backs, sometimes appearing separately) which are more or less evident relative to distance 'from observer and contrasting background. Blows may be seen without a visible whale and whales may be seen without a visible blow. Note that, whatever the sighting cue, the whale's presence may be concealed. Concentrated, attention and proper scanning techniques are essential.

Bowhead whales migrating past Point Barrow in the spring generally pass ice-based observers from left to right. These whales may swim completely past the station underwater; therefore, observers must search everywhere a whale could reasonably be located. Concentrating solely on the anticipated direction of arrival (to the left) is inadequate. Dive profiles of bowheads generally consist of long dives followed by rises to the surface. During the rise a whale may surface several times in a series of short rolls. The observer should attempt to record the position of the whale only once during each rise. The usual sequence of events is for the observer to recognize the presence of a whale during the first few rolls of a rise, and take bearings with

a theodolite as soon as possible. Once a reading is completed, the observer should resume a general search and not concentrate singularly on the recorded whale; Appendix VI describes how such a concentrated behavior study may be carried out apart from primary census effort. According to Carroll and Smithhisler (1980), bowheads roll at the surface six to seven times (SD = 3) during an average rise sequence. Therefore, if observers are quick enough to take theodolite readings by the third roll of every rise, most rises will be recorded. Characteristic ice features near the last surfacing and ripples in the water may help guide an observer to a sighting even if the whale submerged prior to viewing it through the scope. Bearings can be made on rises with as few as one recognized roll.

Whether or not a whale sighting is to be linked to previous sightings is a function of an observer's depth perception, sense of timing, and general understanding of bowhead whale behavior. Each clear view of a surfacing may show a whale's direction and give a sense of its relative travel rate (which is generally around 5 km/hr or a speed comparable to a fast walk). After a surfacing, the submerged whale is traced in the observer's mind and subsequent surfacings anticipated. Thus linkages are subjective and rely on acute senses and experience on the part of observers. Assistance using mathematical probability is described later in this manual under "Standardized Computer Counting." Typically, all sighting information with appropriate timings and bearings will be analyzed by computer to test observer judgements against expected speed and direction parameters (explained further in Krogman et al. 1982).

A few of the more specific instructions for filling out field forms are as follows:

OBS/ON,OFF - The first time observers log on each season, full names should be written out with indication of the exact unique initials by which to identify that observer for the remainder of the season. It is CRITICAL observers log time on and off, highlighting the event by marking out the line number with a bold "X". Enter a slash below observer initials and write "S" for on (Start) or "F" for off (Finish).

When a watch extends through to a new day, observers should enter a "C" for continue. Thus at midnight (24:00:00), all persons on duty are "continued" onto a new day. On the new day's form, these same people are continued by re-entering their initials with another "C" at 00:00:00 hours.

TIME - The order of all events is chronological. If an event is recorded out of sequence, the time should be noted and an arrow drawn to indicate where it should have been entered. Observers sign on and off and environmental conditions are recorded to the nearest whole minute, but each sighting is recorded to the nearest second. Time is recorded as military time, i.e., 13:00:00 instead of 1:00:00 p.m.

The number of whales sighted is recorded in this column. If a whale has already been recorded, indicate it as a duplicate (e-g., 1 /D. If it is not certain that the whale has been counted before, indicate it as a conditional (e.g. l/C). If two whales surface, only one of which has been seen previously, indicate them as (1+1/D). If you notice calves, differentiate them from adults by circling the count (e.g., 2 1 means 2 adults plus 1 calf), and describe on the reverse side of the sheet how distinctive the calf was. Describe the calf's coloration, apparent size, number of surfacings viewed, position relative to other whales, and notable behaviors.

SP (Species) - All recorded sightings are considered to be of bowheads unless' otherwise specified. Legal species codes are

"blank" or BM = Balaena mysticetus -- bowhead whale

DL = Delphinapterus leucas -- white whale

ER = Eschrichtius robustus -- gray whale

00 = Orcinus orca -- killer whale

Other cetacean species names should be written out and great detail given in describing their appearance. Pinnipeds and birds should not be entered on the front side of the sighting logs. They clutter the page and are not important to this research effort.

The one exception to the above codes is ICE. Repeated bearings can be made on floating ice to measure current speed. See CURRENT (SPD - DIR) later in this report.

P#/L# (page number, line number) - this column allows the observer to linkbsequent sightings and thus provides more clear-cut linkage information. Only whales which are designated as "D" (duplicate) are linked, i.e., "C" (conditional) should not be linked. For purposes of data processing, the P#/L# column should be left blank for initial 'sightings, but with each linkage, the P#/L# should refer back to the initial sighting, not to intermediate sightings. For example, if the first observation of a whale was made on page 11, line 3, and the same whale was subsequently resighted on page 11, line 7, and again on page 12, line 1; then for both of the latter sightings, the P#/L# value would be written as 11/3. Filling in this column should only be done when there is a high degree of certainty that the linkage is correct.

VERT ANGLE - A theodolite provides vertical and horizontal angles to whale sightings. Make note of the theodolite serial number in the field log. This allows for later corrections of internal instrument error in vertical readings. Vertical angles should be recorded to the nearest second, although accuracy to the nearest 20-second interval has proven adequate. Field technicians should be instructed on its use at

the initiation of field activities. Because of the wide range in theodolites, transects, and other surveying devices which may be applied in this attempt to establish whale positions, no specific instructions on use of these instruments is provided here. However, it is recommended that the selected instruments have high resolution optics with 15 to 25 power magnification, not higher. Digital readouts and convenient placement of control knobs expedite readings.

HOR ANGLE (see also VERT ANGLE) - Horizontal angles need only be recorded to the nearest minute. These angles are based on zero degrees magnetic north. It is best to establish a calibration-mark to increase the relative accuracy of bearings.

EST DIST (M) - For each sighting, observers estimate the distance from their perch to the whale (in meters). Observers can receive distance estimation training via practice with theodolites. When the computer counting algorithm processes the data base, it will read the theodolite data to determine the exact position of whale sightings. The estimated distance column will be used as a backup to theodolite data.

VIS - Visibility and other environmental data, except current speed and direction, should be recorded once every two hours, preferably at the change of watch. Visibility conditions are defined as they relate to the ability of observers to see whales. The data recorder is responsible for making these judgements and measurements, and his/her initials should appear on the respective line.

Code	Description	
EX	Excellent	- horizon or far shore of the lead is visible without obstruction from weather or sea surface conditions. Unlimited viewing range.
VG	Very Good	- lighting, waves, reflections, precipitation, or fog may cause minor interference with detecting distant sightings, but far shore of the lead is still discernible. Viewing range less than to the horizon.
GO	Good	- most of the lead is visible, but lighting, waves, etc., interfere with sightings at a distance. Viewing range less than 3 km.
FA	Fair	- most of the lead is difficult to see because lighting, waves, etc., cause interference. Broken ice makes the far shore of the lead difficult to discern. Viewing range is under 1.5 km.

PO	Poor	- lighting, fog, broken ice, etc., prevent adequate viewing beyond 0.5 km.
UN	Unacceptable	- open lead is faintly visible or cannot be seen at all. - lead is closed or full of ice (even though the view may be clear to the horizon).

WEA - (weather) Record weather relative to the generalized situation between you and the lead; e.g., do not record a snow squall if it is occurring behind you.

Code	Description
CL	clear (less than 10% overcast)
PC	partly cloudy
OV	overcast (less than 10% clear)
LS	light snow
HS	heavy snow
LF	light fog
HF	heavy fog
SR	snow/rain mix
LR	light rain
HR	heavy rain

LEAD WIDTH - Estimated or measured average distance in meters from one edge of the lead to the other in front of the observation perch.

WIND (SPD - DIR) - Estimated or measured wind speed in knots. Estimated or measured wind direction should be recorded as a magnetic compass bearing pointing toward the direction the wind is coming from. These data help keep observers alert to changing weather conditions which could affect their safety.

CURRENT (SPD - DIR) - The measurement of current speed and direction is done by taking a sequence of timings and theodolite bearings on an identifiable ice floe. Allow about 1/2 hour between readings. Direction is defined as the magnetic bearing pointing down current. Estimated and calculated values should be entered in these columns with current described in knots. The usefulness of these variables depends on the validity of the assumption that the drifting motion of ice chunks serves as an approximation of the general current which affects swimming speeds of whales as observed relative to the ice camp. The computer counting algorithm

assumes certain parameters exist which describe swimming rates relative to the ice camp, but these parameters can also be adjusted automatically, such as for strong currents.

DATA PROCESSING

Maintaining the integrity of field data cannot be overemphasized. Field biologists have the responsibility of interpreting their observations and recording them within strictures of the codes and procedures set forth in this manual. Following the initial recording, data should not be tampered with except, perhaps, for minor clerical flaws. Errors discovered in later reviews should be highlighted and corrected in such a manner that the original judgement and notes of the recorder remain legible. Note errors and have the respective recorder informed so that such errors may be avoided, in the future.

Following each day's data collection, all field sheets should be numbered with indication of the total pages in the set ("page of pages"). Then the field record should be reviewed for logic and obvious errors. A summary sheet (Appendix IX) filled out by field personnel will provide a good, intensive review of the data and allow later data synthesis to be done more efficiently. Each summary sheet should be carefully checked by someone who participated in the data collection but who did not fill out the sheet. This is to counter problems incurred by judgement discrepancies and data transfer errors. These summary sheets are checked again in the laboratory to further ensure consistency in field procedures.

Raw data are transferred from the original field sheets to hand-scribed computer forms. These are given a 100 percent check. These computer logs are presented to keypunchers who have no understanding of the field situation, making it critical that entries are legible and recorded exactly according to instructions. Following keypunching and printouts, quality control programs are run on the data to flag common and expected transferral errors. After completion of this quality control, the data are available for programming various synthesis and analysis routines. Instructions for the initial transferral of data from field to computer forms are provided in Appendix X. Further details are described in "Computer data format for an ice-based bowhead whale census" by Richard Grotefendt (Forest Consultant, 339 Securities Bldg., 1904 Third Ave., Seattle, WA 98101, 10 p.)

EXPERIMENTS

Experiments may be conducted as a secondary part of census activities. It is not expected, however, that observers will be required to work a substantial number of hours more than would be necessary to conduct the base census, i.e., 48 hours per week per person.

MBQ (missed whales)

During periods of intermediate whale movement which normally occur during the last two weeks of April and the last two weeks of May, tests may be conducted to measure the number of whales which pass undetected

by the primary perch. Previous research has revealed that the percentage of whales escaping by South Perch uncounted is not closely related to the rate per hour. It is therefore experimentally easier and more accurate to derive the percent missed correction factor during a period of intermediate whale movement, i.e., less than 10 per hour. At rates of less than 1 whale per hour, it is inefficient to maintain a secondary counting crew.

The field experiment is designed such that a secondary counting perch (North Perch) is set up approximately 1 km north of the primary perch (South Perch). Distance between perches can be determined by using a theodolite (see Appendix V). In order that both perches use common horizontal bearings on magnetic north, an accurate north reading is made at one perch and, through mutual bearings between perches, calibration marks may be set so that at either perch magnetic north will read exactly 0°00'00". Eye height at North Perch must be determined (see Appendix IV). The experiment begins when observers at both sites are logged on.

Observers at South Perch relay all sighting data to observers at North Perch by CB radio. North Perch observers have an easier time locating whales than South Perch because they are privy to South Perch observations. South Perch sightings are described relative to three sectors: Sector 1 is south of South Perch, Sector 2 is the area between the two perches, and Sector 3 is north of North Perch. North Perch must be notified of all sightings as they occur at South Perch before they are recorded; even if it is only: "North Perch, we see a whale in Sector 2." Observers at North Perch evaluate South Perch sighting data along with their own to determine whether or not any whales observed at North Perch were completely missed by observers at South Perch.

Observers at North Perch record all data relayed to them on the left side of their field log under the heading of "PRIMARY CAMP". Data on the left side of the North Perch field log serves as a convenient record of what South Perch has seen. The North Perch recorder writes down sighting data acquired at North Perch on the right half of the sighting form, under the heading of "SECONDARY CAMP". Details on how to fill out North Perch's field log are explained in Appendix VIII.

Using all of the information available, North Perch observers are required to make decisions about each of their sightings. Whales that are seen from North Perch and assessed as being missed at South Perch are designated as "M" on the right hand margin of the North Perch sighting log. Whales seen by both teams are designated as "B". When North Perch observers are unsure as to whether or not a whale was previously seen at South Perch, the whale is designated as "Q" for questionable.

There are two important aspects to this experiment that must be understood by observers. First, South Perch must remain naive to North Perch sightings; thus communication must be one way, from the South to the North Perch. North Perch must never volunteer sighting information

to the others, or it will bias the correction factor. Secondly, if and when a North Perch observer scores a whale as missed, the observer must be certain that South Perch has not previously scored the whale at an earlier surfacing. Also, if the South observer subsequently sights the whale, the North observer must cross out the "M" or change it to a "B", since the whale has now been recognized by both teams. In summary, it is important for observers to understand the objective of this experiment: to determine the number of whales which were completely missed by South Perch observers.

An attempt should be made to conduct this experiment for a total of at least 120 hours, with each test period lasting at least 4 hours, The first and last hours of any continuous period of watch are deleted from analysis to allow time for observers to make full appraisal of whales present. In analysis the experiment is divided into cells of 2 hours each. Therefore, contiguous hours of search provide the most efficient returns.

Simultaneous Sightings

In the event that ice along the edge of the lead is unridged and low and a theodolite cannot be used, an alternate system can be applied for determining distances to whales, ice floes, and lead widths. Observers at North and South Perches may be provided with bearing binoculars or bearing compasses, either of which enables observers to shoot horizontal angles to targets.

A simultaneous sighting can only be obtained when both teams are in operation. As a whale surfaces, and for each subsequent surfacing, the South Perch recorder calls "blow" to North Perch. When it is established that observers at both sites are looking at the same whale, the South observer says "mark" and shoots a bearing to the whale. If the North observer was also able to shoot a bearing on that "mark", then the mission was accomplished; otherwise another attempt is made.

Simultaneous sightings are designated on North Perch data forms by drawing a line connecting the respective lines on left and right sides. For example, if a South Perch sighting was entered onto line 6 on the left hand side of the form, and the North Perch sighting was entered onto line 7 on the right side, then a line would be drawn across the middle blank column to connect line 6 with line 7. See Appendix VIII, North Camp Field Form, for examples.

Standardized Computer Counting

This exercise will include the use of CB radios and a minicomputer to improve observers counting techniques. It should be conducted near the beginning of the season for approximately two weeks. A TERAK

minicomputer should be kept in an office or laboratory located within reliable communication range of CB radios at the ice camps.' Upon request, the TERAK operator could provide observers with statistics regarding whale positions, swimming speeds, direction of travel, and probability of linkages to replicate sightings.

The objective of this experiment is to measure and improve observer proficiency. Current speed, whale size, color and shape, as well as behavioral and environmental cues all provide the observer with certain advantages for distinguishing new sightings from duplicate sightings of whales. But raw mathematics, statistical probabilities, and a completely consistent logic for evaluating each sighting, place certain advantages with the computer. Melding of the two techniques should provide a reasonable basis for detecting changes in population size over many years.

Aerial Survey

Aerial surveys may be conducted during the census to determine the spatial frequency distribution of whales relative to the ice edge. The experiment must be designed to operate independently of the ice-based census results. Aerial surveys may also be applied to search for whales prior to and after the period in which ice-based counts can operate. Comparative counts from the air and ice may also be attempted; however, sensitivity to Barrow whalers is essential.

Photography

At this time, no technical use has been made of photographs collected from the ice camps other than in assisting with communicating to scientific and lay audiences the circumstances of the research effort and the appearance of bowhead whales. Whales rarely approach close enough to the observation perches to allow photographs of identifiable characteristics. However, it is recommended that cameras with zoom telephoto or fixed (e.g., 300 mm) lenses be available for documenting unusual behavior or the rare instance when a distinctively marked whale does pass within range.

Behavior Records

A study peripheral but pertinent to the bowhead census is the recording of whale behavior. By maintaining accurate logs of surface timings, the amount of time a whale is visible to ice-based observers can be calculated. This and related parameters may eventually provide indices to the ratio of sighted vs. missed whales. See Appendix VI for a description of behavior recording procedures.

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APPENDIX I

RECOMMENDED OBSERVER CHARACTERISTICS

(1) Eyesight 20/20 or better (glasses or contacts acceptable).

(2) Reasonable handwriting ability.

(3) The ability to understand data collection procedures; a Bachelor of Science degree in a biological field has been required in the past.

(4) Experienced in coping with polar environments and wilderness settings; preferably trained in basic rescue and first aid techniques.

(5) Tolerant of temperature extremes, long periods of little activity, and harsh living conditions isolated from familiar comforts.

(6) Willing to take risks (considering the hazards of moving ice, snowstorms, cold, polar bears, fire, and guns).

(7) In good health with stamina and strength enough to stand long, cold watches and carry out essential camp chores (chopping trail, gathering ice, loading sleds, and adapting to irregular sleep schedules); no addictions or chronic medical complications.

(8) Socially affable and willing to follow directions; respectful of other's needs, especially for personal space.

(9) Mentally capable and emotionally enthusiastic about this endeavor.

PROFICIENCY TESTS

(1) Using the theodolite, make repeated bearings on two static targets within 60 seconds in time, within 20 seconds of accuracy in vertical readings, and within 1 minute accuracy horizontally. At least four bearings should be made in sequence within the above limits.

(2) Fill in a blank South Camp data log by having someone else reading aloud data from the sample in Appendix VII.

(3) Do the same for North Camp data using Appendix VIII as your sample.

(4) Run drills with South and North camps in full operation but using a mock whale (such as a person walking, raising a hand to mimic blows).

(5) Practice recording dive timings by having someone call out data as in Appendix VI. Practice with digital stopwatches.

(6) Practice using Daily Summary forms as in Appendix IX.

APPENDIX II

EQUIPMENT LIST

The following lists are basic needs for a one-camp operation with eight people.

Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Base Station Arrangements

food source - local purchase (see "Suggested Menu")
fuel source - local purchase
snowmobile repair - local purchase
computer system - optional
telephone communication
mail receipt
recreation facility (showers, laundry, warm berthing through the Naval Arctic Research Laboratory or house rental in Barrow)
staging area for logistics (with storage for backup gear)
CB radio communication with antenna (18 ft) and facilities adequate for receiving and transmitting to field camps.
recharge units for radio batteries.

Research Gear

2 CB radios
4 gel cel batteries
3 handheld microphones
2 antennae (16 ft)
fuses
spare leads
spare antennae head connections
packboard with adaptors for radio transport
thermos and extra cups
2 ensolite pads (preferred to blue foam)
windbreak - canvas tarp
wood poles
line
stakes
bino compass (a binocular with integral reading magnetic compass)
airtight, padded case for bino compass
2 binoculars (7x50)
theodolite with tripod and case
measuring tape (30 m)
2 digital watches or clocks with seconds continuously displayed
digital time lapse stopwatch
sweephand stopwatch
tallycounter
thermometer
anemometer
camera gear with cover, case, tripod, telephoto lens (300 mm) and both fast (ASA 400) and slow (ASA 64) film

APPENDIX II (continued)

Research Gear (continued)

data form field binder
field data sheets
pencils, dark
day pack
tape recorder with microphone, batteries, and casettes.

Travel Gear

2 or 3 snowmobiles
2 wood sleds 3 x 14 ft
snowmobile repair kits including tools
2 five-gal gerry cans with mixed fuel
1 pour spout
2 spare drive belts
2 sets spark plugs
ear protection (optional)
2 carabiners, 2000 lb tolerance or higher
60 ft towline, hemp 7/8 in
100 ft lashing cord, l/4 in goldline
2 tarps (canvas) for wrapping gear
2-4 footlockers for containing gear
2 heavy picks for trail cutting
50 trail markers, 2-3 ft bamboo sticks

Camping Gear

2 canvas tents (7' x 10' x 4' wall)
ridge poles and uprights
20+ steel spikes
spike bag
spare line
2 floor tarps (also used to cover gear in transit)
10 plywood floorboards (3' x 10')
2 parachutes (as tent flies)
10-15 insulating pads
heavy sleeping bags - 2 for each 3 people
flannel liners for sleeping bags
alarm clock
2 ice saws
ice axes
2 hammers
CB radio (see "Research")
transistor radio
1 Coleman 2-burner stove
1 spare tank and burner
1 spare generator
20 gal white gas
small funnel
4 boxes matches, large, nonsafety

APPENDIX II (continued)

Camping Gear (continued)

1 spark lighter
5 candles
2 or more footlockers
1 spoon and fork per person
spreading knives
2 cup per person
1 bowl per person
3 plastic plates
large cook pots (for melting water)
2 sauce pans
2 kettles
1 iron frying pan
spatula
1 large spoon or ladle
1 thermos (water only) (=2 thermos total)
sponges, brillo
dish soap
tea ball
2 can openers
1 box large trash bags

Suggested Menu (units are in servings per person per week)

Breakfast		Lunch		Supper	
14	coffee		(coffee)		(coffee)
14	tea (herbs and black)		(tea)		(tea)
14	milk		(milk)		(milk)
18	chocolate milk		(chocolate milk)		(chocolate milk)
7	orange	10	juice		(juice)
14	jam		(jam)	4	rice
28	bread or pilot bread		(breads)		(bread)
21	butter	16	tortillas		(butter)
8	honey		(honey)		(cheese)
7	brown sugar	5	peanut butter	7	vegetables
5	oatmeal, Roman meal, etc.	9	soup		(soup)
10	raisins		(raisins)	1	macaroni
7	nuts		(nuts)	1	spaghetti
7	dried fruit		(dried fruit)	1	tomato sauce
7	eggs	14	cheese	2	onions
3	dried cereal	4	hot sauce	2	garlic
2	pancake	14	candy	5	meat and chicken
2	syrup	2	tomatoes	2	fish
9	oil, cooking	2	tuna fish	3	carrots
7	potatoes			2	beans
4	ketchup			2	cornmeal
14	salt				
7	pepper				
14	condiments				
				21	toilet paper
				21	paper towels

APPENDIX II (continued)

Safety (units are to be maintained both at the camp and the perch)

- 2 day packs
- 10 smoke flares
- 1 bottle powder dye
- 2 ELT's (Emergency Locating Transmitters)
- 3 12 ga shotguns or 30/06 rifle (w/shoulder straps)
- 20 slug and 00 shells or bullets
- 1 cleaning kit
- 2 gun cases
- 1 inflatable raft
- CO_2 cartridges
- 2 oars
- safety line (100 ft)
- 2 survival suits
- 2 First Aid kits
- surplus bandaids
- 1 fire extinguisher
- 5 whistles
- 2 hand warmers
- 1 lighter fluid
- 1 water bottle
- 2 dark goggles
- 5 tubes high intensity sun cream
- 2 space blankets
- 2 CB radios (see "Research")
- magnetic compass
- bright tarps
- knife (personal)
- waterproof matches
- candle
- notebook and pencil
- toilet tissue in waterproof container
- emergency food
- signal mirror
- fishing gear
- spare mitts
- spare socks
- spare hat

Repair

- sail repair kit
- duct tape
- electric tape
- sharpening stone
- steel
- sewing kit
- sailor's palm -.
- parachute cord
- twine
- Steem-off (for glasses)
- medium gauge wire
- lo-penny nails
- lubricating oil
- pliers
- mole foam
- glue
- WD-40
- screwdrivers
- vice grip

APPENDIX II (continued)

Suggested Personal Gear (all infield gear should fit into a single duffle)

high intensity, polarizing sunglasses; not plastic; one pair very dark, a second pair intermediate in darkness
wristwatch that reads to the second
warm, insulated boots ("bunny boots") and insoles; sorel boots may be adequate late in the season
heavy wool socks, some knee length, enough for wearing two pair at a time with no more than once a week laundry
wool or polyester long johns and underwear enough to make it between weekly washes
heavy wool pants
down or Fiberfil overpants
cotton pant shells for covering other pants (reducing their wear and abuse)
wool sweaters or jackets, several for layered warmth
wind shell jacket
heavy down overcoat with fur-lined hood
white shell for the overcoat (to improve its longevity and reduce visibility when near the lead edge)
wool scarf
wool hats, especially balaclavas, with spares
wool gloves and mitts plus work gloves
expedition-type down mitts (for driving snowmobiles)
rain jacket and pants, lightweight
carrying case, especially a duffle, for in-transit use
sack or day-pack for storing personal gear in camp
ear plugs for noise protection (while on snowmobiles)
knife with a large blade and case (must be easily accessible)
compass
lip balm
skin cream to reduce drying problem
suncream of high intensity
Wash N' Dry packets or alcohol swabs for hygiene in camp
towel and toiletries (foot powder, nail clippers, tweezer, scissors, toothbrush and paste, laundry soap, shampoo, special first aid needs, etc.)
reading material, games, writing material
camera and accessories
travel and indoor clothing plus gym clothes
money for personal use

APPENDIX III

SUGGESTED REFERENCES

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APPENDIX IV

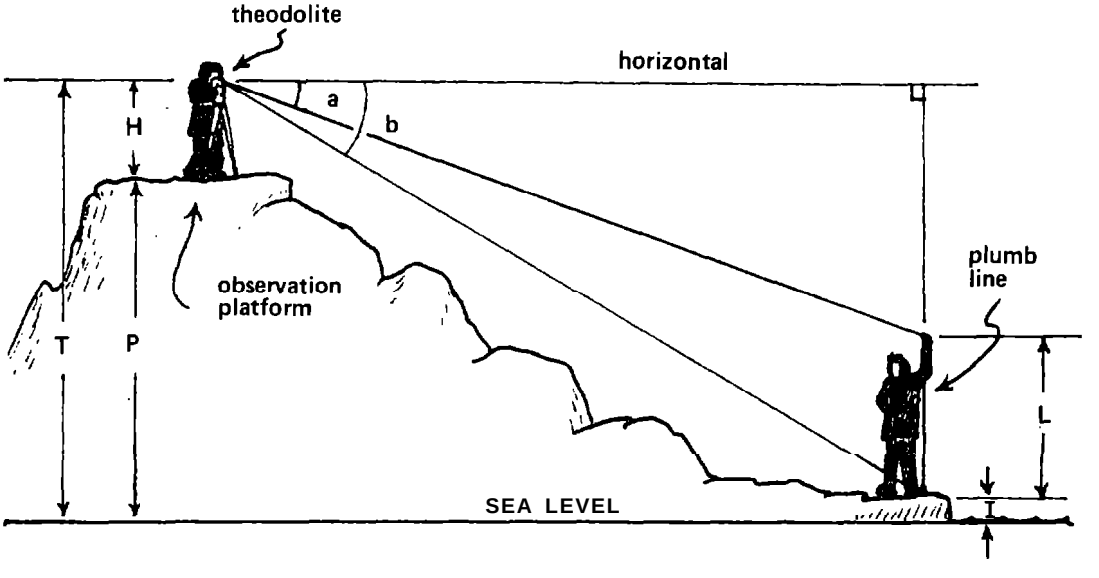
CALCULATIONS FOR OBSERVATION PLATFORM ALTITUDE

For purposes of calculation, establish the following values, preferably measured in meteric units (see accompanying schematic).

H = measured height of the instrument (vertical distance from the observation platform to the vertical axis of the theodolite).
L = measured length of the plumb line or surveying rod.
I = measured height of the plumb bob or base of surveying rod above the water.
a = measured angle between true horizontal and the top of the plumb line or surveying rod.
b = measured angle between true horizontal and the bottom of the plumb line or surveying rod.
T = calculated altitude of the vertical axis of the theodolite ("eye height").

$$T = L \frac{\sin (90 + a) \cos (90 - b)}{\sin (b - a)} + I$$

P calculated altitude of the observation platform.
P = T - H



APPENDIX V

CALCULATIONS FOR DISTANCES BETWEEN PERCHES

METHOD I

Let X = South Perch

Let Y = a point landward of X (or Z) in view of both perches

Let Z = North Perch

Measure Sl (from X to Y) compensating for changes in elevation and keeping the line as straight as possible while making Sl as long as is practical.

S_2 = the distance from Z to Y

S_3 = the distance from X to Z

From X measure the Y to Z angle (A3) which, preferably, should approach 90"

From Z measure the Y to X angle (A2)

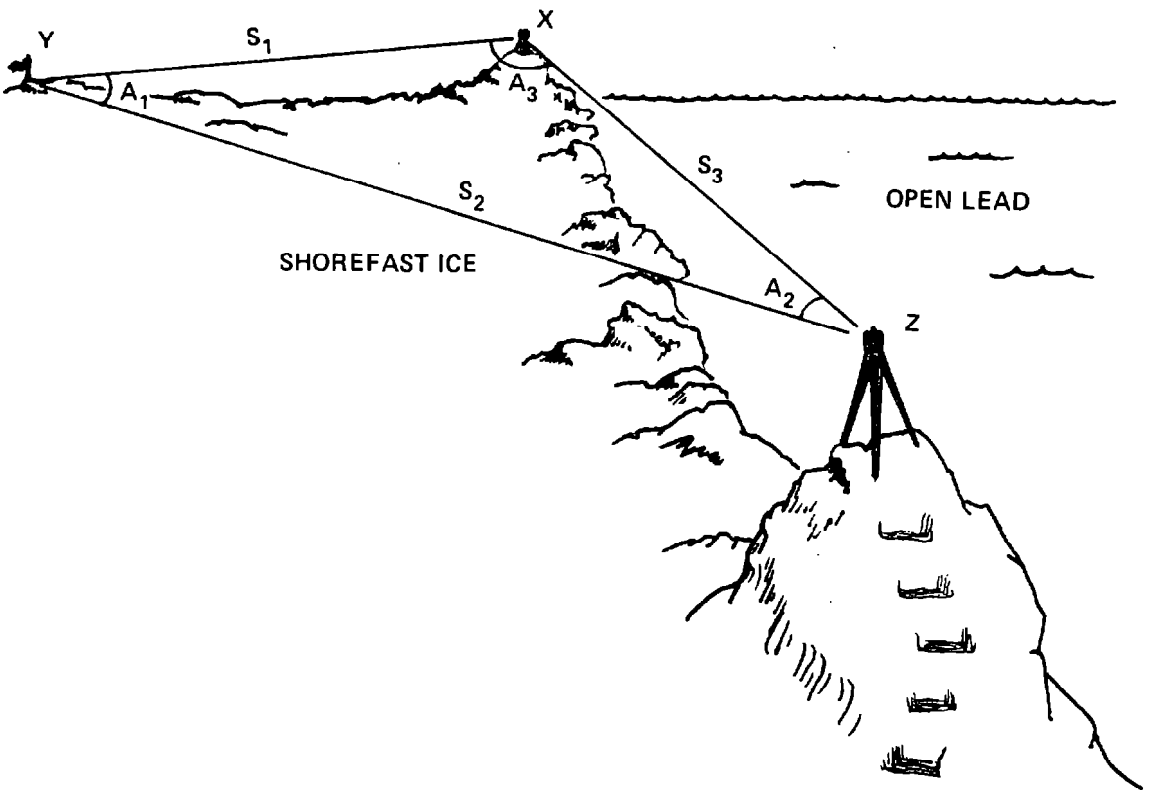
From Y measure the X to Z angle (Al)

Check the measured three angles: Al + A2 t A3 = 180 ?

Calculate $S3 = \frac{Sl \sin Al}{\sin A2}$

APPENDIX V (continued)

METHOD I



APPENDIX V (continued)

CALCULATIONS FOR DISTANCES BETWEEN PERCHES

METHOD II

Let X = South Perch

Let Y = a point at sea level opposite X (or Z) in view of both perches

Let Z = North Perch

Let T_X =. South Perch elevation (see Appendix IV for calculations)

Let T_z = North Perch elevation

S_1 = the distance from X to Y

S_2 = the distance from Z to Y

S_3 = the distance from X to Z

From X measure the Y to Z angle (A_3) which, preferably, should approach 90°

From Z measure the Y to X angle (A_2)

From X measure the vertical angle to Y ($=V_x$)

From Z measure the vertical angle to Y ($=V_z$)

Calculate Al = 180 - A_2 - A_3

Calculate $S_1 = T_X \frac{\sin (90 - V_X)}{\sin V_X}$

Calculate $S_2 = T_Z \frac{\sin (90 - V_Z)}{\sin V_Z}$

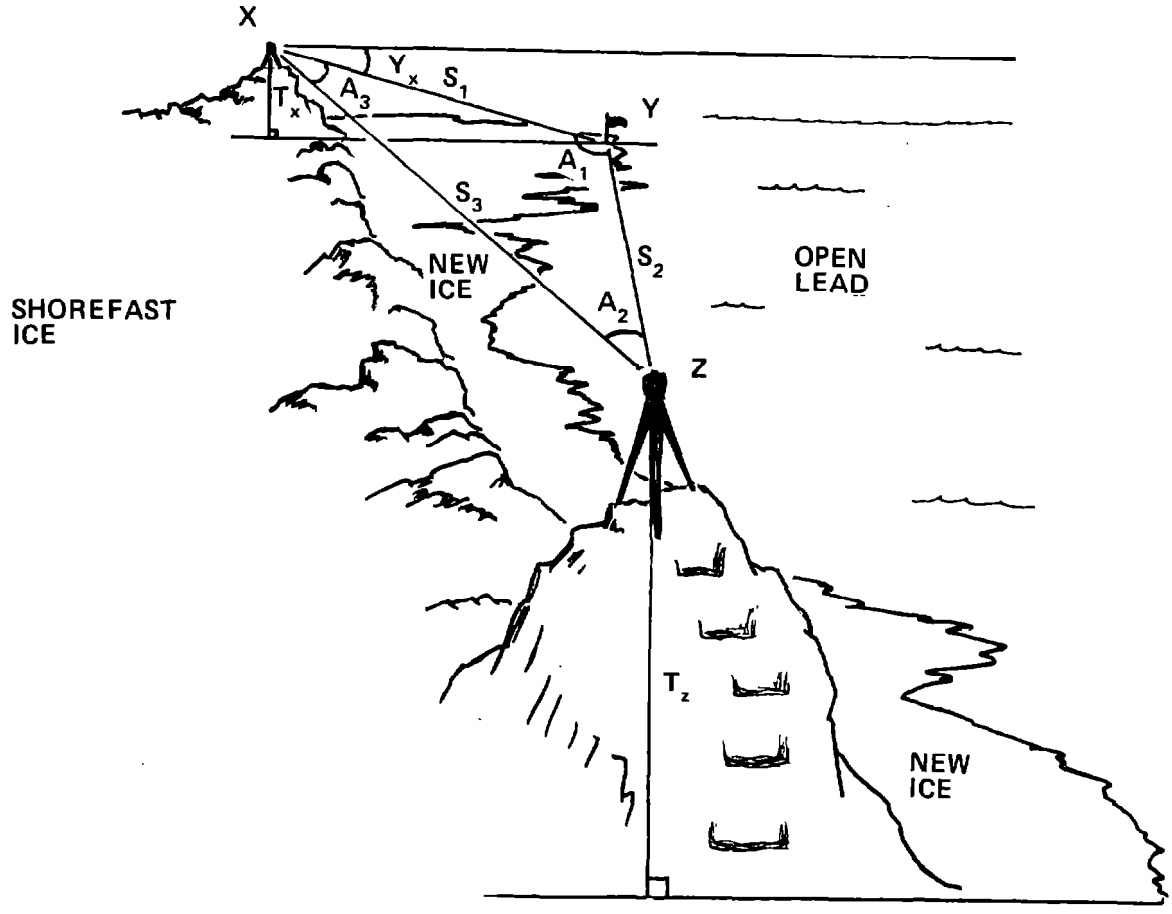
Calculate $S_3 = S_1 (\cos A_3) + S_2 (\cos A_2)$

or $S_3 = S_2 \frac{\sin A_1}{\sin A_3}$

or $S_3 = S_1 [\cos A_3 + \frac{(\sin A_3)(\cos A_2)}{\sin A_2}]$

APPENDIX V (continued).

METHOD II



APPENDIX VI

BEHAVIOR RECORDS

The accompanying sample field form helps categorize behavior observations. The banner asks for background information on location (perch name or general description), elevation, date, and personnel involved. BLOW# is the count of surfacings as observed; this provides information on how many surfacings were in view (let blow = surfacing here so that each time a whale is seen it can be logged as a blow whether or not a puff of vapor was visible). If timing information is provided with a series of consecutive blows, it will be assumed no surfacings occurred between the recorded timings. If there was a possibility of a blow being missed, use an X and restart the blow count series.

Time may be recorded on a stopwatch or as real time. In the former case, note what time the stopwatch was started. UP time and DOWN time are a function of visibility (and the observer's reflexes), UP corresponds with the whale's exhalation, and DOWN is the timing of the submergence of the last visible portion of the whale.

Note particular behavior for each surfacing. See the accompanying list for suggested designations. Also record the presence of other whales, interactions, human or ice-related distractions, or any other environmental component that potentially may have affected a whale's behavior. Besides the usual parameters of overall means, deviations, etc., uncomplicated, exemplary, migratory bowhead behavior information needs to be extracted from the data.

TIME AT SURFACE is the difference between up and down time when recorded. DIVE TIME is the difference between up times for sequential recordings. Both surface and dive timings are calculated after the observational data entries are completed, usually done after returning to camp.

The following behavior codes help abbreviate notations and systematize the data; however, do not feel bound to them. Their purpose is to speed recording efforts in the field and to allow more consistent categorization in analysis.

NO SPOUT	whale rose to the surface but no blow was visible
TRAK	ripples, whale track, or turbulence sighted
MUD TRAK	trail of mud seen near whale
HEAR	whale blow heard
FLIP	flipper visible
FLIPS	flipper waving or slapping
FLUK	fluke visible
FLUKS	fluke slapping (tail-lobbing)
FLUK HI	fluke raised unusually high; tail stock visible
BR	breach
BRL	low breach (lunge with less than 40% of the body clear)
BRH	high breach (tail stock almost shows)
BR X	breach with fall directly down axis of body

APPENDIX VI (continued)

Behavior codes (cont'd)

BR D	breach onto dorsal side (landing on back)
BR V	breach onto ventral side (landing on belly)
BR F	breach onto lateral side (landing on flank)
SPY	spy-hopping (head held above the water by more than momentum)
SYNC	synchronous activity
MATE	copulation or potential copulation (describe in detail)
MILL	milling and turning, nondirectional
ROLL	rolling or twisting on longitudinal axis
TMBL	somersault (tumble)
ARCH	whale rises high out of the water
LOW	shallow dive and rise
N, NW, . . .	direction headed
MIGR	no apparent deviations from a strictly migratory course
FAST	swimming distinctly more rapid than normal
SLOW	slow swimming; almost sleeping though moving
HURT	whale hurt, wounded, or sick (describe)
REST	whale motionless (resting, sleeping, or potentially dead)
DEAD	whale is decidedly dead
w/DL	with white whales
w/00	with orca etc.
w/BIRD	with birds (describe size of aggregation, activity, proximity).

Indicate proximity to other bowheads
Indicate time spent in each behavior
- or number of surfacings in which behavior was observed

APPENDIX VI (continued)

Sample of Behavior Record form

BEHAVIOR RECORD

Page 1 / 1

LOCATION South #6 - Stair Peak, Brw. ELEV. 12 m DATE 15 May 81

OBSERVER D. Rugh RECORDER J. Moore

BLOW #	HOUR	UP MIN : SEC	DOWN MIN : SEC	BEHAVIOR	TIME AT SURFACE	DIVE TIME
1	20	03 25		MIGR		
2		03 39				14
X		—		..... We talk on CB; may have missed a blow		?
1	20	04 58	05 02	BR L	04	
2		05 28	05 31		03	30
3		05 39	05 41		02	11
4		05 46	05 55	FLIP + ROLL	09	07
5		05 56	06 02	FLUK	06	10
6		06 28	06 33	BR A	05	32
7		07 09	07 12	BR A	03	41
8		07 41	07 44	2nd BM in view 2km to south	03	32
9		07 49	07 51		02	08
10		08 00	08 02	LOW - NO SPOUT	02	11
11		08 09	08 12	ARCH + FLUK	03	09
12?		12 23		HEAR - but ice blocks view — end record on this BM —	04 : 14?	

APPEND-IX VII

SOUTH CAMP FIELD FORM

The following narrative explains the sample entries on the accompanying field forms and augments the instructions for filling out South Camp field logs. Page and line numbers noted below refer to those on the respective field sheets in the example. All data are fictitious and are provided for demonstrative purposes only.

15 May 81

Page #l/Banner: The camp (perch) identification is "Stair Peak" also known as South #6 in the sequence of sites. Names, however, are much easier to remember and may be illustrative.

Perch height is measured with the use of surveying instruments. The altitude is calculated later and entered here in dark ink to indicate a value not recorded in the field. Heights need only be recorded when they change.

Inst. height is the distance from the perch platform to the center of the vertical axis of the theodolite. This needs to be measured and recorded with each resetting of the tripod. Enter the new value in the unmarked column on the right hand side of the field sheet.

Day, month, year must be entered on every sheet. Never are two days on one sheet.

Page No. shows which page of the sequence of pages is in hand. The second value shows how many pages of field data there are for that particular perch for that day. This latter value is entered after the last entry of the day has been made.

Page #l/ Line #l RN logs on at 12:30 pm. An X in the first column signals this line is an observer-effort entry. /S under RN signals the start of a watch. Because RN is signing on for the first time this season, his name is written out on the same line. No other entry is made on this line. Sign on and sign off timings may be rounded to the nearest whole minute. This is the time that significant watch effort has begun and is under way.

Line #2 PD logs on with RN, but, because PD was logged on earlier in the season, it is not necessary that his name be written out.

Line #3 Environmental data is recorded as happening at the exact same time the watch effort began. Otherwise the timing of this entry may be rounded to the nearest approximate

APPENDIX VII (continued)

15 May 81

Page #l/Line 3 (continued)

10 minute interval. Usually it takes several minutes to make the recordings anyway. These calculations are often representative of the situation for the following 2 hours when the next environmental entry is made. Avoid making changes at less than 1 hour intervals; winds are forever shifting and weather is variable. The environmental log is to be considered representative of generalized conditions and should not absorb an inordinate amount of time.

In the example, the visibility was Good; there was a Light Fog (first judged to be CLear, then changed to LF because the latter was more descriptive of the situation between the observer and the lead), the lead was estimated to be 2000 m across, wind was 5 kn out of the southwest. These measurements and judgements were made by RN (in OBS column).

Line #4 The line number is circled to indicate a comment on the back side of the data sheet, such as: "Stair Peak is 25 m from the lead edge with a 160" view of the lead. The nearshore edge of the lead is fairly regular in this area, but the far shore is confusing for the litter of small ice floes. We took the following horizontal bearings on visible land features (our position will be calculated later): Nuwuk Tower 59°25'43"; northernmost tank at NARL 88°32'56"; Dewline Dome center 116°05'50"; Church in Barrow 170°06'09". Two whaling crews are in view 1 or 2 km south of us; none to the north." Using a magnetic compass, the average bearing along the ice edge was determined (in this case, 10 degrees east of north), a parameter important for several aspects of the analysis. The measurement should be made from the ice edge, not from the perch.

Line #5 The theodolite serial number is recorded because each instrument has its own inherent correction factor (a minor value, such as -.0031) which should be entered into calculations later. This entry need be made only when theodolites are changed.

APPENDIX VII (continued)

15 May 81

Page #l/Line #6 — RN sights and reports a single bowhead whale (BM) at 13:35:20 (1:35:20 pm) with the respective bearings recorded in the appropriate columns. Note that vertical readings are to the second, horizontal bearings are to the minute. An estimate of the distance to the sighting was noted (5500 m).

The regular Z-hour report of environmental conditions was neglected, an error on the part of the recorder.

Lines #7 and 8 — DR and HM sign on. This is an example of a non-overlapping schedule where each pair of observers logs on and off at the same time. DR was signed on earlier in the season; HM signed on for the first time here. Sign on new observers before signing off the old.

Line #9 — shows visibility has improved to Very Good, weather is CLear, the lead has expanded to 4000 m, and wind is 10 kn out of thesouthwest.

Lines #lO and 11 — PD and RN leave the perch after giving DR and HM time to adjust to the new watch. The /F in the OBS Column indicates finish.

Line #12 — Another check on environmental conditions. The lead is now wide open (a). The sky is Partly Cloudy (PC).

Lines #13 and 14 — DR takes two sets of bearings on a representative, drifting ice floe to measure current direction and speed. Exact timings and theodolite bearings are recorded. The calculated results (entered at a later date) show a current of 0.48 kn and going toward 34" magnetic. DR estimated the ice was 550 m away, calculations showed it to be actually 644 m when first recorded and 569 later (dark ink).

Line #14 — had an original time entry that was illegible. In review it was obvious that the hour was 19. With different ink the original note was crossed out and 19 written in, leaving the field note reasonably intact.

Line #15 — HM sees a bowhead: Although DR was in the position of primary observer, he did not see this whale, so HM entered his initials in the OBS column. Only a horizontal bearing and estimated distance could be made under the circumstances.

Lines #16 and 17 — The start of the watch for JM and SK.

APPENDIX VII (continued)

15 May 81

Page #l/Line #18 DR and HM stay on watch because whales are in view, and not until JM and SK are oriented to what is happening will the former two leave. An entry in the #/C,D,T column with no entry in the SP column indicates a bowhead (BM may be written for redundancy).

Line #19 A whale is recorded twice in a rise, an unnecessary effort. The l/D shows that the whale has already been recorded (on the previous line - page l/line 19). The heavy, black entry of l/18 on line 18 is not made in the field, but is made later in data review. The l/18 on line 19 is made in the field.

Page #Z/Banner is filled in for camp name, date, and page numbers each time.

Lines #2 and 3 were entered out of order. An arrow shows where they should lie.

Lines #l and 4 show two sightings of one whale as it passes the perch.

Line #5 is a recording of a change in visibility occurring between the regular bihourly recordings.

Lines #6 to 11 describe how first one bowhead was seen, then another. The two joined at 22:29:25 (Line #8 and #9 are separated by one second for ease in analysis). Then at 22:39:12 they were resighted together along with a calf (on Line #ll). At this point JM takes over from SK to rotate duties. Line #ll is circled to refer to notes on the rear of the field sheet which further describe the whale sightings, particularly in regard to the calf's appearance and behavior.

Line #10 links the duplicate sightings to 2/6, the initial sighting, not to intermediate lines.

Lines 12, 13, and White whales, Delphinapterus leucas, (DL) are sighted in several groups. Only horizontal bearings are recorded since linkages are not attempted.

Line #15 Although SK is a recorder at this point, he sights white whales missed by JM, so he enters his initials and related values.

Lines #16 and 17 The watch continues through midnight, so JM and SK end the day's log by signing off with a /C in the OBS column. Midnight is written here as 24:OO:OO.

APPENDIX VII (continued)

16 May 81

Page #l/Lines #l and **2**	show that JM and SK have continued the watch through midnight (with /C in the OBS column). Midnight is written here as 0O:OO:OO.
Line #3	SK records environmental conditions as it is often easier for those who are finishing a watch to make these calculations than it is for those just starting their watch. Note that this entry must reflect the very start of the day (00:00:00).
Lines #4 and 5	DR and HM start their watch 10 minutes late.
Line #6	JM sights a whale which might be the same one seen at 23:16:10 on the previous day. Because of the ambivalence, the whale was recorded as l/C or a Conditional duplicate. Only whales labeled as Duplicates have page/line number linkages. This is treated in the analysis as half a whale sighting.
Lines #7 and 8	JM and SK sign off after the others have adequately taken over.
Line #9	A snow squall deteriorates the visibility to UNacceptable. Lead width is left blank as it cannot be determined under the circumstances.
Lines #lO and 11	Terminate the watch due to hazardous conditions.

NMFS MARINE MAMMAL ARCTIC WHALE TASK

PRIMARY CAMP

Camp Name/ Location: South #6 - Stair Peak

Perch Height: 10.86 m

Inst. Height: 1.12 m

Date: 15 May 81

Page No. 1 of 2

L #	OBS ON, OFF	TIME HR : MIN : SEC	# / C,D,T	SP	P# / L#	VERT. ANGLE DEG : MIN : SEC	HOR. ANGLE DEG : MIN	EST DIST (M)	VIS	WEA	LEAD WIDTH (M)	WIND SPD	WIND DIR	CURRENT SPD	CURRENT DIR
X	RN/S	12 30 00				Ron Nalikak									
X	PD/S	12 30 00													
3	RN	12 30 00							GO	LF CL	2000	5	SW		
(4)		12 30 00					010 —>	average	beaching along ice edge						
5		12 30 00							theodolite serial # 573270						
6	RN	13 35 20	1	BM		359 52 55	300 29	5500							
X	DR/S	16 00 00													
X	HM/S	16 00 00				Harold Mongoyak									
9	DR	16 00 00							VG	CL	4000	10	SW		
X0	PD/F	16 10 00													
X	RN/F	16 10 00													
12	DR	18 00 00							VG	PC	∞	10	SW		
13	DR	18 55 16		ICE		358 56 34	271 37	~~550~~ 644							
14	DR	~~18~~ 19 12 16		ICE		358 48 11	293 36	569						.48	34
15	HM	19 15 20	1	BM			260 —	2000							
X	JM/S	20 00 00													
X	SK/S	20 00 00													
18	DR	20 03 25	1		1/18	359 49 26	284 12	2200							
19	DR	20 03 39	1/D		1/18	359 49 24	284 14	2200							
20	SK	20 05 00							VG	OV	∞	12	SW		

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NMFS MARINE MAMMAL ARCTIC WHALE TASK

PRIMARY CAMP

Camp Name/ Location: Stair Peak

Perch Height:

Inst. Height:

Date: 15 May 81

Page No. 2 of 2

L #	OBS ON, OFF	TIME HR : MIN : SEC	# C,D,T	SP	P# L#	VERT. ANGLE DEG : MIN : SEC	HOR. ANGLE DEG : MIN	EST DIST (M)	VIS	WEA	LEAD WIDTH (M)	WIND SPD	WIND DIR	CURRENT SPD	CURRENT DIR
1	SK	20 27 36	1		2/1	359 48 30	261 06	2000							
X	DR/F	20 15 00													
X	HH/F	20 15 00													
4	SK	21 16 10	1/D		2/1	359 47 00	331 36	2800							
5	SK	21 45 00							GO	OV	∞	9	SW		
6	SK	22 01 10	1		2/6	359 17 19	230 21	800							
7	SK	22 12 30	1		2/7	358 51 54	252 59	600							
8	SK	22 29 25	1/D		2/6	359 10 00	330 55	800							
9	SK	22 29 26	1/D		2/7	359 10 00	330 55	800							
10	JM	22 39 12	2/D		2/6	359 34 20	348 02	1400							
(11)	JM	22 39 13	(1)			359 34 20	348 02	1400							
12	JM	22 47 16	2	DL			242	500							
13	JM	22 52 20	4+(1)	DL			250	700							
14	JM	23 16 10	1			359 47 00	331 36	2800							
15	SK	23 22 14	2	DL			311	1000							
X	JM/C	24 00 00													
X	SK/C	24 00 00													
18															
19															
20															

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NMFS MARINE MAMMAL ARCTIC WHALE TASK

PRIMARY CAMP

Camp Name/ Location: Stair Peak

Perch Height:

Inst. Height:

Date: 16 May 81

Page No. 1 of 1

L #	OBS / ON, OFF	TIME HR : MIN : SEC	# / C,D,T	SP	P# / L#	VERT. ANGLE DEG . MIN . SEC	HOR. ANGLE DEG : MIN	EST DIST (M)	VIS	WEA	LEAD WIDTH (M)	WIND SPD	WIND DIR	CURRENT SPD	CURRENT DIR
X	JM/C	00 00 00													
X	SK/C	00 00 00													
3	SK	00 00 00							GO	LS	∞	5	SW		
X	DR/S	00 10 00													
X	HM/S	00 10 00													
6	JM	00 16 51	1/C			359 30 51	293 01	1800							
X	JM/F	00 20 00													
X	SK/F	00 20 00													
9	HM	01 35 00							UN	HS		2	N		
X	DR/F	02 14 00													
X	HM/F	02 14 00				Ice crack reported behind us — abandon watch!									
12															
13															
14															
15															
16															
17															
18															
19															
20															

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APPENDIX VIII

NORTH CAMP FIELD FORM

29 April 81

Page #l/Banner: Completely fill out the banner information. Note that this is a one-page, 4-hour experiment for missed whales. The banner information on the sample shows that Primary Camp (South Perch) is 10.51 m high (observation platform plus instrument height) and the Secondary Camp (North Perch), on which this log was filled out, is 11.30 m high. South Perch is 190° (a bit west of south) from North Perch (made by a direct magnetic compass bearing), and the two perches are a measured 1,100 m apart.

Lines #l and 2 GGJ and SS log on at North Camp at 05:lO:OO.

Line #2 At 5:10:40 South Camp saw a Conditional whale. This South Camp data was radioed to North Camp by South Camp observers as is all data recorded on the left side of the page.

Line #3 South Camp and North Camp see a whale simultaneously. Note that North Camp has entered a "B" in the MBQ column indicating that South Camp has seen this whale. Simultaneous sightings are demarcated with a line connecting the two sightings. In this instance it is redundant but beneficial to enter line number 3 in the OBS/On, Off column.

Line #4 South Camp sees a whale at 5:22:02, and North Camp sees it a little later at 5:27:32. Note that we know that this North Camp sighting references the South Camp sighting by the South Camp line number (4) entered in the North Camp observer column. North Camp again enters "B" into the MBQ column. North Camp considers this whale a potential duplicate of the earlier sighting, thus a l/C; however, South Camp considers it new.

Line #5 Here's where it starts getting fun!
North Camp sees a whale at 5:41:25 that they determine has been missed at South Camp. An "M" is entered in the MBQ column to designate a missed whale. (Ignore for the moment that the M is scratched out, and that a 6 exists in the North Camp observer column.)

Line #6 North Camp sees another whale at 5:45:55 that South Camp did not see previously; North Camp marks it as a miss.

APPENDIX VIII (continued)

29 April 81

Page #l/Line #6 and 7 — South Camp now sees a whale at 6:03:25 which is a simultaneous sighting with North Camp; the North Camp sighting being entered on line #7 and connected with a line in the center blank column. The North Camp sighting is further identified as a duplicate of page #l/line #5 of North Camp.

North Camp observers realize that this 6:03:25 whale is the same one that they determined was missed on line #5. They thus strike out the "M" on line #5 and enter a 6 in the North Camp OBS/On, Off column at line #5 referencing this connection.

Line #8 — North Camp sees another whale at 6:27:30 but they do not know if South Camp has seen it before. A "Q" for questionable is entered to designate this uncertainty. South Camp resights the 6:15:02 whale at 6:56:02 and calls it a duplicate. Note that the South Camp recorder should always reference previous sightings over the radio by time only, and that it was the North Camp recorder that determined what the Page#/Line # code should be, i.e., l/7 in this case refers to Page #l/Line #7 on the left side of the North Camp field log. South Camp's Page#/Line # are not reported over the air.

Line #9 — South Camp sees another whale at 7:lO:OO. North Camp records another missed whale at 6:40:50.

Line #lO — North Camp sees South Camp's 7:lO:OO whale 45 seconds later at 7:10:45 and marks it as "B". They also realize that the 6:40:50 whale (marked as missed on North Camp line #9) is really a resurfacing of the 6:15:02 whale on South Camp's line #7, and they cross out the "M" on line 9.

Line #ll — North Camp sees another missed whale at 7:37:00. South Camp sees a conditional at 7:48:00.

Line #12 — North Camp sees a whale at 7:40:00 which is a duplicate of the 7:10:45 whale. Even though South Camp did not see this surfacing, they did recognize the whale earlier, therefore a "B" is given in the last column. Note that virtually all duplicate sightings made at North Camp will result in "B" evaluations, as by definition, North Camp observers must have already made an evaluation as to whether or not the whale was a missed whale the first time they saw it. At most, only one missed designation may be given per whale. South Camp sees another new whale at 8:OO:OO.

APPENDIX VIII (continued)

29 April 81

Page #l/Line #13.	North Camp sees another whale at 7:45:00 and marks it as "B", and references the whale as the one seen by South Camp on line #ll at 7:48:00.
Line #14	North Camp resights the 7:45:00 whale at 8:15:00. South Camp also resights their own 8:lO:OO whale at 8:35:00.
	And thus it continues to the end of the experiment, which must be clearly designated.
Lines #13-17	A whale is sighted by South Camp at 8:lO:OO and again at 8:35:00. This latter sighting was also made at North Camp at 8:35:00 and 8:35:01 who recognized it as two whales instead of one. Thus the separation of entss on two lines, one marked B, one marked M. Then, at 8:36:00 South Camp sees a new whale. This is identified as the second of the pair seen by North Camp. Accordingly, the M of line 16 is crossed out, Both Camps resight one of this pair of whales at 8:55:01.
Lines #17 and 18	North Camp sees a whale at 8:55:27. Lacking a call from South Camp, and having reviewed all other previous South Camp sightings, the whale is determined to be M (missed). But at 8:58:57 South Camp sees a whale approximately where the 8:55:27 whale might be expected to surface. The M is then crossed, which shows how North Camp can identify a whale as seen by both camps without seeing the whale at the same time.

Accordingly, we see that the most important role of North Camp is to identify the whales missed (M in the MBQ column) by South Camp.

The validity of this experiment depends on the assumption that watch effort is not interrupted at either camp during the course of the experiment. It should be apparent why such a test is run only when there is a moderate rate of whale sightings.

NMFS MARINE MAMMAL ARCTIC WHALE TASK

PRIMARY CAMP

Eye height 10.51 m

Mag Bearing to other camp 190°

SECONDARY CAMP

Eye height 11.30 m Date 29 April 81

Distance between camps 1100 m Page 1 of 1

L #	TIME HR. : MIN. : SEC.	# C,D,T	P# L#	HOR. ANGLE DEG. : MIN.	EST. DIST. (M)	OBS On,Off	TIME HR : MIN : SEC	# C,D,T	SP	P# L#	VERT. ANGLE DEG : MIN : SEC	HOR. ANGLE DEG : MIN	EST DIST (M)	M B Q	L #
1	: :			:		GGJ/S	05 10 00				: :	:			1
2	05 10 40	1/C		220 00	1500	SS/S	05 10 00				: :	:			2
3	05 11 36	1		240 00	2000	3	05 11 36	1			359 44 16	219 30	2500	B	3
4	05 22 02	1		310 00	1400	4	05 27 32	1/C			359 29 21	265 00	1250	B	4
5	: :			:		6	05 41 25	1			359 06 19	253 00	700	M	5
6	06 03 25	1		340 00	1500		05 45 55	1			357 59 58	348 30	350	M	6
7	06 15 02	1		250 00	1900	6	06 03 25	1/D		1/5	359 07 54	292 40	700	B	7
8	06 56 02	1/D	1/7	330 00	1300		06 27 30	1			359 35 59	231 40	1500	Q	8
9	07 10 00	1		320 00	400	7	06 40 50	1			359 35 39	235 15	1050	M	9
10	07 40 00	1		350 00	800	9	07 10 45	1			359 18 30	204 10	1000	B	10
11	07 48 00	1/C		269 40	950		07 37 00	1			359 27 41	276 50	1200	M	11
12	08 00 00	1		289 00	1050	10	07 40 00	1/D		1/10	358 44 46	217 05	500	B	12
13	08 10 00	1		210 00	700	11	07 45 00	1			359 36 50	225 30	1700	B	13
14	08 35 00	1/D	1/13	252 00	900	12	08 15 00	1/D		1/13	359 20 45	248 15	975	B	14
15	08 36 00	1		254 00	700	14	08 35 00	1			359 29 43	211 00	1500	B	15
16	08 55 01	1/D	1/15	294 40	600	15	08 35 01	1			359 29 43	211 00	1500	M	16
17	08 58 57	1		003 00	700	16	08 55 01	1/D		1/16	359 24 52	219 20	1100	B	17
18	: :			:		17	08 55 27	1			357 54 07	204 50	300	M	18
19	: :			:		GGJ/F	09 10 00				: :	:			19
20	: :			:		SS/F	09 10 00				: :	:			20

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APPENDIX IX

DAILY SUMMARY FORM

The daily summary form is used by field personnel for summarizing

1. Daily watch effort by:

   observer
   a. visibility
   lead width
   d. weather
   e. total watch

2. Hourly and total number of whales recorded as:

   new
   b. conditional
   c. duplicate

3. Total time and whale counts in each visibility category.

4. Total time and whale counts in each lead width category.

5. Total time in each weather category.

6. Grand total of bowhead whales sighted (white whales are not included).

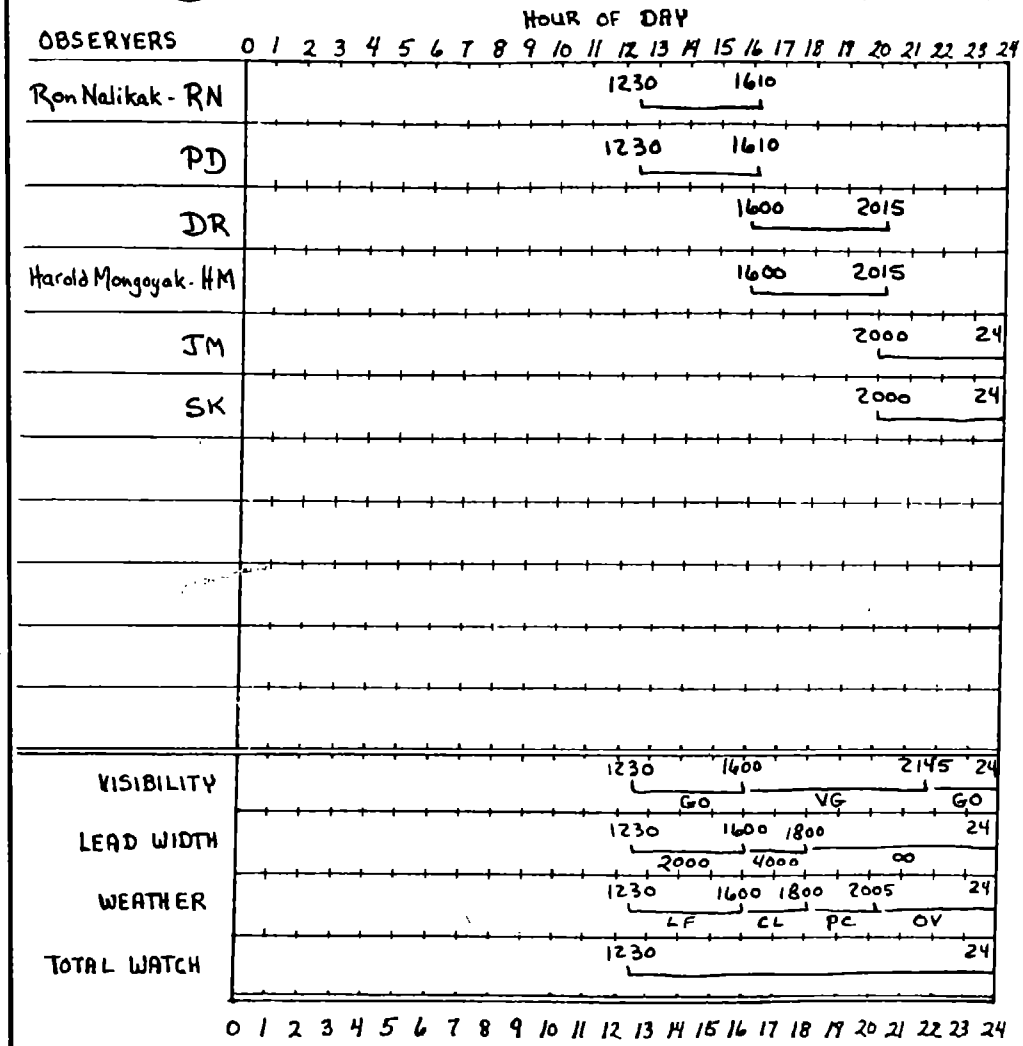
This form serves nicely as an aid for checking data because there are many built-in cross checks. It should be filled out as soon as possible after a day's data have been collected, preferably by an observer who actually participated in the data logging. Whoever fills out the form must sign their initals and date the form on the line marked "Recorder". Shortly thereafter someone else should check that this summary form accurately reflects the field logs. Final checks will be made later when the data is being transcribed to computer keypunch forms.

Examples of the South Camp Whale Census Daily Summary follow. The data used are based upon previously presented examples of the field forms.

WHALE CENSUS DAILY SUMMARY

CAMP NAME South #6 - Stair Peak

EYE HEIGHT 11.98 m DATE 15 May 81



VISIBILITY

EX	VG	GO	FA	PO	UN	
0	5:45	5:45	0	0	0	HR: MN
	3	5				NEW
	0	0				COND
	2	4				DUPL

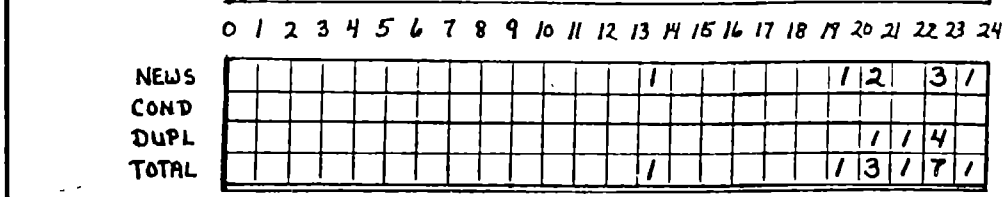
LEAD WIDTH

0	<500	500-2000	≥2000	∞	TOTAL	
0	0	0	5:30	6:00	11:30	HR:MIN
			1	7	8	NEW
			0	0	0	COND
			0	6	6	DUPL

WEATHER (HR:MIN)

CL	PC	OV	LS	HS	LF
2:00	2:05	3:55			3:30

HF	SR	LR	HR	TOTAL
				11:30



11:30 TOTAL WATCH

8	NEWS
0	CONDITIONALS
6	DUPLICATES
14	TOTAL

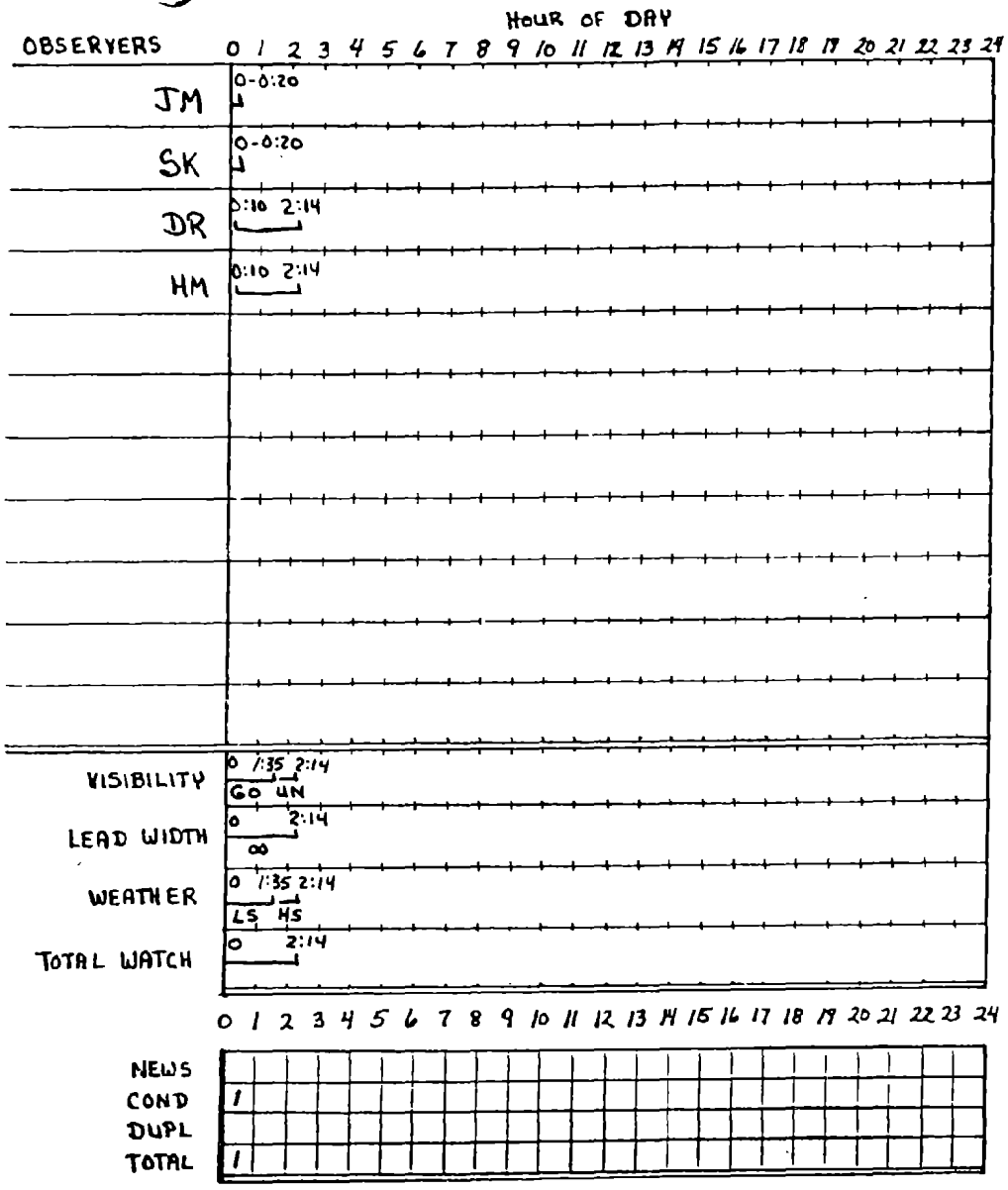
Recorder DR / 16 May 81

Field Check HM / 17 May 81

Final Check BK / 5 June 81

Initials / Date

WHALE CENSUS DAILY SUMMARY



CAMP NAME South #6 - Stair Peak

EYE HEIGHT 11.98 m DATE 16 May 81

VISIBILITY

EX	VG	GO	FA	PO	UN	
0	0	1:35	0	0	:39	HR: MN
		0			0	NEW
		1			0	COND
		0			0	DUPL

LEAD WIDTH

0	<500	500-2000	≥2000	∞	TOTAL	
0	0	0	0	2:14	2:14	HR:MIN
				0	0	NEW
				1	1	COND
				0	0	DUPL

WEATHER (HR:MIN)

CL	PC	OV	LS	HS	LF
			1:35	:39	

HF	SR	LR	HR	TOTAL
				2:14

2:14 TOTAL WATCH

0	NEWS
1	CONDITIONALS
0	DUPLICATES
1	TOTAL

Recorder JM/16 May 81
Field Check SK/16 May 81
Final Check BK/5 June 81
Initials / Date

APPENDIX X

DATA TRANSCRIPTION FROM FIELD FORMS TO COMPUTER LOGS

All pertinent data recorded during the bowhead census must be transferred onto computer forms for keypunching and later analysis. This data transfer provides 1) an exacting review on field rates as each entry is rewritten, 2) data security as all results are stored apart from field notes, 3) rapid and precise analysis of large data sets, and 4) systematic quality control checks. Specific instructions for the field transcription of data onto the computer forms are provided here.

Make a note of who transcribed the data and when ("logged by Krogman 3/31/82" in the example), as well as notes on anyone who checked the transcription.

Note that there are three types of banner cards: Header (type l), Comment (type 2), and Data (type 3). Each series of pages - i.e., data from one camp for one date - needs a Header Card to identify camp location and to serve as a title to the series. Never should more than one date or more than one camp appear on a single page; however, perch changes at one camp may be included within a page.

Remember that each line on the computer form will appear as a separate key punch card. It is critical that every card have the date written on the far right. Because of its repetitiveness, a vertical line may be drawn to indicate all lines on which the date should be typed (see example); however, this is the only case where this shortcut is allowed.

Codes are alphanumeric; that is, both letters and numbers are acceptable. Left justify alpha codes (where several blocks are available for an entry, start writing from the left) but right justify numeric codes. When entering numbers, it is important to note where decimal points should be. These appear on the header cards used to guide entries. Decimal points should not be logged -'they are assumed. All alpha entries are done in capital letters.

The Header Card has the following specific codes:

Column 1 (Camp ID): 1 = South Camp
2 = North Camp
5 = Experimental or Rotating Camp
(3 and 4 were designations used in previous years)

Column 2 (Card Type) : 1 = Header Card

Columns 3 - 11 are left blank as are the other columns marked with slashes.

Column 12 - enter zero (for sorting logic).

Columns 15 - 34 (Organization): write NORTH SLOPE BOROUGH.

APPENDIX X (continued)

Columns 36 - 47 (Camp Name): write either SOUTH CAMP, NORTH CAMP or EXPERIMENTAL.

Columns 49 - 73 (Additional Descriptive Text): enter perch name and/or number.

Columns 75 - 80 (Year, Month, Day): enter numeric code only.

Comment cards may be entered anywhere in the data set where they belong chronologically. The Camp ID, Card Type (2), and Year, Month, Day are entered in the same manner as for the Header Card. Under "Observer" enter the initials of the person making the comment. Left justify the initials. In columns 7-12 enter the hour, minute, and second, respectively. Keep the prose succinct.

Data Cards have the followins specific instructions:

Column 1 (Camp ID): 1 = South Camp
2 = North Camp
5 = Experimental or Rotating Camp
(3 and 4 were designations used in previous years

Column 2 (Card type): 3 = Data Card.

Column 3 - 5 (Observer): Left justify.

Column 6 (Observer Flag): S = Start
F = Finish
C = Continue

Columns 7 - 12 (Hour Minute, Second): Right justify and enter zeros in blank spaces.

Columns 13 - 15 (Adu Its): Right justify whale count.

Column 16 (D,C,T): D = Duplicate
C = Conditional
T = Tentative
blank = New whale

Note: When an adult-calf pair occurs with D or C designations, enter each whale on a separate line.

Columns 17 - 18 (Calves): Right justify whale count.

Columns 19 - 20 (Species): No entry necessary for BM.
Enter IC for ICE.
Remaining legal codes are DL, ER, 00.

Columns 21 - 42: Enter directly from field log.

Column 43 (North Camp MBQ): Enter M (Missed), B (Both), or Q (Questionable) if data is from North Camp; leave blank otherwise.

APPENDIX X (continued)

Columns 44 - 74 are blank on North Camp Data Cards.

Columns 44 - 45 (Visibility): Legal codes are EX, VG, GO, FA, PO, UN.

Columns 46 - 47 (Weather): Legal codes are CL, PC, OV, LS, HS, LF, HF, SR, LR, HR.

Columns 48 - 52 (Lead Width): Right justified; use 99999 for lead.

Columns 54 - 63 (Wind and Current Speed and Direction): Enter numeric values only (N=O, NE=45, etc.).. Note the decimal point between columns 59 and 60.

Columns 64 - 67 (Total Height): Total Height = Instrument height plus Perch height. Note the decimal point between columns 65 and 66. Only the first data card for each day needs to have the height entered; if there is a change in height, one entry at the appropriate place will suffice.

Columns 68 - 71 (Theodolite Correction Factor): Right justify. Get these values from a list for each respective theodolite serial number and enter them as decimal degrees.

Columns 75 - 80 (Year, Month, Day): Enter thisnumeric code on the first -data cards and draw lines to show all cards with these values. This shortcut should be used for these columns only.

Leave several blank rows at the bottom of each page to allow for late entries. If a row (card) is out of sequence, use an arrow to show where it belongs.

Be sure the computer log is checked. Patience and accuracy in the initial logging saves an incredible amount of effort later.

COMPLETE IN BIOMETRICS UNIT; DATE ____ PROGRAM ____ PROJECT ____ ACCOUNT NUMBER ____ SUBMITTED BY ____ NUMBER OF CARDS IN JOB ____ SHEET NO ____ OF ____

HEADER

CAMP ID	CARD TYPE			MONTH		DAY		YEAR		ORGANIZATION		CAMP NAME		ADDITIONAL DESCRIPTIVE TEXT		YEAR	MONTH	DAY

Card type: 1

COMPLETE IN BIOMETRICS UNIT; DATE ____ PROGRAM ____ PROJECT ____ ACCOUNT NUMBER ____ SUBMITTED BY ____ NUMBER OF CARDS IN JOB ____ SHEET NO ____ OF ____

COMMENT

CAMP ID	CARD TYPE	OBSERVER		HOUR	MINUTE	SECOND		COMMENT AS PROSE		YEAR	MONTH	DAY

Card type: 2

COMPLETE IN BIOMETRICS UNIT; DATE ____ PROGRAM ____ PROJECT ____ ACCOUNT NUMBER ____ SUBMITTED BY ____ NUMBER OF CARDS IN JOB ____ SHEET NO ____ OF ____

DATA

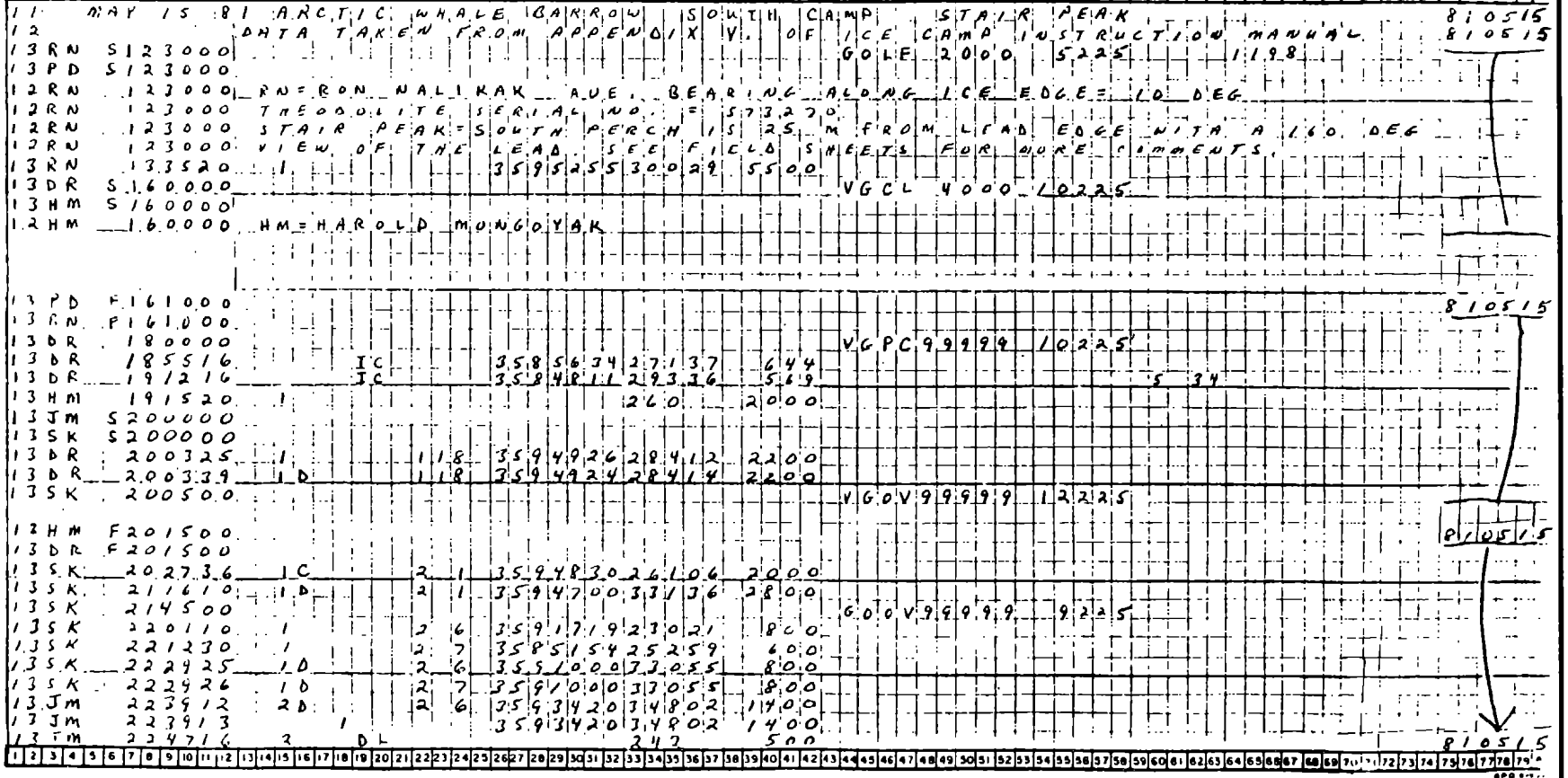
→ Total height [illegible]

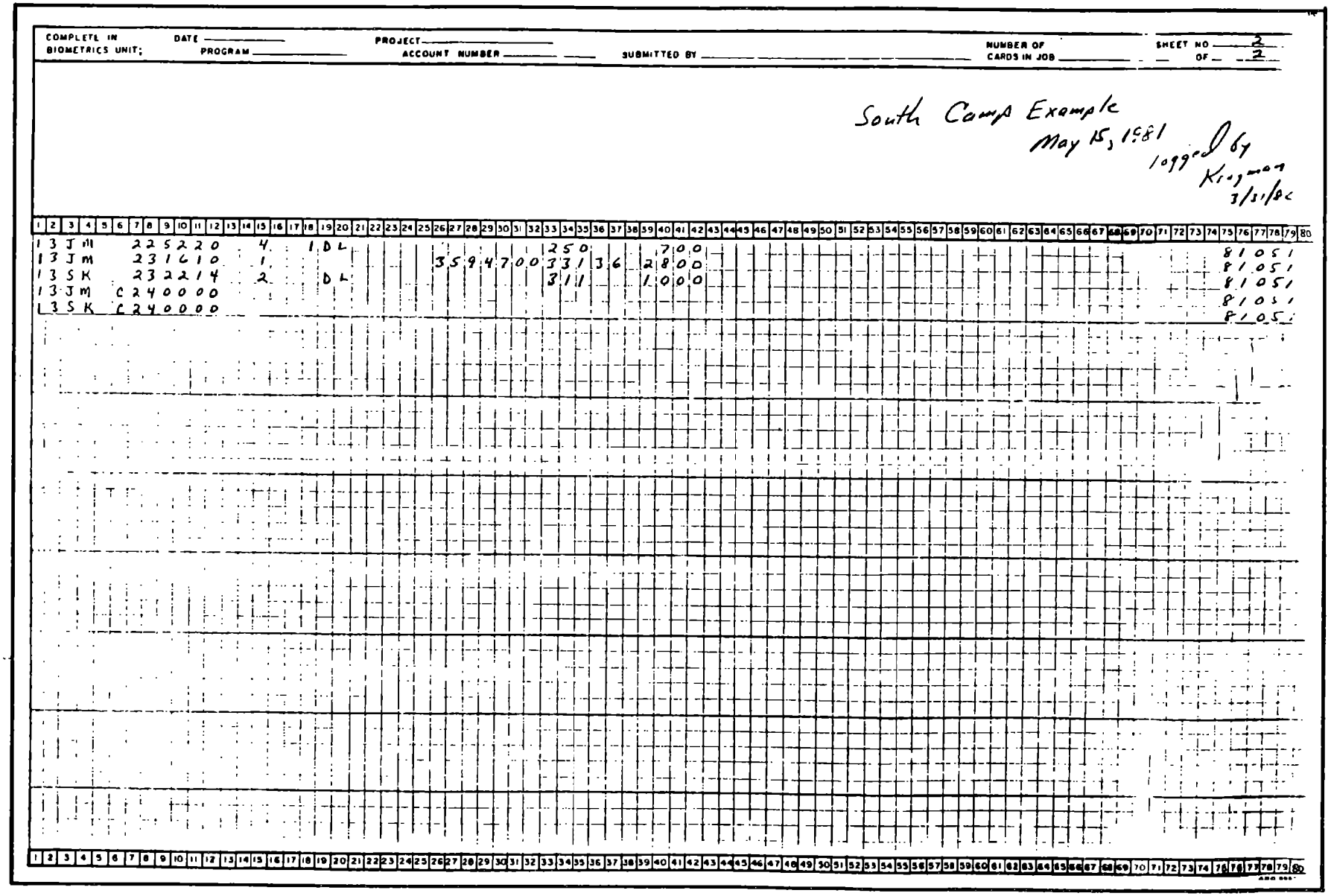
CAMP ID	CARD TYPE	OBSERVER	OBS FLAG	HOUR	MINUTE	SECOND	ADULTS	ICT	CALVES	SPECIES	PAGE #	LINE #		VERTICAL ANGLE			HORIZONTAL ANGLE			DISTANCE (m)	NORTH CAMP MBQ	VISIBILITY	WEATHER	LEAD WIDTH (m)		WIND		CURRENT		HEIGHT (m)	THICKNESS / CLARITY / LIMIT		YEAR	MONTH	DAY
														DEG	MIN	SEC	DEG	MIN								SPEED	DIRECTION	SPEED	DIRECTION						

Card type: 3

COMPLETE IN BIOMETRICS UNIT; DATE ____ PROJECT ____ PROGRAM ____ ACCOUNT NUMBER ____ SUBMITTED BY ____ NUMBER OF CARDS IN JOB ____ SHEET NO 1 OF 2

South Comp Example
May 15, 1981
logged by Higman
3/31/82




COMPLETE IN BIOMETRICS UNIT;
DATE
PROGRAM
PROJECT
ACCOUNT NUMBER
SUBMITTED BY
NUMBER OF CARDS IN JOB
SHEET NO 2 OF 2
South Camp Example
May 15, 1981
1099 0 64
Kingman
3/31/80
13 JM 225220 4 1 DL 250 700 81051
13 Jm 231610 1 3594700 331 36 2800 81051
13 SK 232214 2 DL 311 1000 81051
13 JM C240000 81051
13 SK C240000 8105

COMPLETE IN BIOMETRICS UNIT; DATE ______ PROGRAM ______ PROJECT ______ ACCOUNT NUMBER ______ SUBMITTED BY ______ NUMBER OF CARDS IN JOB ______ SHEET NO. 1 OF 1

South Camp Example
May 16, 1981
logged by Kingmond 3/31/82

```
11   MAY 16 81 ARCTIC WHALE BARROWW SOUTH CAMP   STAIR PEAK        810515
13JM  C000000                                 60KS 99999   5225     810515
13SK  C000000                                                       810515
13DR  S001000
13HM  S001000
13JM   001651  1C        35930512930118 00
13JM  F002000
13SK  F002000
13HM   013500                                 UNNS          2000
13DR  F021400
13HM  F021400
12HM   021400 ICE CRACK REPORTED BEHIND HS - ABANDON WATCH              810515
```

COMPLETE IN BIOMETRICS UNIT: DATE ______ PROGRAM ______ PROJECT ______ ACCOUNT NUMBER ______ SUBMITTED BY ______ NUMBER OF CARDS IN JOB ______ SHEET NO 1 OF 1

North Camp Example
April 29, 1981
logged by Kingman 3/11/82

```
21   APR 29  81 ARCTIC WHALE TASK      NORTH CAMP    EXAMPLE                          810429
23GGJS051000                                                           L130
2355  S051000
23     051136  1          3594416219 30  2500B
23     052732  1C         35929212650 0  1250B
23     054125  1      1 5 35906192530 0   700B
23     054555  1          35759583483 0   350M
23     060325  1D     1 5 35907542924 0   700B
23     062730  1          35935592314 0  1500Q
23     064050  1          35935392351 5  1050B
23     071045  1     110  35918302041 0  1000B
23     073700  1          35927412765 0  1200M
23     074000  1D    110  35844462170 5   500B
23     074500  1     11[illegible] 35936502253 0  1700B
23     081500  1D    113  35[illegible]2045248 15   [illegible]75B
23     083500  1          35929432110 0  1500B
23     083501  1     116  35929432110 0  1500B
23     085501  1D    116  35924522192 0  1100B
23     085527  1          35754072045 0   300B
23GGJF091000
2355  F091000                                                                         810429
```