Abstract ˆ 4HE IMPORTANCE OF GLACIAL ICE HABITATS TO HARBOR SEALS PHOCA VITULINA IN !LASKA HAS BECOME INCREASINGLY APPARENT (OWEVER ENUMERATING HARBOR SEALS HAULED OUT ON ICE IN GLACIAL FJORDS HAS BEEN DIFFICULT !T *OHNS (OPKINS)NLET IN 'LACIER "AY !LASKA WE COMPARED A SHORE BASED COUNTING METHOD TO A LARGE FORMAT AERIAL PHOTOGRAPHY METHOD TO ESTIMATE SEAL ABUNDANCE $URING EACH AERIAL SURVEY SHORE BASED OBSERVERS SIMULTANEOUSLY COUNTED SEALS FROM AN OBSERVATION POST "OTH SURVEY METHODS INCURRED ERRORS IN DOUBLE COUNTING AND MFROM ADULTS AND TO DISTINGUISH MOBILE SEALS FROM SHADOWS OR GLACIAL DEBRIS OF SIMILAR SIZE !ERIAL PHOTOGRAPHY PROVIDED A PERMANENT RECORD OF EACH SURVEY ALLOWING BOTH A RECONCILIATION OF COUNTS IN OVERLAPPING ZONES AND THE DOCUMENTATION OF THE SPATIAL DISTRIBUTION OF SEALS AND ICE WITHIN THE FJORD

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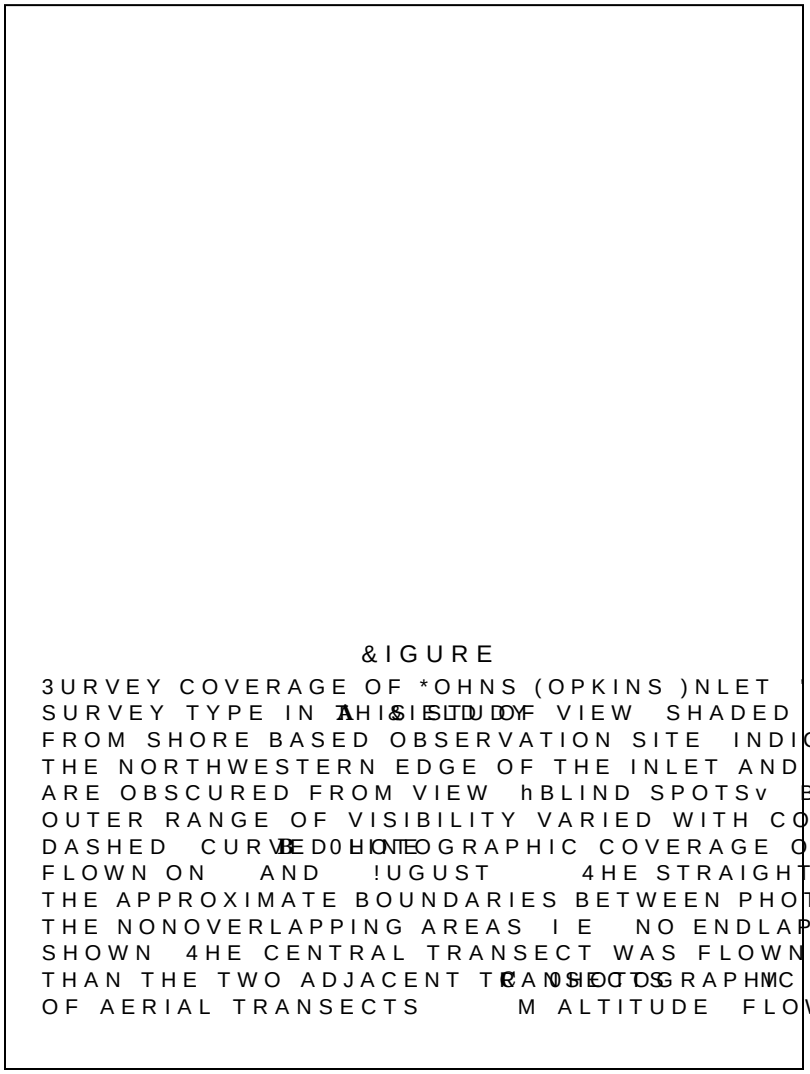
STUDY IN *OHNS (OPKINS)NLET 'LACIER "AY AND DETERMINED THAT IT WAS FEASIBLE TO COUNT HARBOR SEALS ON GLACIAL ICE FROM MEDIUM FORMAT AERIAL PHOTOGRAPHS AND COMPARISONS OF THESE COUNTS WERE MADE TO SIMULTANEOUS SHORE COUNTS)N OUR STUDY WE EMPLOYED HIGHER RESOLUTION LARGE FORMAT FILM CONDUCTED THREE SIMULTANEOUS AERIAL AND SHORE SURVEYS VS ONE IN THE PILOT STUDY AND USED DATA FROM DIFFERENT ALTITUDES TO ASSESS SOURCES OF COUNTING ERROR WITHIN AER IAL PHOTOGRAPHS

!ERIAL SURVEYS OF HARBOR SEALS ARE MOST OFTEN CONDUCTED WHEN PEAK NUMBERS ARE HAULED OUT WHICH USUALLY OCCURS DURING THE ANNUAL MOLT IN LATE SUMMER $URING SUCH SURVEYS LOW ALTITUDE ¥ M PHOTOGRAPHS OF HARBOR SEAL GROUPS ARE OBTAINED FROM WHICH SEAL COUNTS ARE MADE /LESIUK ET AL "OVENG ET AL 3UR VEYING SEALS IN GLACIAL FJORDS IS MORE DIFICULT THAN ON TERRESTRIAL SITES BECAUSE THE MOVING LARGE EXPANSES OF SCATTERED ICE ON WHICH SEALS HAUL OUT OFFER LITTLE SPATIAL REFERENCE TO AID IN COUNTING SEALS &URTHERMORE THERE IS OFTEN IN SUFICIENT MANEUVERING ROOM FOR LOW ALTITUDE AERIAL SURVEYS IN THE FJORDS 4HE MAIN OBJEC TIVE OF OUR STUDY WAS TO COMPARE THE RELATIVE



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3URVEY COVERAGE OF *OHNS (OPKINS)NLET 'LACIER "AY ACHIEVED BY EACH SURVEY TYPE IN THIS STUDY A SHADED AREA OBSERVED FROM SHORE BASED OBSERVATION SITE INDICATED WITH A STAR .OTE THAT THE NORTHWESTERN EDGE OF THE INLET AND A SMALL AREA NEAR THE GLACIER ARE OBSCURED FROM VIEW hBLIND SPOTSv BY GEOGRAPHICAL FEATURES 4HE OUTER RANGE OF VISIBILITY VARIED WITH CONDITIONS AND IS DENOTED BY A DASHED CURVE B 0HOTOGRAPHIC COVERAGE OF AERIAL TRANSECTS FLOWN ON AND !UGUST 4HE STRAIGHT LINES IN THE INLET REFLECT THE APPROXIMATE BOUNDARIES BETWEEN PHOTOGRAPHS &OR SIMPLICITY ONLY THE NONOVERLAPPING AREAS I E NO ENDLAP OR SIDELAP OF EACH IMAGE ARE SHOWN 4HE CENTRAL TRANSECT WAS FLOWN AT A LOWER ALTITUDE M THAN THE TWO ADJACENT TRANSECTS R 0HOTOGRAPHIC COVERAGE OF AERIAL TRANSECTS M ALTITUDE FLOWN ON !UGUST THE

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3HORE BASED AND AERIAL PHOTOGRAPHIC COUNTS OF HARBOR SEALS IN 'LACIER "AY !LA
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WHEN ICE MOVED SUBSTANTIALLY DURING THE TIME THAT
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OR DIRTY ICE ALTHOUGH THIS ADVANTAGE PROBABLY DI MINISHED WITH DISTANCE 3TATIONARY SEALS COULD STILL BE DIFFICULT TO DISTINGUISH AT ANY DISTANCE ALTHOUGH THEIR CHARACTERISTIC PROFILES AND THE REFLECTIVITY OF THEIR FUR HELPED TO DISTINGUISH SEALS FROM ROCKS OR DIRT OF SIMILAR SIZE !S WAS THE CASE FOR THE AERIAL ES TIMATES NO CORRECTION WAS AVAILABLE FOR SEALS MISSED OR MISIDENTIFIED BY SHORE BASED OBSERVERS AND SOME UNKNOWN NUMBER OF SEALS WERE IN THE WATER DURING THE OBSERVATION PERIODS

Advantages of each method

Shore-based counts 4HE MAIN BENEIT ASSOCIATED WITH COUNTING HARBOR SEALS FROM LAND IS THE ABILITY TO OBTAIN MULTIPLE COUNTS THROUGHOUT THE DAY AND ON SUCCESSIVE DAYS RELATIVELY INEXPENSIVELY COUNTS CAN ALSO BE MADE FROM LAND UNDER SUBOPTIMAL WEATHER CONDITIONS WHEN AERIAL SURVEYS ARE IMPOSSIBLE OR WHEN THE RESULTING PHOTOGRAPHS WOULD BE OF POOR QUALITY 2EPEATED SURVEYS ALLOW AN ASSESSMENT OF CHANGES IN SEAL COUNTS RELATED TO COVARIATES SUCH AS TIME OF DAY ICE CONDITIONS AND WEATHER -ATHEWS AND 0ENDLETON 4HE NUMBER OF HARBOR SEALS COUNTED ON ICE IN *OHNS (OPKINS)NLET VARIES FROM DAY TO DAY AND THUS INCREASES THE PROBABIL ITY THAT A SMALL NUMBER OF AERIAL SURVEYS COULD YIELD MISLEADING RESULTS &OR EXAMPLE ON CONSECUTIVE DAYS IN !UGUST THE NUMBER OF SEALS COUNTED FROM SHORE NEAR FRS RET
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!DMINISTRATION AND THE .ATIONAL 0ARK 3ERVICE TO * ,
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'LACIER "AY .ATIONAL 0ARK FOR THEIR SUPPORT IN HELPING TO
SECURE FUNDING 3 3LADE AT ,EICA 'EO3YSTEMS PROVIDED
TECHNICAL ASSISTANCE FOR %RDAS)MAGINE FOR THE AERIAL
PHOTOGRAPHY COUNTS 3 4ACKLEY PRODUCED &IGURES AND
4HIS MANUSCRIPT WAS IMPROVED BY COMMENTS FROM *
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