Annual Assessment of Subsistence Bowhead Whaling Near Cross Island, 2009: Continuation of Monitoring Activities Annual Report

Prepared by:
Michael Galginaitis
Applied Sociocultural Research
Anchorage, AK

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Applied Sociocultural Research
1652 Sunrise Drive
Post Office Box 101352
Anchorage, AK 99510-1352

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April 2010

Executive Summary

This Task Order, funded by the Minerals Management Service (MMS), has as its broad objective the description of subsistence whaling as currently conducted near Cross Island by residents of Nuiqsut. This effort is designed to measure basic descriptive parameters of Cross Island whaling so that observed changes (if any) can be analyzed in relation to such factors as oil and gas activities, weather and ice conditions, or other variables. Special attention is devoted to geospatial information through the sharing of GIS information by participating whaling crews. Annual project reports only report information collected, with no analysis of the information either as a self-contained database or in conjunction with the many pertinent external databases.

As a second broad objective, the project is designed as a collaborative effort of MMS and its contractor, Applied Sociocultural Research (ASR), the subsistence whalers from Nuiqsut, and the Alaska Eskimo Whaling Commission (AEWC). The project will develop a system for collecting information that local whalers themselves can adopt, adapt, and maintain. This report documents the results of the eighth year of this effort, which continues as a stand-alone project the prior task components of ANIMIDA and cANIMIDA (prior publications available on the MMS reading room website http://www.mms.gov/alaska/ref/AKPUBS.HTM - search on "Cross Island").

Three methods of information collection are employed – systematic observations, collection of daily vessel locational information from handheld GPS units, and whalers' self-reports and perceptions. Emphasis has been placed on such measures as:

- Number of crews actively whaling (observation)
- Size and composition of crews, and fluctuation over the whaling season (observation)
- Number of whales harvested (observation, self-report)
- Days spent whaling, and days prevented from whaling (weather, equipment failure or repair, etc.) (observation, self-report)
- Days suitable for whaling when whaling did not occur (observation, self-report)
- Subsistence activities occurring other than whaling (self-report, observation)
- Location of whale sightings and whale harvest (GPS, self-report)
- Location of whale searching (GPS, self-report)
- Local weather and ice conditions (observation, self-report)
- Bowhead whale behavior in the Cross Island area, and indicated differences from past experience (self-report)
- Changes in access or other issues related to the whale hunt, such as increased effort for the same (or reduced) harvest, increased risk, increased cost (self-report)

In 2009, a total of six crews with a total of 11 boats whaled from Cross Island. Five crews traveled to Cross Island on August 27, with the sixth crew traveling on August 28. A few boats scouted on August 28 and 29, but most crews spent these days on preparing equipment and fixing cabins on Cross Island. Conditions on August 30 and 31 were not suitable for scouting for whales. Most boats scouted on September 1–4, September 6–7, and September 11–13. Conditions (mainly high wind and sea swells) prevented scouting on August 30–31, September 5, and September 8–10 (although one boat did scout briefly on September 10). Whales were seen on most days when scouting occurred (but not on August 28 or September 10). However, conditions on most days made seeing whales very difficult, some reported sightings may be less

certain than others, and relatively few whales were seen. The lack of ice during the 2009 whaling season also often contributed to adverse sea states (the presence of large rolling swells) even on some days with little wind. The whalers concluded that there were relatively few whales in the area, and the ones they saw behaved as if they were "spooked". The whalers observed various types of boat traffic (commercial barges, ACS vessels, or private craft) on four different days (with two different sightings on one day). One of these encounters was on September 12 with the ACS vessel *Mikkelsen Bay* while it was servicing the DASARs in the Northstar array (see also Chapter 2, section "Time and Bearing Calibrations"). The *Mikkelsen Bay* returned to Wes Dock directly after they were contacted by the Communication Center. There was no consensus on why so few whales were seen or why they were "spooky", but factors discussed included vessel traffic, sea state and lighting conditions, the possible presence of killer whales, and possible changes or variation in the path or timing of bowhead whale migration. The results of the whale calls analyses of the 2009 DASAR records confirm the observation by the whalers, i.e., compared to 2008 there were significantly fewer calls detected and the migration path was slightly further north (see Chapter 4, section "Number of Whale Calls Detected"). The whalers ended their season on September 13, due to deteriorating conditions and other factors. Four crews returned to Nuiqsut on September 14 and two crews on September 15.

The 2009 Cross Island whaling season extended over 20 days. Scouting for whales occurred on 12 of these days. On two of these days only one or two boats went scouting, due to marginal conditions. Weather or sea conditions prevented crews from whaling on five days. Three days were devoted to traveling between Nuiqsut and Cross Island or preparing for whaling or butchering. Nuiqsut whalers used only three of their four strikes. A whale was struck and lost on 6 September and single whales were landed on September 11 and September 13. Strikes were made an average of 14 mi (22 km) ENE of Cross Island (10.7 mi [17.2 km] east; 11.6 mi [18.7 km] ENE; 19.7 mi [31.7 km] ENE).

In summary, the 2009 Cross Island hunt was challenging; only three of Nuiqsut's four strikes were used, and only two bowheads were landed. Although whalers were able to scout for whales on most days, overall sea-state and weather conditions often made it difficult to reliably observe whales and relatively few whales were seen. The whalers thought that the whales they did see were behaving strangely. Whalers reported two instances of observed whale feeding. Weather and sea conditions prevented any scouting activity on five days, and effectively prevented it on a sixth day. There were 12 days when boats went scouting for whales, under variable and sometimes marginal conditions that made detection of whales difficult. The absence of ice increased the adverse effect of wind, and even on relatively calm days large swells sometimes made scouting somewhat difficult. More than in previous years of this study, the whalers had a season-long concern with non-whaling vessel traffic, and spotted vessels when they were whaling on four different days. The level of effort expended by the whalers, in terms of boat hours on the water scouting for, chasing, and towing whales was much higher in 2009 than in any year for which comparable information is available.

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Acronyms and Abbreviations Used in Tables, Text, and Appendices (Crews Listed First)

Acronym or Abbreviation	Expanded Term or Reference
BO[1]	Oyagak Whaling Crew
IAN	Aqargiun Whaling Crew
IP[1]	Ipalook Whaling Crew
NAP[1]	Napageak Whaling Crew
NUK[1]	Nukapigak Whaling Crew
TAL[1]	Taalak Whaling Crew
UA[1]	Ahkiviana Whaling Crew
ACS	Alaska Clean Seas
AEWC	Alaska Eskimo Whaling Commission
ANCSA	Alaska Native Claims Settlement Act
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
BP	Barometric Pressure
BPXA	British Petroleum Exploration Alaska
CAA	Conflict Avoidance Agreement
cANIMIDA	continuation of ANIMIDA
CI	Cross Island
esp.	especially
F	Fahrenheit (temperature measurement)
ft	Feet
GIS	Geographical Information System
GPS	Geographic Positioning System
HCC	High Cloud Cover
HP	Horse Power
IHLC	Inupiat History, Language, and Culture Commission
IWC	International Whaling Commission
MFCI	Miles From Cross Island
mmddyy	Date Format – month/day/year
MMS	Minerals management Service
MPH	Miles Per Hour
N,S,E,W and combinations	Compass directions (north, south, east, west, northeast, etc)
NA	Not Applicable
NQT	Nuiqsut
NSB	North Slope Borough
NSB DW	North Slope Borough Department of Wildlife Management
OCS	Outer Continental Shelf
OWA	Oil/Whalers Agreement
TOT	Total Time (of individual boat trips)
UNK	Unknown
w/number or /number	With the specified number (of people)
WCA	Whaling Captains Association
WCC	Whaling Communication Center
WD	West Dock (Prudhoe Bay)
WF	Weather File (time series of weather station measurements)

[1]When crews use multiple boats, each boat is differentiated by a number after the crew designation (1-4)

Acknowledgments

Numerous people contributed greatly to whatever merit exists in this report. Foremost among them must be the whalers and other residents of Nuiqsut. While it is unfair to single out individuals when all provided essential information and support in what is after all a communal and cooperative undertaking, I would be remiss if I did not explicitly thank those whaling captains and their crews who extended me the hospitality of their cabins. This is the report on my ninth field season on Cross Island, for which the Oyagak crew served as my host (and previously in the third and seventh seasons). Paul Kittick, as my host for the first year when the project was still an unknown quantity to the whalers, will always have my utmost appreciation. Archie Ahkiviana agreed to be my host the second year, as well as the fifth, sixth, and eighth years. The late Thomas Napageak was my host for the fourth season. I, of course, also thank the other crews who were out on Cross Island during the 2001-2009 seasons (Nukapigak, Aqargiun, Ipalook, and Taalak), and David Pausanna for all the help he has given me over the phone and while I have been in Nuiqsut. I cannot begin to list the other residents of Nuiqsut who shared so much of their time and knowledge. The AEWC and its staff have also been consistent supporters of the project.

Industry has also provided assistance in various forms, from advice to more concrete logistical support. Ray Jucubczak, Concie Rock, and Bill Streever at BPXA have benn especially notable in this regard. BPXA also assisted with the transformation of the raw GPS track information into more usable GPS-based maps for the 2001-2003 data. Although these maps have since been replaced through more recent in-house software, their early assistance is much appreciated. More recently, other industry participants in the Conflict Avoidance Agreement have also provided logistical support, and BPXA has provided supplemental financial support for the Cross island research effort in conjunction with their annual application for permits for the Northstar production unit.

MMS, as the sponsor and funder of the project, also deserves a formal "Thank you." Dick Prentki, as COR for seasons 1-7, Dee Williams and now Chris Campbell for this continuing effort have all been responsive supporters, even though the course of the project has not always been smooth.

Lastly, the entities for which ASR performed this work as a subcontractor for the 2001-2003 field seasons, LGL Limited of Alaska and Batelle, must be thanked for their willingness to trust that the work would be accomplished with a minimum of oversight on their part. The budget for this limited task would not support a good deal of administrative overhead, and both worked with me to make it work. I am grateful to Dale Funk and especially W.J. Richardson of LGL.

The above notwithstanding, all errors and shortcomings of this report are the responsibility of Michael Galginaitis and ASR. Please advise me of as many errors, misunderstandings, or confusing discussions as you find, so that whatever effort continues in this regard can bear as much fruit as possible. But again, none of this work would be possible without the cooperation and support of the Nuiqsut whalers, to whom I again give my most profound thanks.

Introduction and Objectives

This project, funded by the Minerals Management Service (MMS) has as its broad objective the description of subsistence whaling as currently conducted near Cross Island by residents of Nuiqsut. It continues the only socioeconomic component of the Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) and the Continuing Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA) programs, which were funded by MMS to monitor the potential effects of the Northstar production unit and other offshore oil development. These multi-task efforts focused almost exclusively on physical science and potential biological/chemical effects. While "traditional" subsistence whaling has been well documented in a number of locations, contemporary subsistence whaling is not as well documented, especially in terms of changes over time. This effort is designed to measure basic parameters of Cross Island whaling so that observed changes (if any) can be analyzed in relation to such factors as oil and gas activities, weather and ice conditions, or other variables. Observations, and the narrative annual report summarizing them, will focus on descriptive measures of activities associated with whaling. Special attention is devoted to geospatial information through the sharing of GIS information by participating whaling crews. Project annual reports are only for the purposes of reporting information collected, with little analysis of the information either as a self-contained database or in conjunction with external databases. Among the many external databases of potential pertinence to the descriptive information collected under this task order are the Human Activities Database (HAD), although the database does not contain information later than 2000, and thus does not cover the time period of this project. Thus the HAD is primarily historical and is of most interest in terms of what information can be recovered about Nuiqsut whaling seasons prior to 2001. Of perhaps more potential utility for the detailed information collected for this effort and the ANIMIDA and cANIMIDA projects are remote sensing information on ice cover or other geophysical parameters. Other linkages for potential future analysis (AEWC records of whale harvest, or untranscribed IHLC tapes, for example) also exist.

As a second broad objective, the project is designed as a collaborative effort among MMS (and its contractor, Applied Sociocultural Research), the subsistence whalers from Nuiqsut, and the Alaska Eskimo Whaling Commission (AEWC). Beyond the goal of multiple years of descriptive information on Cross Island subsistence whaling activities, the project was to develop a system for collecting such information that local whalers themselves could adopt, adapt, and maintain. The methodology has now been developed sufficiently, but the transition to local implementation of the program has been slow and is still in process.

This is the eighth field season for overall effort. Annual reports have been produced for the 2001-2007 seasons (Galginaitis and Funk 2004, 2005; Galginaitis 2006a, 2006b, 2007a, 2009). A more analytical report summarizing and analyzing the full seven years of data (2001-2007) is also in process. A list of acronyms and abbreviations used is provided on page ix.

An Overview of Contemporary Subsistence Whaling in Alaska

The Inupiat of the North Slope maintain a vital Native culture -- with kinship, dependence on hunting wildlife resources, and a respectful relationship to the land as fundamental values. Hunting provides most of the meat consumed by Inupiat. Whaling not only provides a significant

part of this food, but is also a key social organizational activity for North Slope Inupiat. Whaling is also a central ideological idiom for the expression of key cultural values, and an important vehicle for the transmission of those values (Worl 1978, Rexford 1997). Subsistence whaling has been (and continues to be) a key focus for Inupiat and Yupik culture and society (Bering Straits area, Northern coastal Alaska) for at least 1,000 to 1,500 years (Dumond 1984, Krupnik and Stoker 1993, McCartney 1994). However, nothing more than a brief orientation to contemporary subsistence whaling in Alaska is attempted in this report, and references are illustrative, not exhaustive. This discussion provides only a general description of some key aspects of the organization of subsistence whaling, within the context of its management regime, that are important for an understanding of this project's methods and results. This discussion proceeds from the general to the more specific.

In Alaska, eleven coastal communities currently field whaling crews and are members of the Alaska Eskimo Whaling Commission (AEWC). The AEWC was formed in 1977 in direct response to the International Whaling Commission's (IWC) decision to ban the Alaskan subsistence bowhead whale hunt. The IWC had two main concerns – that the bowhead whale population was too small to sustain a regular harvest, and that subsistence hunting methods were too wasteful (too many animals were killed but then "lost"). As a result of a complicated series of negotiations, the United States and the AEWC convinced the IWC to allocate an initially small quota of bowheads that could be harvested in 1978. This quota is supported by a data collection program that measures and monitors the bowhead whale population, and the efficiency of the subsistence whaling harvest. This has resulted in an increased confidence in the robust size of the bowhead whale population and an incentive for the reduction of "struck and lost" whales (increase in the efficiency of the hunt) which has been quite successful. Because the bowhead population has been steadily increasing, along with the overall success rate of the hunt, the IWC has consistently increased the quota of animals available for harvest, and now considers and allocates the quota in five-year blocks rather than year-by-year. Since 1978 the AEWC has co-managed the Alaskan subsistence bowhead whale hunt with the National Oceanic and Atmospheric Administration, Department of Commerce, under a mutual cooperative agreement.

The AEWC is essentially a self-regulating body that has implemented management practices that protect the reproductive capability of the resource, increase whaling success and/or reduce waste, increase the safety of the hunt, and enforce individual accountability for not complying with these practices. For example, whales with calves cannot be taken. This not only maximizes the population's growth, but is also a safety rule, since Inupiat whalers know that female bowheads with calves are the most aggressive and dangerous animals to approach. The first strike on a whale in the fall must be made with a darting gun, so that a bomb is shot into the whale at the same time that a float is attached to the whale with a harpoon. Since not all whales are killed with the first strike, the float serves to both slow the whale down and to assist the whalers in following it. A research program to increase the efficiency of whaling bombs has been ongoing, with periodic workshops to disseminate information and new technology to the whalers (2005 was the first year that the penthrite bomb, often termed the "superbomb," was available to Nuiqsut whalers). Guidelines for the size of whales to be taken are suggested, since experience has shown that larger whales pose the potential for more wastage than smaller whales (they potentially take more time to tow and butcher, and time often is directly related to wastage). AEWC sanctions have been most severe for violation of the quota set for a given community or

for striking a mother with a calf – the revocation of the right to go whaling for a specified number of years. Other sorts of violations may result in fines or public censure. In short, the AEWC has constructed a flexible system that rewards its members for compliance with rules and practices that foster both AEWC and IWC goals, and potentially penalizes them for noncompliance. Few cases of noncompliance have occurred, and this management regime is consistently cited as one of the most successful examples of such management (Huntington 1992). The original decision documents for the 1978 IWC action (U.S. Department of Commerce 1977, 1978) also contain much of interest.

The IWC sets an overall quota for the hunt, and the AEWC in turn allocates that quota among the whaling communities. Each whaling community is represented by a local Whaling Captains' Association (WCA) at the AEWC, and each local WCA is responsible for managing the hunt in its respective community. Nuiqsut initially received an allocation of one whale landed or one strike, whichever occurred first, for 1978. That is, a harpoon that penetrates a whale counts as a strike, regardless of whether the bomb explodes or not, or whether that animal is actually taken or not. Not all "struck and lost" whales necessarily die, but the conservative AEWC/NOAA management system assumes that they do. Nuiqsut's current allocation is four whales or four strikes. Unused strikes and quota can be transferred between communities, quota is now allocated in multi-year blocks, and there can be some "roll-over" of quota from one year to the next. Thus, the harvest in some years for any given community may be greater than the "normal" quota allocated, if a community's WCA requests and is granted one or more strikes over their "normal" quota allocation. Similarly, overall take per season can vary, depending on whaling conditions and use (or not) of any "roll-over" quota.

Subsistence whaling in Alaska occurs in the spring (generally April-May) and the fall (generally September-October), when the bowhead whale migration brings them reasonably close to the whaling communities. The conventional thinking is that in the spring, bowhead whales migrate north through the Bering Strait and then, in Alaskan waters, east of Point Barrow into Canadian waters, where they spend the summer (some also go west into Russian waters). In the fall they reverse this course. Spring whaling differs from fall whaling. In the spring whales migrate through relatively narrow open leads in the ice, whereas in the fall the icepack is farther offshore and the water is generally more open. Some years can be very different, however and there can be thick floating ice near Cross Island in the fall. The first years documented by this project, 2001-2004, were relatively ice-free, but in 2005 and 2006 floating ice packed against the north shore of Cross Island confined Nuiqsut whalers for most (2005) or part (2006) of the whaling season. The latest two documented seasons, 2007 and 2008, were nearly ice-free. Spring leads do not open up close enough to Nuiqsut or Kaktovik to allow these communities to whale in the spring. In the fall, because whales are not confined by leads and generally travel far offshore once west of Barrow, it is difficult in most years for whaling communities other than Kaktovik, Nuiqsut, and Barrow to hunt them in that season.

Thus, most whaling communities, those located on the Bering and Chukchi Seas, whale primarily in the spring (but current weather patterns resulting in poor spring whaling seasons have provoked some of these communities to investigate whaling in the fall as well). Barrow, located where the Chukchi and Beaufort Seas meet, has traditionally whaled in both the spring and the fall. Nuiqsut and Kaktovik whale only in the fall. Some Nuiqsut whalers will whale on

other crews in other villages in the spring, and sometimes even in the fall after the Cross Island season is over. Spring whalers have traditionally and historically used only skin boats (until recently), whereas fall whalers use more durable wood, aluminum, and fiberglass boats. This is related to three general seasonal differences: the greater need to avoid unnecessary noise in the spring, the harsher environmental conditions of fall whaling (rougher seas, more floating ice), and the greater need for speed in the fall to find and pursue whales in more open water. Recent changes in spring whaling, especially in Barrow, have been described and discussed in Wohlforth (2004), and interested readers are referred to that source. This report discusses only Nuiqsut whaling, currently conducted from and near Cross Island in the fall.

The Historical Context of Cross Island Whaling

The present community of Nuiqsut has a relatively short history, having been resettled in 1973. However, Inupiat use and occupation of the Nuiqsut area has a very long history, which is the basis for Nuiqsut's status as a village recognized under the Alaska Native Claims Settlement Act (ANCSA). Nuiqsut is located about 12 miles inland on the Colville River (Figure 1), which is not a typical location for a whaling community. However, its residents trace their ancestry to people who whaled in the mid-Beaufort Sea (including near Cross Island) in the first half of the twentieth century, as well as prior to that time. Treatments of the complex and dynamic history of the North Slope region in general, and the Nuiqsut area in particular, can be found in Brown 1979, Galginaitis et al. 1984, Hoffman et al. 1988, Galginaitis 1990, and Long 1996. These sources are the basis for the information in this section. Figure 1 shows the location of Nuiqsut on the Colville River, and Cross Island in the Beaufort Sea, as well as typical routes between Nuiqsut and Cross Island and some significant landmarks in between. Cross Island is about 73 miles northeast of Nuiqsut "as the crow flies" and from 92 to 109 miles away by boat, depending on which channel of the Colville River can be used to reach the ocean. When the water level in the river is high, the more direct route can be used. When the water level is low, the more direct river channel is too shallow for most boats, so the longer route is used. Cross Island itself is about eleven miles offshore, but more importantly from a logistical point of view is ten miles from the Endicott causeway and fifteen miles from West Dock.

Prehistoric use of Cross Island has not been well documented or investigated archaeologically, but documentation for more recent use is quite extensive. Families who lived on and used Cross Island seasonally during the first half of the twentieth century included the Woods, Pausanna, Saavgaq, Ulaaq, Ahsoak, Ahgook, Ikpikuk, Ahvakana, Akpik, Sovalik, Kaigelak, Tigulak, Ahsogeak, Ahkivgak, Ekolook, and Ekowana (Smith 1980). Perhaps most important in terms of whaling was Taaqpak, who used Cross Island as a whaling base from the early twentieth century through the late 1940s. Documentation for whaling harvests near Cross Island is incomplete, but includes accounts of whales taken near Cross Island in 1921, 1922, 1927, 1928, 1931, 1935, 1938 and 1940 (by Taaqpak and others – Carnahan 1979, Shapiro and Metzner 1979, Smith 1980). While few of today's active whalers learned directly from Taaqpak, many have learned from those who were on his crews (or from those who knew Taaqpak once or twice removed). Taaqpak maintained that Inupiat had hunted whales near Cross Island for centuries (Carnahan 1979:21-31). Thus whaling near Cross Island has a strong cultural continuity.

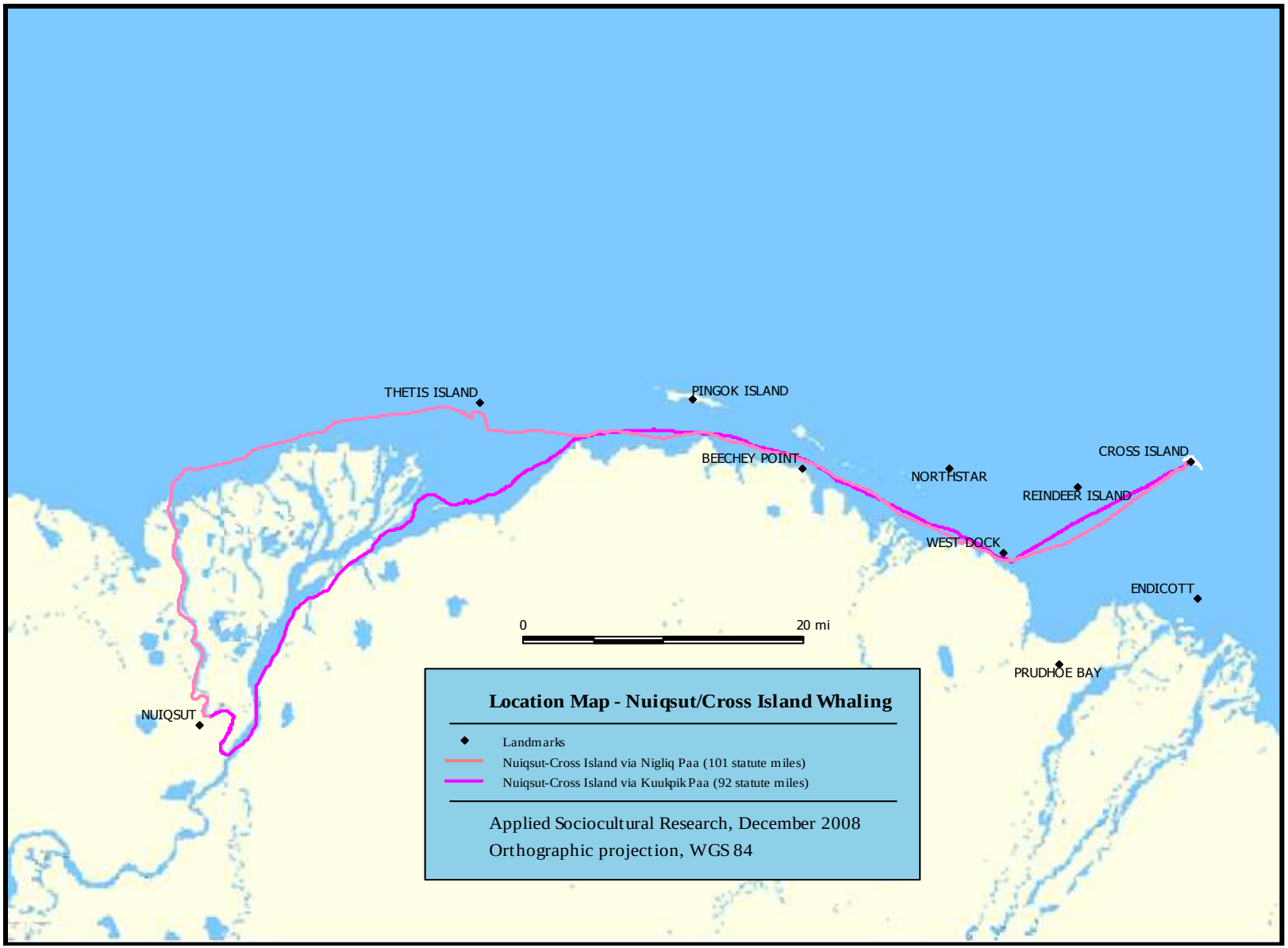


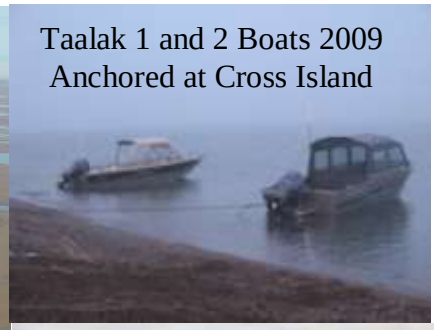
Figure 1: Location Map, Landmarks, and Routes Between Nuiqsut and Cross Island

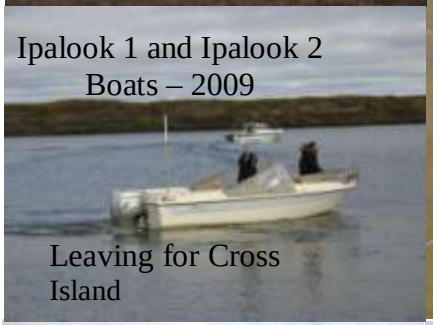
Plate 1: Nuiqsut and Cross Island Photographs


Oyagak2 and Oyagak1 Boats at Cross Island - 2009

Getting ready to Scout

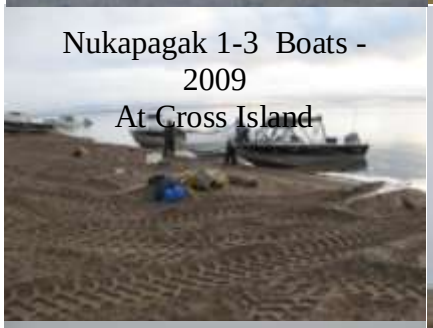

Nuiqsut, August 2008


Taalak 1 and 2 Boats 2009 Anchored at Cross Island


Ipalook 1 and Ipalook 2 Boats – 2009

Leaving for Cross Island

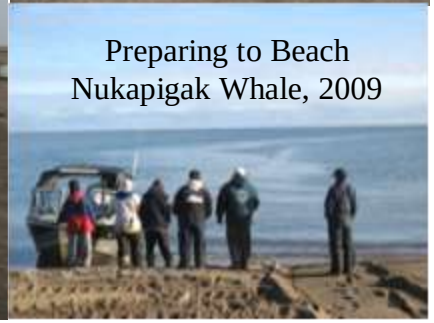

Aqarguin Boat At Cross Island


Nukapagak 1-3 Boats - 2009 At Cross Island


Cross Island form the top of Oyagak Cabin 9/08/08


Taalak Whale, 2009


Napageak Boat - 2009 Leaving to Scout for Whales


Preparing to Beach Nukapigak Whale, 2009

All photos taken by M. Galginaitis

When Nuiqsut was resettled in 1973, many of the original settlers traveled from Barrow with the supplies necessary for their life in tents for a year or more. They used a variety of means – sleds towed by a small Cat (a tractor with tracks), snow machines, and weasels (another sort of tracked vehicle, of WWII vintage). One of the original founders took the first whale for Nuiqsut that fall, while on his way to Kaktovik to obtain some *muktuk* and meat to take back to the village. He and his crew had been looking for whales and had been out about six weeks. They had not seen any whales in that time, although they had seen a great number of seals. By the end of the third week of their trip they had run out of most of their food (other than salt), and were relying almost entirely on seal for sustenance. By the sixth week of their trip the whaling captain had concluded that they were too late – that the whales had either passed them by or were too far from the shore for them to find and successfully land. On the chance that Kaktovik whalers had been more successful (since communications were much more rudimentary in 1973 than now, he did not know if Kaktovik had taken any whales or not), he decided to go to Kaktovik to obtain some *muktuk* and meat to take back to Nuiqsut. They then came upon a whale in the Brownlow Point/Flaxman Island area, in shallow water. They took this whale, butchered it, and returned to Nuiqsut with as much as possible. Several boats from Nuiqsut then made another trip to the harvest site to recover more of the *muktuk*.

Most of the six members of this 1973 crew are now senior (or retired) Nuiqsut whalers, and the captain, belying his age, was one of the most active Nuiqsut whalers until his recent death in 2005. In the years immediately after 1973 relatively few crews whaled from Nuiqsut, with relatively infrequent success. Nuiqsut whalers regularly went to other communities in the spring to participate in spring whaling (a pattern that some continue up through the present), and sometimes in the fall, rather than whale in the mid-Beaufort Sea area. The next "Nuiqsut" whale was not taken until 1982, although crews whaled from various locations between 1973 and 1982 – Pingok Island, Narwhal Island, and Cross Island among them. A summary of whale harvest by Nuiqsut crews is presented in Table 1 below. Nuiqsut whalers attribute at least part of their relative lack of success in the 1970s and 1980s to interference from oil and gas exploration, as well as poor weather and ice conditions in some years, and a difficult logistical situation. These factors are also evident in the three years with the greatest incidence of "struck and lost" whales (1989-1991 or 1992). Nuiqsut whalers say that one reason they settled on Cross island as a logistical base is that it is to the east of Prudhoe Bay oil and gas activities, so that they could intercept whales before they are disturbed and influenced by those activities. Once Cross Island was established as a logistical center for Nuiqsut whaling, and Nuiqsut whalers gained experience there, harvest success became much more regular. Another factor in this increased success may be more moderate ice conditions since 1992 (although this may be countered by the greater effects of higher winds when ice cover is lacking).

Cross Island is a low sandy barrier island with an artificial higher area built from gravel. This higher area was constructed for past oil and gas exploratory drilling. Cross Island is about 3 miles long and 150 yards wide, and is constantly changing due to erosion and redeposition. Especially in the earlier years, logistical support for whaling on Cross Island was very difficult. Whalers had to haul or find their own gas and water, and hunted and fished to provide most or all of their food. There was at most one cabin for however many people were whaling. Since the mid-1980s, with the advent of the Oil-Whalers Agreement (OWA) in 1986 between the oil industry and fall whalers (represented by the AEWC), logistical considerations have become somewhat easier. The

Table 1: Recent Harvest of Bowhead Whales Near Cross Island

Year[1]	Whales			Notes
	Quota[2]	Landed	Struck & Lost	
1973	NA	1	0	
1982	1	1	0	
1986	2	1	0	
1987	2	1	0	
1989	3[3]	2	2	Oil industry vessel disturbance noted
1990	3	0	1	Oil industry disturbance, also rough seas
1991	3	1	2	Poor weather, bad ice conditions
1992	3	2	1	
1993	3	3	0	Very favorable conditions
1995	4	4	0	
1996	4	2	0	
1997	4	3	1	
1998	4[3]	4	1	
1999	4	3	0	
2000	4	4	0	Very favorable conditions
2001	4	3	0	Little ice, whales relatively distant and skittish
2002	4[3]	4	1	Little ice, whales closer than in 2001
2003	4	4	0	Poor weather, whales close to Cross Island
2004	4	3	0	Poor weather, whales close to Cross Island
2005	4	1	0	Very poor weather, bad ice conditions, disruption
2006	4	4	0	Ice restrictions first half of season
2007	4	3	1	No ice, generally poor weather and rough sea conditions, whales close to Cross Island
2008	4	4	0	No ice, rough seas, whales close to Cross Island
2009	4	2	1	No ice, swells and some difficult sighting conditions, whales relatively distant

[1]Years of no harvest and no "struck and lost" are not listed. Whaling effort may still have occurred.
[2]"Quota" was not applicable in 1973. Records and informants do not clearly indicate when the quota for Nuiqsut increased to 2 strikes and then to 3 strikes (documentation for 1983-1991 is not definitive and values provided for those years are best guesses based on inconsistent information).
[3]An additional strike (above regular quota) was requested during the season for this year
Source: Compiled from AWC records, personal communications from Nuiqsut whalers, and field notes from the 2001-2006 whaling seasons

current agreement is referred to as the "Conflict Avoidance Agreement" (CAA). The oil and gas industry (and especially BPXA) has been providing logistical support of various sorts to Nuiqsut whalers as a mitigation measure for potentially disrupting subsistence whaling by exploration, development, and/or production activities. With the increased interest in offshore exploration in the Beaufort Sea in 2005 and for the foreseeable future, other energy companies are also significant participants in the CAA, with Shell most recently acting as the managing party for industry (2006-2008).

At the most basic level, the OWA/CAA provides for the constant communication between industry and the whalers about all of their respective ongoing activities, so that each can avoid interfering with the other. The mechanism for this mutual communication is the Whaling Communication Center (WCC – also referred to as the "Conflict Avoidance Communication Center", the "Oil/Whalers Communications Center", or "Com Center") in Deadhorse. The WCC operates during each fall whaling season and is staffed by bilingual radio operators. All industry and whaling vessels are required to report their activities to the WCC in real time (purpose, time left, time returned, significant events as they occur), and the WCC maintains a log of these reports which is archived by the AEWC. This provides a record of activities as they take place, and also documents to some extent the whaling activities. It also allows the WCC to advise industry of planned industry activities that may interfere with ongoing whaling, or to suggest windows of opportunity (when whaling is not taking place) when industry activity may have minimal potential effects. Unfortunately, vessel activity not associated with the oil and gas industry (for example, commercial barge traffic) need not coordinate with the WCC in the same way, so that this is not a totally effective mechanism for the mitigation of all such potential effects. Other sorts of logistical support have been supplied at least in part by industry. These have included low-cost connex units (converted into seasonal cabins on Cross Island); a winch to help haul whales up at Cross Island; assistance with a steadier supply of gasoline; a generator system to supply electricity to the cabins during the whaling season; diesel fuel (for the winch and generator); water and other supplies; help with transporting the butchered whale to Nuiqsut; at least limited phone service for one or two crews; help with mobilization and demobilization; and the assurance of available emergency assistance. Alaska Clean Seas (ACS) is the industry's contractor for much of this OWA support, as a small part of its overall responsibilities (which are mainly logistical and/or related to oil spill response). In theory, all petroleum companies with activities on the North Slope pay for ACS, with the majors – BPXA, ConocoPhillips, and now Shell - providing most of the funding. In reality, BPXA has been the most frequent participant in this agreement, probably due to its ownership of Northstar, the only current offshore petroleum production facility in the Beaufort Sea. Thus BPXA may have borne the majority of OWA-related costs since ConocoPhillips has little or no offshore interests and Shell participates only when it has exploration activities scheduled for the Beaufort Sea. The AEWC does pay for some of the services provided under the OWA, but the amount and exact services are not reported. Neither industry nor the AEWC discloses the financial terms of the OWA.

Preparations for whaling, in one form or another, take place during the entire year. This report focuses on the activities during the harvest season. The final preparation of boats and equipment happens in August, and a meeting of the Nuiqsut Whaling Captains' Association (NWCA) is conducted to set a date for the start of the hunting effort and to review the rules and regulations. Labor Day is the normative date for whaling crews to go to Cross Island, but it is not unusual for individual crews to go out earlier, especially if Labor Day is "late." In 2004, one crew (with two boats) went out August 15. This was considered extremely early by the other crews, but this captain was thinking that the migration of whales had been earlier in the last several years than it had historically been and that weather in early September had been increasingly marginal for whaling in the last several years. The combination of bad weather and mechanical problems did not allow him to fully test his conjectures. The few times that his crew went scouting in August they did not see any whales Galginaitis 2006a). Crews prefer to go out together or with multiple boats, for safety, so that two boats is usually the minimum number.

Once the crews are on Cross Island the focus is on whaling. Boats usually go scouting for whales on all possible days unless a whale was taken the prior day, in which case butchering usually has priority. However, this pattern may be changing, as Nuiqsut whalers increasingly seem willing to take more than one whale a day, or to allow some crews to go out to scout before a whale already landed has been fully butchered. When a whale is taken, it is towed to Cross Island, hauled up on the gravel beach, and butchered. Although some specific parts of the whale are distributed to specific individuals (one flipper to the harpooner, half the baleen to the captain, etc.), the butchered whale consists of three main parts. Select parts of the whale from the captain's share or "belt" near the middle of the whale ("*tavsi*") are sent to Nuiqsut via whaling boat the same or the next day "to feed the village". Occasionally it will be flown to Nuiqsut from West Dock, but will still be accompanied by a crew member to "run the flag" to the captain's house upon its arrival in Nuiqsut. The *tavsi* separates the rear of the whale (*uati*) from the front of the whale (*niniq*). The *uati* is the community share, and once it is removed from the whale it is processed by the crew that landed the whale, and served to the public at Thanksgiving, Christmas, and Nulukataq. The *niniq* is the crew share and once it is removed from the whale is divided equally among all the crews helping with that whale and then processed further by each crew. All of this meat, *muktuk*, organs, and baleen is packed into plastic fish totes (or heavy, reinforced, corrugated cardboard boxes in 2004-2008) and transported to West Dock and then to Nuiqsut (most recently via ACS barge to West Dock and air freight to Nuiqsut). What is left of the whale is disposed of in the "bone yard." Once the quota is taken or conditions threaten to prevent returning to Nuiqsut (usually mid- to late-September), the whalers clean up the island, pack, and leave. Successful captains for that season will fly their flags during the trip back to Nuiqsut.

Nuiqsut whalers first used wood boats and relatively small motors. Although they remember these vessels with fondness, and long for the economy of those motors, they also remember that they were limited in terms of speed and towing capability. In 2008 Nuiqsut whalers all used aluminum or fiberglass boats, 17 to 24 feet long, with motors of 115 to 225 horsepower. It is possible that a 16-foot boat may be used as a whale boat on occasion, but it would not be considered a primary whaling boat. A few boats have cabins, but most are open. Boats typically scout for whales with a complement of three or four people, although some boat crews are as small as two and as big as eight. Although single boats do take whales on occasion, it is not encouraged and Nuiqsut boats almost always scout for whales in pairs, in case of mechanical break downs or other emergencies. Whaling crews with two or three boats are willing to whale on their own, but it is commonly agreed that five to seven boats is a preferable number to have available for whaling on a given day. More boats would be useful, and the availability of fewer boats decreases the efficiency, safety, and overall chance for success of the hunt.

Methodology

The data to be collected for this research will be discussed in terms of methods, with emphasis on the actual collection of descriptive information. In addition, it is important to address the issue of "hypothesis testing" in relation to the products of this research effort.

Hypothesis Testing

MMS explicitly required, as part of the proposal submission, the formulation of hypotheses related to potential changes in Cross Island subsistence whaling. These hypotheses can later be tested using the information collected by this research effort. Two major hypotheses were formulated:

- H1: Subsistence whaling activity and behaviors in the vicinity of Cross Island are significantly changed by offshore oil developments at Northstar and/or Liberty.
- H2: General subsistence activities on/near Cross Island are significantly changed by oil and gas activities associated with Northstar and/or Liberty.

These hypotheses are not stated in the "null hypothesis" format because such a formulation is counterintuitive to at least some of the local research participants and perhaps to the general public at-large. It will be necessary to express their implementation in the null hypothesis form for quantitative testing. The annual reports were not intended to test or discuss these hypotheses. Such tests require more data (longer time series) and more effort devoted to analysis, than is available for the Annual Reports, and are part of the synthetic cANIMIDA final report.

In summary, the hypotheses have been formulated as examples of possible relationships that are testable after concrete empirical (and ideally quantitative) measures of Cross Island whaling related to those hypotheses have been systematically compiled as time-series data for a number of years. The hypotheses (and the measures to test them) thus guide the practical methods of collecting and archiving the information, to ensure that they will be useful for testing these hypotheses (as well as others as they are developed).

Descriptive Data Categories

The primary goal of data collection is the compilation of quantified measures of subsistence whaling behavior. Emphasis has been placed on such measures as:

- Number of crews actively whaling
- Size and composition of crews
- Fluctuations in active crew size and composition over the whaling season
- Number of whales harvested
- Days spent whaling
- Days prevented from whaling (weather, equipment failure or repair, etc.)
- Days suitable for whaling when whaling did not occur
- Subsistence activities occurring other than whaling
- Location of whale sightings and whale harvest
- Location of whale searching
- Local weather and ice conditions

These measures are a mixture of descriptive characteristics suggested by MMS and factors derived from or related to the perceptions of whalers on how and why whale behavior has changed, requiring that whalers change their behavior in hunting whales. For instance, size and composition of crews are fundamental descriptive characteristics that must have some relationship with the availability of whales. They also depend on the alternative (non-Cross Island) activities available to the crew members, such as alternative subsistence activities, wage labor opportunities, education, and so on. Because of the focus on Cross Island activities, information on the "full" range of factors that may be affecting the data collected was thus not compiled, but the range of possibilities was generally elicited from whalers during discussions of topics such as crew composition or crew recruitment. In this sense, these generally descriptive measures are thus also characteristics identified by Nuiqsut whalers as potentially significant and variable measures from year-to-year. The locations of whale sightings, harvests, and general whale searching behavior are all important in the examination of whether whales can be found in the same locations every season, or if this changes from year-to-year. If the latter, what causes such shifts in location is important. Nuiqsut whalers have experienced such variation and have suggested a number of factors to account for it. This project develops information to examine these questions about variation and changes in Cross Island whaling behavior. For instance, this information will allow for a preliminary (albeit rough) examination of "catch per unit effort" as well as factors associated with the distance whalers need to travel from Cross Island to whale.

Nuiqsut whalers generally agreed that the suggested measures were significant and pertinent to the issues to be addressed. During the first field season (2001), Nuiqsut whalers also wanted to ensure that their more general perceptions and observations of whale behavior, and especially changes in whale behavior that had implications for hunting success or safety, were adequately noted. Such perceptions are also the most likely way for Nuiqsut whalers to contribute to future hypothesis formation and testing. Thus, information categories were added to ensure that whalers' perceptions and observations were noted on:

- Bowhead whale behavior in the Cross Island area, and differences from past experience; and
- Changes in access or other issues related to the whale hunt, such as increased effort for the same (or reduced) harvest, increased risk, increased cost, and so on.

These aspects of the research assumed more importance after the 2005 whaling season. Whalers reported that commercial (non-whaling) vessel traffic interfered with their whaling activities. BP requested that the researcher present a report on these aspects of the Cross Island subsistence whaling season at the stakeholder meetings conducted to collect information during the annual agency permitting process for planned offshore activities. MMS, the sponsor of this project, determined that this was not a conflict of interest with the purposes of the research – and indeed, was a direct example of how the information from the project could be used for ongoing management decisions. Thus, the project results of the 2005 Cross Island subsistence whaling season were presented at the 2006 "Open Water" meetings in Anchorage on April 18, to an audience of stakeholders including Government agencies, industry, whalers, scientists, and environmentalists. A similar presentation for the 2006 season was given to the Open Water meeting in April 2007, for 2007 to the Open Water Meeting in April 2008, and is scheduled for the Open Water Meeting in April 2009.

The overall objective of the MMS Cross Island project is to describe Cross Island whaling using measures that document year-to-year variability in whaling and, when sufficient time series data are available, will allow tests of hypotheses on the causes of this variability. Concern about potential effects of oil and gas development on whaling is the prime motivation for the MMS project, but it is recognized that other factors can strongly affect Cross Island whaling and thus need to be considered as well. These other factors include weather and ice conditions, equipment problems, whalers' decisions, and non-industrial human activities. During the MMS-sponsored project, information is collected on level of hunting effort, including how many boats go out each day, crew size, how much time is spent on the water, lengths of trips in miles, and furthest point away from Cross Island during each trip. Information is also collected on the abundance and distribution of whales, including the number and location of whales observed and/or struck by the whalers. This information will be applied to internal MMS management leasing plans and decision, as well as stipulation requirements, and has also been recognized as important for the management decisions for other agencies.

Information on the level of hunting effort was collected by systematic observations by the researcher, who was on Cross Island for most of the whaling season in each of 2001–2008. This information was supplemented by conversations with all of the boat crews. Further information on the hunting effort, and on the abundance and distribution of whales, was obtained by issuing Garmin handheld GPS (Global Positioning System) units to all boats. The whalers were given instructions on how to record the GPS coordinates (track) of the boat's trip, and how to mark waypoints of significance, including whale sightings and strikes, sightings of vessels other than whaling vessels, and other pertinent observations. This information is then mapped, and is the basis for the Figures included in this report. It should be noted that whaling crews mark relatively few points when on the water, and the points they do mark represent the boat's position at the time a whale or group of whales was seen. These whales may be quite close or miles away.

This information was supplemented by subsequent conversations with each boat crew, while reviewing the mapped GPS information on a laptop computer with them. When reviewing tracks after their return, crew members would often identify locations where they saw whales, and these points were added to the GPS information. Some of these points were boat positions, and some were estimated positions of whales (and thus not on a boat track). Other points were reference coordinates and may represent past whale sightings, so they also may not be on boat tracks. The rsearcher did not accompany the whalers in their boats while they were hunting, since it is not permissible for any non-Native to participate actively in hunting marine mammals.

Consultation

Consultation for the ninth field season built upon and was coordinated with that for the eighth previous seasons, as described in previous annual reports, and overlapped with them as appropriate. These consultation efforts occurred in conjunction with efforts on behalf of several other ongoing or prospective projects. In addition to periodic phone calls (primarily to the Native Village of Nuiqsut, the City of Nuiqsut, and various whaling captains in Nuiqsut; and the AEWC in Barrow), consultation efforts consisted of the following:

- Informal talks and consultation about the upcoming 2009 field season involved NSB Wildlife personnel, AEWC representatives, and individual whalers at the Open Water Meeting in April 2008. The results of the 2008 field season were presented formally at the meeting on April 6, 2009. MMS's intention to continue the research was mentioned.
- Trip to Nuiqsut, June 15 – June 20, 2009. This trip was to review the 2008 Annual Report with the Nuiqsut whalers and to make tentative plans for the 2009 field season. June 16 was the date of the Nulukataq for the Oyagak crew, and June 19 for the Ipalook and Napeak crews. .
- August 22 – September 19, 2009 trip to Nuiqsut and Cross Island (2009 field season – about four days more than in 2008). Nuiqsut whalers had advised the researcher that they hoped to go out to Cross Island "early" so he went to Nuiqsut in order to help get ready for the season. Five crews left for Cross Island August 27 (not as early as some had desired, but earlier than in recent seasons), and the last crew left Cross Island September 15. The researcher stayed in Nuiqsut September 14-19 clarifying aspects of the field season, documenting further details of the season, and helping process crew shares. It was also difficult to find a seat on a plane leaving Nuiqsut due to many people traveling at the same time.
- Informal consultations with Nuiqsut whalers about the draft 2009 annual report in October, when several were in Anchorage attending the AFN Conference.
- March 1 – March 5, 2009 trip to Nuiqsut to review the 2009 draft annual report (and the summary report prepared for BP) with the Nuiqsut whalers. Other issues to be discussed during this trip will be permission to conduct field work in 2010, and modifications in the implementation of the project.
- There is no planned presentation on the 2009 subsistence whaling season at Cross Island at the 2010 Open Water Meeting in Anchorage the week of March 22, 2009. In the past, this presentation was in conjunction with BP's requests for permits for activities at Northstar. Given the limited amount of time allocated to BP and Northstar issues on the meeting agenda, related to their relative routine nature, and the press of time needed for more controversial exploration and development activities, a Cross Island presentation was given low priority. Galginaitis will attend the meeting and use it as a chance to talk with the AEWC representatives and whalers present, as well as other interested stakeholders, about the Cross Island research and how it relates to development issues.

As in most prior years, the field arrangements were not totally firm until shortly before the season started. The captain who had agreed to host the researcher was not sure he would actually go whaling until shortly before the season actually began.

Data Collection

Three types of data were collected during the 2009 field season, as briefly discussed above in the methodology section. These are GPS information; systematic observations and quantifiable measurements of various components of subsistence whaling activity; and whalers' observations on whale behavior (and changes in such behavior). Whalers' observations are often accompanied by perceptions of possible causes for such changes and the implications such changes may have for subsistence whaling activities. Each is discussed in an appropriated section below.

GPS Data

All whalers participating in the research in 2009 had participated in the research in previous years. Thus, all crews whaling in 2009 were reasonably familiar with the goals and methods of the project, and in using a GPS unit. All crews had been issued GPS units previous years, but several required an additional unit either because of using an additional boat or the desire of the researcher, based on the 2005-8 field seasons, to increase the number of more capable GPS units for gathering data. The tracks from such units are of significantly greater quality than from prior units, the units have greater storage capacity (both for basemaps as well as tracks), and many whalers liked using that unit more than the others. Whalers were again instructed to record the locations of whale strikes, whale kills, or other subsistence activities or observations. Most boats had at least one crew member familiar with GPS units, and most boats used them as a matter of course. GPS tracks were recovered for most scouting/whaling trips (82 percent, 93 of 113 possible GPS tracks). Of the twenty "missing" tracks, fourteen were due to refusals. Twelve of these were from one captain who simply did not want to participate in the project for 2009. Two refusals resulted from the researcher's mistakes or miscommunication, but were rectified in time to collect further tracks from this co-captain's boat. Six tracks were not available for various reasons, ranging from the "tracking" option on the unit being turned off, the unit never having been turned on, or the unit not being taken on the trip.

All crews were instructed to keep the "tracking" feature on, which recorded the path the boat traveled each time it went out. A few "missing" tracks, as discussed above, were due to the tracking option on one GPS unit being turned off, and the inability of the researcher to check the unit before the crew went out scouting for the first time during the 2009 whaling season. This may be unavoidable unless the person responsible for data collection can always accompany the first crew out to Cross Island. Crews sometimes forgot to take their GPS units when they are in a hurry, but this can be minimized (although not eliminated) by reminders to take the project units along on all trips, and to turn them on even if the crews will not be using them. As in previous years, a few tracks were incomplete or composed of several separate tracks, most likely due to whalers turning the unit off and on, loss of battery power, or the unit losing its positional fix (unit memory limitations are no longer much of a problem). These problems did not occur with the frequency of previous years, however – due in part to the past experience of the crews with the project and in part to the use of more capable units than in the past. As for recent years, all boats were provided with a power cord so that the GPS units could be operated from the boat's electrical system, so that depleted batteries were not the problem they had been in the first two years of the project. However, not all boats were wired to use such cords. Also, all boats were provided with a boat-

mounted holder for the GPS unit, so that the units would be readily available, secure, and not be mistakenly shielded from satellite signals due to being put in a pocket. Still, at times satellite coverage was spotty and reception was lost. Whalers were instructed how to mark points, and told to mark the points where whales were seen. Whalers were also asked to mark other events such as "blows," other animals (polar bears, seals, and so on) and key points in their trip (the ice edge between "open-water and the ice pack, places where weather conditions change, and so on). Positions where whales were seen, struck, or killed were marked by a number of crews, but were seldom if ever labeled and so required additional discussion with the crew and additional processing of the "track" file. Relatively few points were marked in 2009, but whalers were able to approximately locate many points while reviewing their tracks on the computer screen, and the researcher was able to make some fairly reliable conclusions about other whale event points from the GPS track characteristics. In any event, the process of increasing the incidence of marking significant points will require steady attention and constant encouragement.

The researcher visited each crew that had gone out scouting after they came back, in order to download the information from their GPS unit into his laptop computer. This ensured that the GPS units were always available to the crews should they decide to go out at short notice. This procedure also enabled the crews to immediately see where they had been that day with the mapping software, and allowed the crew an opportunity to discuss their trip with the researcher while it was very fresh in their minds. The utility of this information, as concretely represented on the mapped tracks displayed by the computer, has been obvious to the whalers since the inception of the project and is one reason for the high degree of participation. An example of the combined tracks for one day of scouting can be seen in Figure 2. This is the track for 08/29/09, when four boats went scouting. GPS tracks for each day that boats went scouting (and tracks were collected) appear in Appendix A, mapped by day. For days when more than five boats scouted for whales, two additional figures are presented, each of which displays half of the tracks for that day. The MMS Alaska OCS Region holds the processed GPS data for all the tracks for the 2009 season.

Hunters were also asked to report other subsistence efforts and results, in terms of time spent, species, number, and location in terms of GPS coordinates. Little such activity was reported, but probably comparable to prior study years (2001-2008). Two polar bear were taken. The first was shot early in the season as a "nuisance" bear. The second was taken later in the season as a matter of choice. The hunter wanted a skin and his relatives in Nuiqsut wanted the meat. Although the whalers saw many ugruk and seal while out scouting for whales, none were taken. Such harvests are seen as diversions from the whale hunt, and in past years almost always took place only when a crew needed some fresh meat and was returning to Cross Island without striking a whale.

Daily boat report forms were used to capture the GPS and associated information. The form for the 2009 field season was essentially the same as used for previous field seasons. A form is completed for each boat that goes out scouting or engages in some other significant whaling activity. Table 2 below presents as example of the form completed for one of the four boats that went scouting on 8/29/09. Forms for the other three boats out scouting that day are not included in the body of this report, but will appear, along with all the other boat report forms, in electronic appendix B on the CD-ROM attached to the final version of this report. Those boats not out scouting on any given day do not have a separate form completed for each of them, but rather have their activities and status summarized on a single form. On days when no boats go out scouting, all

Figure 2: Composite Scouting Tracks for a Single Day – 08/29/09

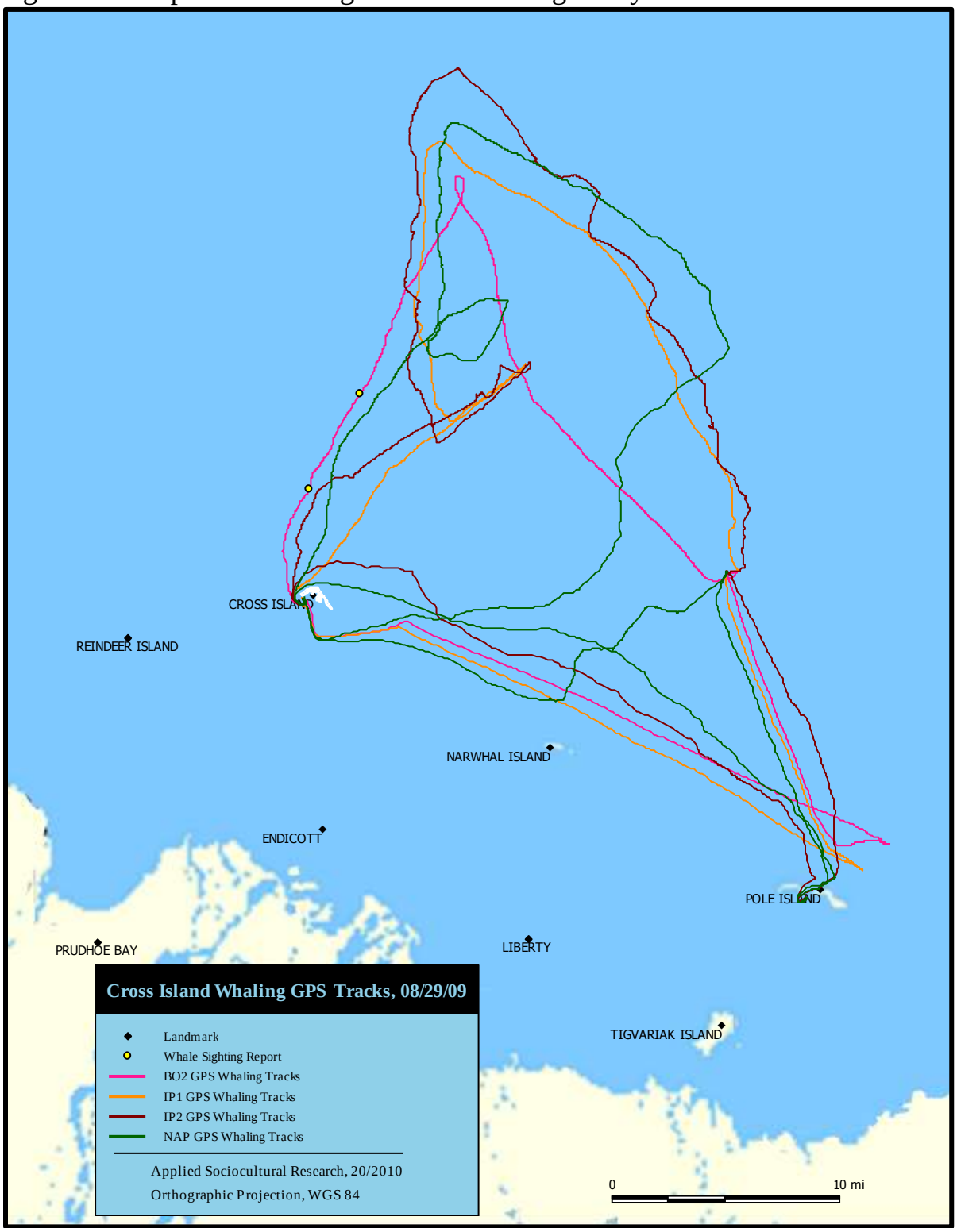


Table 2: Example Daily Boat Report Form

Cross Island Subsistence Whaling Data Collection Form, 2009 **Use one form for each vessel/day**

Date: 08/29/09 **Crew:** Oyagak **GPS Type:** NA

Vessel	Type	Length	HP Motor	# crew aboard/notes
Oyagak 2 (BO2)	FG	17.5	Yamaha 150	Scouting w/4

Whaling today? Yes **If not, why not?**

Time departed: 0756 **Time returned: 1816**

Trip time of 10 hours 20 minutes, roundtrip of 88.8 miles, furthest point from Cross Island of 27.8 miles

Waypoints or Coordinates noted

Way Point #	Lat/Long	Time	Notes (if whale - # of animals, direction of travel, behavior)
BO2_082909A	N70.56 W147.98	829	Reported "whale smell"
BO2_082909B	N70.56 W147.97	831	Blow 4.5 miles from Cross Island
bo2_082909C	N70.59 W147.93	854	Reported "whale smell"
BO2_082909D	N70.62 W147.87	915	Blow 8.5 miles N of Cross Island
bo2_082909E	N70.5 W147.21	1446	Dead Krill in current near Narwhal Island

Describe the day's activity (traveling, hours searching for whales)

Direction of initial search (and explanation):	NE
Time spent actively scouting/# people looking:	4/4
Time spent in travel/tow/assistance to other boats/on "break":	10:20

Notes: All four boats left within a space of 40 minutes (7:17 to 7:56 am) and coordinated their activities for the entire period they were out, and all returned to Cross Island for the day within a period of 25 minutes (17:56 to 18:21). They all headed NE from Cross Island, in the direction where most whales have been landed in the past. Two blows were reported, both by the BO2 boat. One blow was about 4.5 miles from Cross Island (bo2_082909b) and was bracketed by two points where the BO2 boats reported a "whale smell" (bo2_082909a, bo2_082909c). This blow was seen only once and no other details were provided. The second blow was sighted by the BO2 boat at 9:15 (BO2_082909d). This was about 8.5 miles North of Cross Island. The other boats immediately changed course to go towards the BO2 boat to help follow this whale, but this whale/blow was not seen again and by 9:35 or so all boats turned to the north and started to look in that direction. The BO2 boat crew indicated that this was a big blow (maybe 8-feet), and hence a big whale, but they could not tell what direction it was going. Because of the size of the blow, they thought it was a different whale than the first one. BO2 also reported seeing lots of seals, whalebirds, and dead krill in the current near Narwhal Island (bo2_082909e).

Observations of Whaling Crew - weather, sea state, ice-conditions

Fog or clouds?	Rain	**Weather notes:**	Rain was late in the day. Boats came in when wind increased			
Wind Direction:	shifted	**Wind speed and other notes:**	2-17 mph, BP 29.8 and rising to 29.88, then falling			
% Ice Coverage:	0	**Ice Type:**	NA	**Other Notes:**	Wind started as NNW, shifted to W, then S, ended E	
Wave Height:	2' w/swells	**Other notes on sea conditions:**	Got calmer, then wind came up again			

Other pertinent notes: Seas were reported as 2' with swells when boats went out in the morning. Winds calmed in the afternoon but swells remained. Wind shifted and increased later in the day and the boats came in when seas got rougher. By 2100 there was heavy rain and strong wind at Cross Island.

Note: Cross Island weather observations are compiled in a separate file (weather station + observer)

Engaged in any other subsistence activities? No **If yes, describe below**

GPS track? Yes **GPS Track Name:** BO2_082909

If not, why not?

Use Reverse For Additional Notes or Information

will be on one form. Table 3, as an example, contains the information for all the boats that did not go out are scouting on 08/29/09.

As will be discussed below, Nuiqsut whalers expended more effort "on the water" than in any of the prior documented seasons (2001-2008), so that there are more boat report forms for the 2009 season as well. The 2009 Cross Island whaling season was 20 days long. For the twelve days when scouting took place, most boats have separate forms (89 cases – one for each boat) and a group of other "non-scouting" boats are treated on a single form (12 cases – one for each day). For the eight days when no scouting took place, all boats are treated on a single form for each day. The forms are organized in Appendix B in terms of date rather than by crew as in most past reports. Figures of individual boat tracks for each day have not been produced, since this information is conveyed more economically in figures for each scouting day containing the tracks of all boats out scouting that day (Appendix A).

The information used in the Table 3 example was not chosen at random, but rather because it demonstrates some, but not all, of the difficulties presented in the waypoint information reported in this (and previous) documents. Although instructed to mark waypoints whenever whales are spotted or where significant events take place, no crew in fact can mark all such points, for a variety of reasons.

Whaling events often happen quickly when (and after) whales are sighted, and especially during the chase and delivery of strikes. When crew members are fully engaged with their whaling duties, they usually cannot divert their attention to mark a point (or perhaps even remember to do so). When points are marked, crews seldom take the time to assign them names, so that they are designated with "default" numbers. When waypoints are marked for whales, they still do not all necessarily represent the same thing. Waypoints indicating where a whale was struck or killed for the most part represent the immediate area where that event took place. Those indicating a whale sighting are less precise, showing the position of a boat when a whale was sighted. It may indicate a whale seen a short distance away, or the "blow" of a whale seen in the distance (up to 2 or 3 miles away). Also, a waypoint may represent one whale or multiple whales. For some tracks, there are no waypoints that the crew marked while they were on the water, but quite a few that they could approximate when they later reviewed the track with the researcher. Many of these points represent whale sightings, and are not necessarily any less precise than points marked on the water – but in most cases can be assumed to represent whales or blows seen at a greater distance than for a waypoint actually marked when on the water, or events that were not marked because people were too busy at the time to do so.

Since most crews discussed most of their trips with the researcher, it has been possible to collect more waypoint information that is present in the raw GPS data files, but with a potential loss of precision. Crews remember about how many whales they have seen on a trip (except in cases where blows were both distant and numerous), and generally where they were. When looking at the mapped tracks of their trip they are able to identify where they saw whales, so that an approximate waypoint can be generated. In most cases, sighting locations are associated with changes in a boat's direction. Such "generated" waypoints are differentiated from those actually marked by crews by using lowercase letters in their labels. Points for whales that are located "after the fact" may also represent estimated positions of the whale rather than the position of the

boat when the whale was seen. These points are most likely less precise than boat positions, since they are not "anchored" by the GPS track lines from the boat's trip.

Some marked waypoints are also somewhat ambiguous in meaning, however, since the crew may assign one meaning or memory to a point when in fact it may have another. Whalers may misidentify the waypoints they do mark, especially when whales are harvested. Given that crew members have little attention to spare in this situation, the waypoints themselves are usually only numbered. The crew may not remember exactly how many waypoints were marked, or know if all attempts to mark points actually succeeded, or if some unintended positions may have been marked in the flurry of activity. However, since whalers communicate with each other, the Com Center, and sometimes their Cross Island base station, by radio it is often possible to note when significant events take place by what is said on the radio and noting the time. When compared to the date stamps on waypoints these notes can then aid in the interpretation of what the waypoints actually represent. It should also be noted that the researcher is also a potential source of confusion, in that his understanding of a crew's description of their trip activities and events may in fact be in error – the researcher may misinterpret what the crew tells him. The data as presented are the result of cross-checks using the information obtained from all sources (GPS, crew accounts, radio notes, later consultations with the whalers), and are the analyst's best attempt to interpret all the available information in the most mutually consistent manner possible. Not all ambiguities can necessarily be fully resolved.

Ambiguities of meaning influence or may limit the way in which marked points can be used. Whale sighting waypoints cannot be interpreted as point locations. Whale strike and kill locations can generally be interpreted as point locations, but not necessarily precise point locations. Boats are always moving and waypoints are seldom if ever marked at the precise time that a strike is made or a whale is killed.

Table 4 is an example of how the Daily Report Form was used to reduce the number of forms to complete for those days when not all boats went out scouting, as discussed above. Separate forms were still used to record information for those boats that did go out scouting on 09/08/08 (see appendix B). A single form was used for the six boats, from four crews, that did not go out scouting that day. Note that three of these boats were from two crews that had boats out scouting that day, and three boats were from the two crews that did not go out scouting at all that day (one crew had a disabled boat, the other had decided their whaling season was over). A rough indication of what else the crews did on those days (and if the boats were used for other purposes than scouting) is noted, but not in detail. Attempts were made to determine if weather, mechanical problems, or other obligations such as butchering was the major factor in a boat not going out scouting on any given day. For some days where multiple factors applied determining which was most important may not be possible.

Table 3: Daily Boat Report Form for Boats Not Out Scouting

Cross Island Subsistence Whaling Data Collection Form, 2009 **Use one form for each vessel/day**

Date: 08/29/09 **Crew:** various **GPS Type:** NA

Vessel	Type	Length	HP Motor	# crew aboard/notes
Oyagak 1 (BO1)	FG	17.5	Yamaha 80	Onshore finalizing whaling preparations
Aqarguin (IAN)	AL	22	Yamaha 225	Onshore finalizing whaling preparations
Nukapigak 1 (NUK1)	AL	21.5	Yamaha 115	Onshore finalizing whaling preparations
Nukapigak 2 (NUK2)	AL	20	Yamaha 115	Onshore finalizing whaling preparations
Nukapigak 3 (NUK3)	FG	22	Yamaha 150	Onshore finalizing whaling preparations
Taalak 1 (TAL1)	AL	24	Yamaha 250	Onshore finalizing whaling preparations
Taalak 2 (TAL2)	AL	20	Yamaha 115	Onshore finalizing whaling preparations

Whaling today? No **If not, why not?** Preparing for whaling and working on cabins

Time departed: NA **Time returned: NA**

Waypoints or Coordinates noted

Lat/Long	Way Point #	Time	Notes (if whale - # of animals, direction of travel, behavior)
NA			

Describe the day's activity (traveling, hours searching for whales)

Direction of initial search (and explanation):	NA
Time spent actively scouting/# people looking:	NA
Time spent in travel/tow/assistance to other boats/on "break":	NA

Notes:

Observations of Whaling Crew - weather, sea state, ice-conditions

Fog or clouds?	Rain	**Weather notes:**	Rain was late in the day. Boats came in when wind increased		
Wind Direction:	shifted	**Wind speed and other notes:**	2-17 mph, BP 29.8 and rising to 29.88, then falling		
% Ice Coverage:	0	**Ice Type:**	NA	**Other Notes:**	Wind started as NNW, shifted to W, then S, ended E
Wave Height:	2' w/swells	**Other notes on sea conditions:**	Got calmer, then wind came up again		

Other pertinent notes: Seas were reported as 2' with swells when boats went out in the morning. Winds calmed in the afternoon but swells remained. Wind shifted and increased later in the day and the boats came in when seas got rougher. By 2100 there was heavy rain and strong wind at Cross Island.

Note: Cross Island weather observations are compiled in a separate file (weather station + observer)

Engaged in any other subsistence activities? No **If yes, describe below**

GPS track? NA **GPS Track Name:**

If not, why not?

Use Reverse For Additional Notes or Information

Systematic Observations

Systematic observations were also transferred to the standardized recording forms (daily boat report forms). These observations are the basis for the summary tables that appear in the "Results" section, as well as the completed daily vessel activity forms. From these records it is possible to make a basic "census" of the crews on the island, and to track changes as people came to Cross Island and left. In addition, notes were made on which crews went out on each day. In most cases it was possible to note who went out in each boat. From these basic observations can be derived some of the most basic measures of subsistence whaling activity – number of active crews (and boats), size and composition of crews, fluctuations in crew size and composition, and days spent whaling. The GPS data provide systematic locational information for whaling activities. This information also was recorded on the daily boat report forms. Examples of the daily boat report forms appeared above as Tables 3 and 4. The complete series of forms is included electronically as Appendix A. A list of the acronyms and abbreviations used in these tables (and elsewhere in the report) is provided on page ix.

In addition, very basic weather observations were made (temperature, wind direction and strength, degree of fogginess or clarity, barometric pressure). A weather station was installed on Cross Island, with a remote data logger to record the information. The data logger functioned for the period 9/06/08 (12:30 AM) through 9/11/08 (7:56 AM), with readings every five minutes for temperature (outdoor and indoor), wind speed, wind direction, barometric pressure, and relative humidity (file WSF_2008-Tables.xls, also included electronically as Appendix C). There were short periods of data gaps, due to signal interference, instruments freezing up, or other factors.

Formerly, MMS maintained a weather station at Endicott. This data is no longer available in near real-time, but may be available from BPXA. Weather at Prudhoe Bay (Station ID 9497645) is available in real-time, as well as for the past since 09/03/92, on-line from NOAA's website at http://tidendcurrents.noaa.gov/data_menu.shtml?stn=9497645&type=Meteorological. Other potential sources of weather information and whaling activities are the communications logs of the Whaling Communications Center. Since the researcher could not go out in the boat while the crews scouted for whales, he had little ability to judge the degree of ice cover, although the Nuiqsut whalers did report their observations in a general way. There was no ice cover in 2008. The absence of ice increased the adverse effect of wind, and even on relatively calm days large swells made scouting somewhat difficult. Ice observations would have been noted on the daily boat report forms, had there been any ice observations. Information on ice cover (or lack of it) may also be obtainable from remote sensing sources or the MMS aerial bowhead survey.

Whalers' Observations

Whalers would sometimes make observations on whale behavior or give their thoughts on how and why whale behavior in the Cross Island area was different (or the same) in 2008 than it had been in the past. Much of this was recorded in the daily fieldnotes. Much is of limited immediate relevance to the central aims of this project, especially since weather conditions and the proximity of whales seemed to be the most important factors influencing whaling activity (and whalers' observations). A summary of pertinent information is included in the "Results" section.

Results

This section consists of three components – an overview of the 2009 Cross Island subsistence whaling season, followed by a treatment of quantitative measures documented by the project, and concluding with a discussion of whalers' observations on whale behavior and relative whaling success. There may be some repetition from section to section, or even within sections, since many topics are not mutually exclusive.

Overview of the 2009 Cross Island Whaling Season

This section contains a general overview of the 2009 Cross Island whaling season. Annex B provides more detail on a day-by-day basis for both whaling activity and other vessel traffic noted in the Cross Island area.

Six crews whaled from Cross Island in 2009. All had whaled at Cross Island previously. Two crews whaled with one boat, three whaled with two boats, and one crew whaled with three boats. One of the "two-boat" crews was joined late in the season by a "support" boat. This was the only crew in 2009 that used a boat for logistic support. As in previous years, the start of the Cross Island whaling season depended primarily on weather conditions, reports of whale sightings near Cross Island, and the readiness of the whaling boats. The whalers perhaps started the season early rather than late because of recent experiences with poorer weather late in September. The whalers used three of four strikes – landing two, as summarized in Table 4. Table 5 summarizes dailey boat activities for the 2009 Cross Island whaling season and Figure 3 displays them graphically with basic weather conditions (wind speed, barometric pressure).

Five crews left for Cross Island on August 27 in order to get things ready for whaling and to build or repair their cabins. Two crews were relatively newly formed and had "borrowed" cabins the previous year, and wanted to construct cabins of their own. The cabins for three other crews (one not whaling in 2009) had been damaged by polar bears since the 2008 season, and needed to be cleaned and repaired. Other structures that had not been recently used on the island had also been damaged. The sixth crew traveled from Nuiqsut to Cross Island on August 28. Two boats went scouting on August 28, but one was out for only 12 minutes, to check a potential sighting seen from the island (it was negative). Winds were 5 to 17 mph (8 to 27 km/h), so conditions, while not optimal, were at least marginally acceptable. The other boat remained out about 4

Table 4: Summary Characteristics[1] of Whales Struck Near Cross Island, 2009

Date	Time Struck	Length	Sex	Whale ID	Miles from Cross Island	Bearing from Cross Island	Notes
09/06/09	21:11	NA	NA	NA	10.7	50˚	Nukapigak, Struck and Lost
09/11/09	07:59	49'0"	F	09N1	11.6	79˚	Taalak, Landed
09/13/09	10:34	20'4"	F	09N2	19.7	79˚	Nukapigak, Landed

[1]All characteristics are from direct observations or GPS records made on the day of the activity, other than the WhaleID number. WhaleID numbers are assigned by the North Slope Borough Department of Wildlife Management (NSB DW). Times are approximate and are derived from the recorded GPS tracks and/or radio logs, combined with whalers' accounts, as are the distances from Cross Island.

hours 11 minutes and reported no whale sightings. Winds were about the same on August 29 and three crews (four boats) went scouting, with trips of 3.5 to almost 11 hours, and reported a total of two whale sightings. The other three crews remained on shore. Wind speeds on August 30–31 prevented anyone from whaling. Although wind speed dropped as low as 5 mph (8 km/h) on August 30, it had peaked at 35 mph (56 km/h) and sea states were too rough. On August 31 wind speed peaked at nearly 40 mph (64 km/h).

Conditions on September 1–4 were more suitable for scouting for whales, with wind speed generally less than 10 mph (16 km/h). (Although it increased to over 35 mph [56 km/h] at midnight on September 3–4, it decreased to less than 5 mph [8 km/h] late in the afternoon.) Of the 11 whaling boats on Cross Island, eight went scouting during all four days. Of those that did not, one was disabled, one went out the first three days (conditions on September 4 were marginal), and the third went out two days. These were the days when the most whale sightings were reported (36 of 53 total), and these four days (mostly September 1–3) accounted for 64 percent of all the whale sightings reported for the 2009 season (but see the "Distribution of Whales" discussion below). The longest trip times were over 11 hours on 1 September and over 15 hours on September 2 , but only 5.5 hours on September 3 and 4 hours on September 4. Winds on September 5 were generally over 20 mph (32 km/h) and no boats went out scouting.

Winds moderated on September 6 and 10 boats (all but the disabled boat) went scouting and spent from 5 to 17.5 hours on the water. They reported a total of 5 whale sightings, and a whale was struck late in the day. It was left once it became too dark to safely continue to pursue it. Its position was marked on several of the whalers' GPS units. Conditions on September 7 were more marginal, with wind speeds averaging over 10 mph (16 km/h), but nine boats went out scouting. They first looked for the whale struck the day before, but only found an oil slick in the area where they had left it. They continued scouting and most boats spent from 6 to 8 hours on the water. Two whale sightings were reported. Winds speeds were very high on September 8–10, peaking at almost 45 mph (72 km/h) at midnight on September 8–9. One boat went scouting on September 10, once the wind speed was below 5 mph (8 km/h), but only stayed out 2.5 hours and near the island. That crew did not report any whale sightings.

Ten boats went scouting on September 11, with the wind speed was less than 5 mph (8 km/h). The wind speed soon increased, but a whale was seen, followed, struck and landed about 2 hours after the first boat had left Cross Island that morning. Because the whale was large (49 ft [15 m]) and seas were rough, all boats were needed to help with the tow. However, conditions were too harsh for the smaller boats to do so safely so instead of helping with the tow they returned to Cross Island to make preparations to haul the whale onshore. The tow required about 6 to 6.5 hours and reached Cross Island in mid-afternoon.

Butchering progressed to a stage where eight boats—all but those from the crew that landed the whale and the disabled boat from another crew—could go out scouting on September 12 and 13. Conditions on those days were reasonably good for scouting, with wind speeds generally less than 5 mph (8 km/h). Few whales were seen, perhaps four each day. A whale was struck and landed on September 13. Since this was a small whale, three boats towed it to Cross Island while the other boats stayed out to look for another whale. Although several crews may have had potential opportunities to make a strike, no other whale was struck. Once all the boats returned

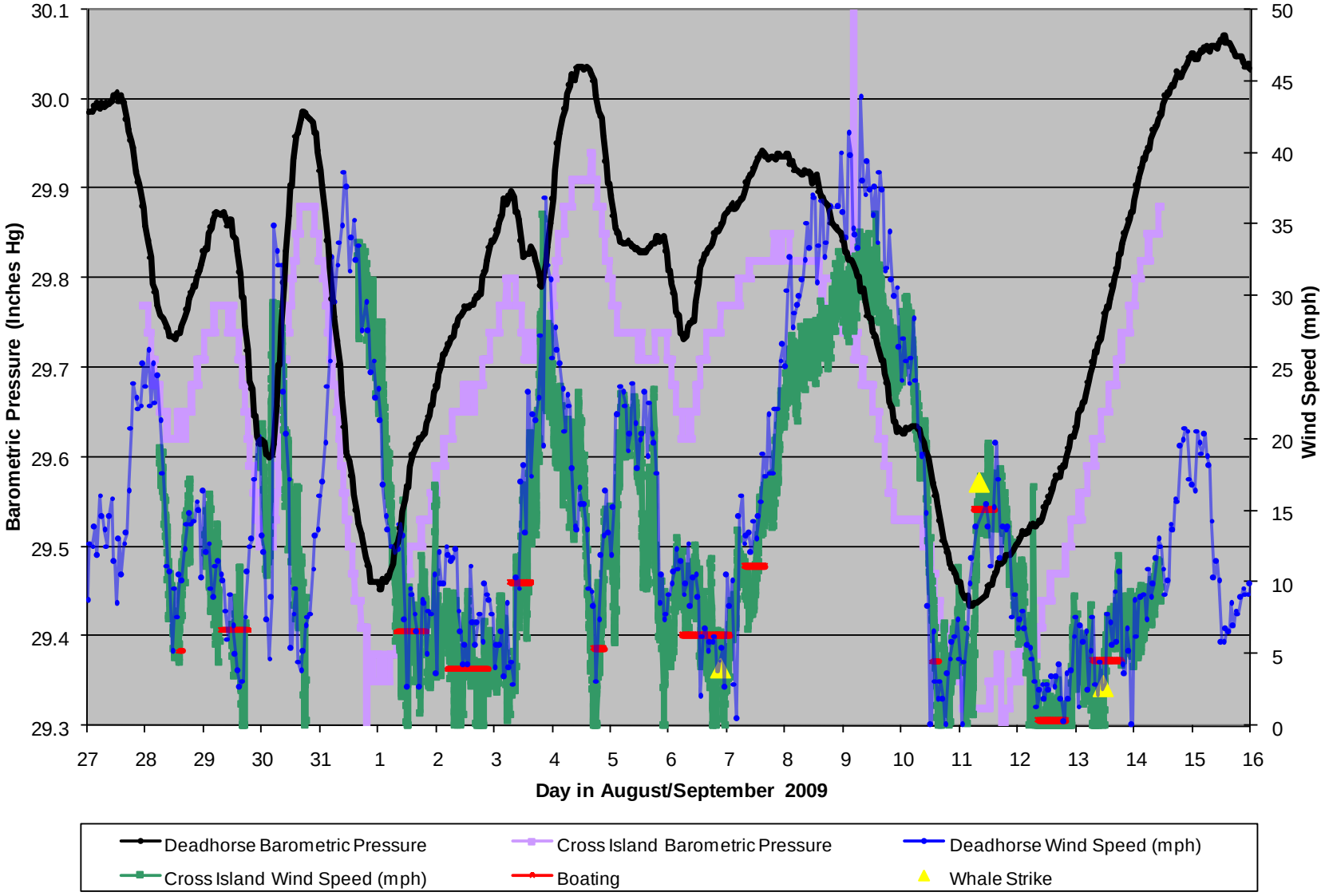
Table 5: Summary of Boat Activity, Cross Island Whaling, 2009

Date	Crew (by Boat)										
	Ipalook		Napageak	Aqarguin	Nukapigak			Oyagak		Taalak	
	IP1	IP2	NAP	IAN	NUK1	NUK2	NUK3	BO1	BO2	CB1	CB2
	FG	FG	FG	AL	AL	AL	FG	FG	FG	AL	AL
	18'	21'	21'	22'	21.5'	20'	22'	17.5'	17.5	24'	20'
	Honda 150	Yamaha 200	Honda 225	Yamana 225	115 Yamaha	115 Yamaha	150 Yamaha	Yamaha 80	Yamaha 150	Yamaha 250	Yamaha 115
8/27	To CI w/2	To CI w/3	To CI w/5	To CI w/4	To CI w/2	To CI w/3	In NQT	To CI w/4	To CI w/5	In NQT	In NQT
8/28	Dry Dock	SC w/5	SC w/5	On Shore	On Shore	On Shore	To CI w/3	On Shore	On Shore	To CI w/4	To CI w/4
8/29	SC w/2	SC w/3	SC w/5 SC w/5	On Shore	On Shore	On Shore	On Shore	Dry Dock	SC w/4	On Shore	On Shore
8/30	On Shore	On Shore	On Shore	On Shore	On Shore	On Shore	On Shore	Dry Dock	On Shore	On Shore	On Shore
8/31	Weather	Weather	Weather	Weather	Weather	Weather	Weather	Weather	Weather	Weather	Weather
9/01	SC w/3 SC w/3	SC w/3	disabled	SC w/5	SC w/3	On Shore	SC w/3	SC w/4 SC w/3	SC w/4	SC w/4	SC w/4
9/02	SC w/3 SC w/3	SC w/3 SC w/3	disabled	SC w/5 SC w/5	SC w/3	SC w/2	SC w/3	SC w/3	SC w/4	SC w/4 SC w/4	SC w/4 SC w/4
9/03	SC w/3	SC w/3 SC w/3	Disabled SC w/5[1]	SC w/5 SC w/5	SC w/4 SC w/3	On Shore	SC w/3	SC w/4	SC w/4	SC w/4	SC w/4 SC w/3
9/04	SC w/3	SC w/3	disabled	on shore	SC w/4	SC w/3	SC w/4	SC w/3	SC w/4	SC w/5	SC w/3
9/05	weather	weather	disabled	weather	weather	weather	weather	weather	weather	weather	weather
9/06	SC w/3	SC w/3 SC w/3	disabled	SC w/5 SC w/4	SC w/3 SC w/3	SC w/3	SC w/3 S&L w/4	SC w/4	SC w/4	SC w/4 SC w/4	SC w/4 SC w/3
9/07	SC w/3	SC w/3	disabled	SC w/5	SC w/3	On Shore	SC w/4	SC w/4	SC w/3	SC w/5/4	SC w/4
9/08	weather	weather	disabled	weather	weather	weather	weather	weather	weather	weather	weather
9/09	weather	weather	disabled	weather	weather	weather	weather	weather	weather	weather	weather
9/10	CI<->NQT	SC w/4	disabled	weather	weather	WD	weather	weather	weather	WD	weather
9/11	SC w/4	SC w/4	disabled	SC w/5	SC w/3	SC w/3	SC w/3	SC w/4	SC w/4	HAR w/5	SC w/3
9/12	SC w/3	SC w/3	disabled	SC w/5 SC w/4	SC w/4	SC w/3	SC w/3	SC w/3	SC w/3	butcher	butcher
9/13	SC w/4 SC w/4	SC w/4 SC w/4	disabled	SC w/5	SC w/4	SC w/2 SC w/2	HAR w/4	SC w/3	SC w/3 SC w/3	butcher	butcher
9/14	WD trip w/2 To NQT w/4	To NQT w/4	disabled	To NQT w/5	butcher	butcher	To NQT w/2/3	To NQT w/4	To NQT w/6	To NQT w/4	To NQT w/4
9/15	In NQT	In NQT	To NQT w/5	In NQT	To NQT w/3	To NQT w/6	Beechey trip w/3	In NQT	In NQT	In NQT	In NQT
9/16	In NQT	In NQT	In NQT	In NQT	In NQT	In NQT	In NQT	In NQT	In NQT	In NQT	In NQT

[1]NAP boat still disabled but NAP crew went scouting using the IP1 boat

YELLOW indicates GPS tracks collected (GREEN indicates non-scouting "transit" trip) RED indicates GPS tracks not available

Figure 3: Graphical Summary of the 2009 Cross Island Subsistence Whaling Season



to Cross Island the captains talked with each other and decided to call a "cease fire" and end their season. Conditions were such (not seeing many whales, whales fairly skittish) that the crews did not want to risk being stuck on Cross Island by an extended period of bad weather. Four crews that had completed their butchering and packing tasks left on September 14. The last two crews left on September 15. One was the crew who landed the whale on September 13 and so had more butchering chores than did the other crews. The other was the crew with the disabled boat, which they fixed either late September 14 or early September 15, in time to go back to Nuiqsut without being towed.

Data from the project's weather station at Cross Island provided information on the weather conditions from when it began to receive wind speed readings up at 05:39 on August 28 through 10:54 on September 14. During this period, crews went out scouting for whales on 12 days, as described above. Wind speeds recorded at Cross Island corresponded well with those recorded at Prudhoe Bay for this period (Figure 3). Although the magnitudes may have varied slightly between the two locations, the overall patterns were the same — winds increased and decreased at the same times. It is clear that whalers go out scouting when wind speeds tend to be lower (5 mph [8 km/h] or so) and that the exceptions are primarily due to increases in wind speed when the whalers are already out on the water (9/03, 9/07, and especially 9/11). Whales also tend to be struck when wind speed is lower (9/06 and 9/13). Whalers remember that the wind came up on September 11 after the whale was struck, so it is possible that the wind speed at Cross Island increased sooner than it did out on the water where the whalers were. In any case, the whale landed on September 11 was seen and approached when wind speeds were lower.

At least one crew was on Cross Island for parts of August 27 through September 15, a total of 20 days. There were several periods of high winds when conditions were not suitable for scouting for whales, on August 30–31, September 5, and September 8–10 (although one boat tried to scout on September 10). This was a total of 5 or 6 weather days. Three days were devoted to travel or other chores. Scouting occurred on 12 days, but one should probably be considered a "weather" day. A summary would be 20 days total, with 11 scouting days, 6 weather days, and 3 days for travel and other chores.

Figure 4 shows all documented GPS tracks for all Cross Island boats on all days during the 2009 whaling season, color-coded by day, along with locations of strikes and other whale sightings. Figure 5 compares the 2009 tracks, coded in pink, with the prior years documented for this project (2001-2008). The GPS tracks for 2001-2007 are combined and displayed in black. The GPS tracks for 2008, the year when Nuiqsut whalers landed their whales closer to Cross Island than in any other year, are displayed in yellow. Figure 6 clearly indicates that scouting tracks during the 2009 season closely resembled those for 2001-2007, in terms of the "core" use area – the quadrant to the northeast of Cross Island. Whalers did not travel quite as far as they did in 2001, but the 2009 pattern corresponds closely to that of 2002, which was a comparison suggested by the whalers during the 2009 season. Nuiqsut whalers had to travel much farther from Cross Island in 2009 than in more recent years (2007–2008) and 2001 was the only recent year when the whalers traveled farther from Cross Island. The whaling effort in 2009, as measured by time spent on the water, was much greater than in any prior year documented by the project (2001-2008). The closest year, 2005, only one whale was struck (and landed) due to ice and sea-state conditions that prevented the whalers from approaching whales on all but one day.

Figure 4: Cross Island GPS Tracks, 2009 Season, by Day

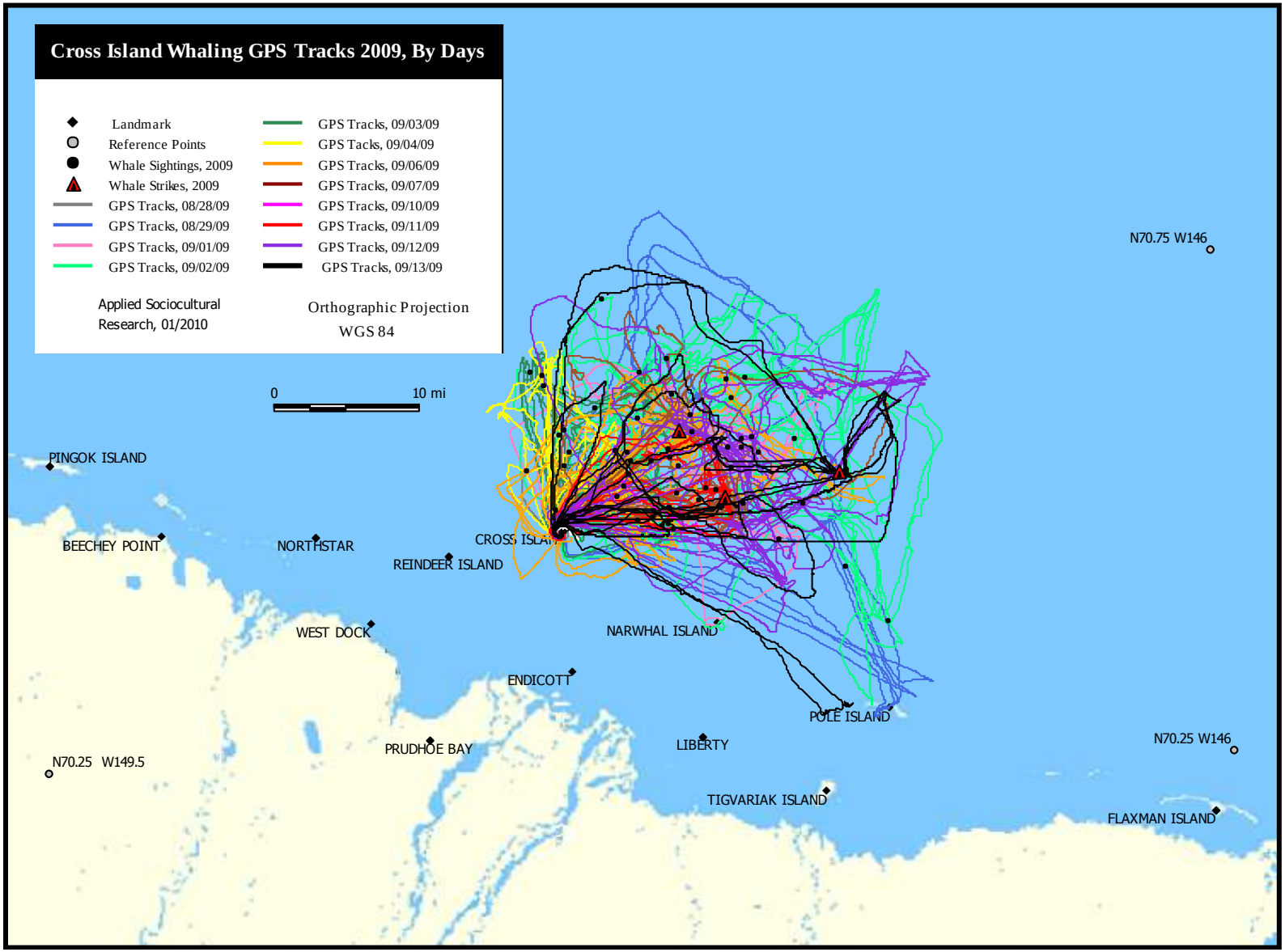
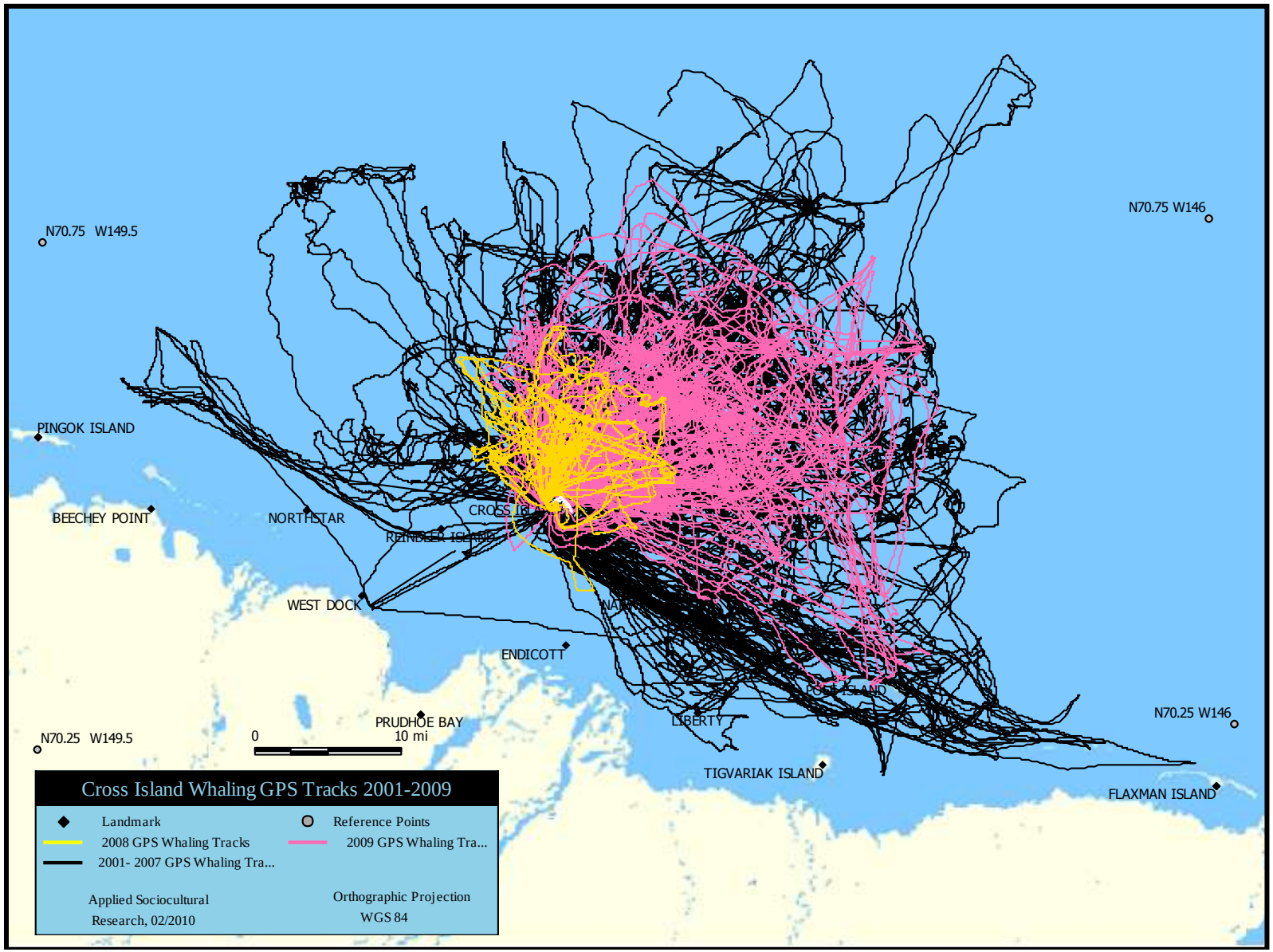


Figure 5: All Cross Island Whaling Tracks, 2001-2007, 2008, and 2009



Considering the period since 2001, in terms of scouting effort the years most similar to 2009 were 2001 and 2002, and those were also years when whalers saw relatively few whales; remarked that the whales were behaving as if they were spooked; and noted that they were farther away from Cross Island than in more "normal" years. The offshore distribution of bowheads in 2001–2002 was also evident from the locations of calling whales offshore of Northstar, which tended to be farther from shore in 2001–2002 than in various subsequent years (Blackwell et al. 2007). That is, this information is consistent with and supports the description of the 2009 season as one where whales were farther away from Cross Island than in most years and were behaving in ways that made them more difficult to see and approach (discussed below). Combined with the environmental conditions that made whales difficult to spot (large swells, lack of contrast) it is not surprising that landing whales was more difficult in 2009 than in most prior years – and certainly the most difficult for any season (2001-2009) where ice was not a factor (ice was a factor in 2005).

Discussion of Qualitative and Quantitative Measures

The most basic summary of quantitative measures of the 2009 Cross Island subsistence whaling season are displayed numerically in Table 6, with the comparative numbers for the 2001-2008 seasons. Figure 6 displays selected measures related to boat activity during the 2009 season graphically. This information, along with selected qualitative information, will be used to discuss the 2009 Cross Island whaling season in somewhat more detail than the in the preceding section.

Crew Characteristics

Figure 6 displays some of the most basic crew/population characteristics of the 2009 Cross Island whaling season related to whaling activity. In 2009, six crews from Nuiqsut whaled from Cross Island. All had whaled from Cross Island in at least one prior season, and all the captains had extensive Cross Island whaling experience. All crews consisted predominately of people with prior Cross Island whaling experience. As in previous years, the start of the Cross Island whaling season depended to a large extent on weather conditions, reports of whale sightings near Cross Island, and the readiness of the whaling boats. However, the need for several crews to work on their cabins, either to repair damage due to polar bear incursions during the winter or to build a new cabin, encouraged all crews to travel to Cross Island early in the season than they otherwise might have.

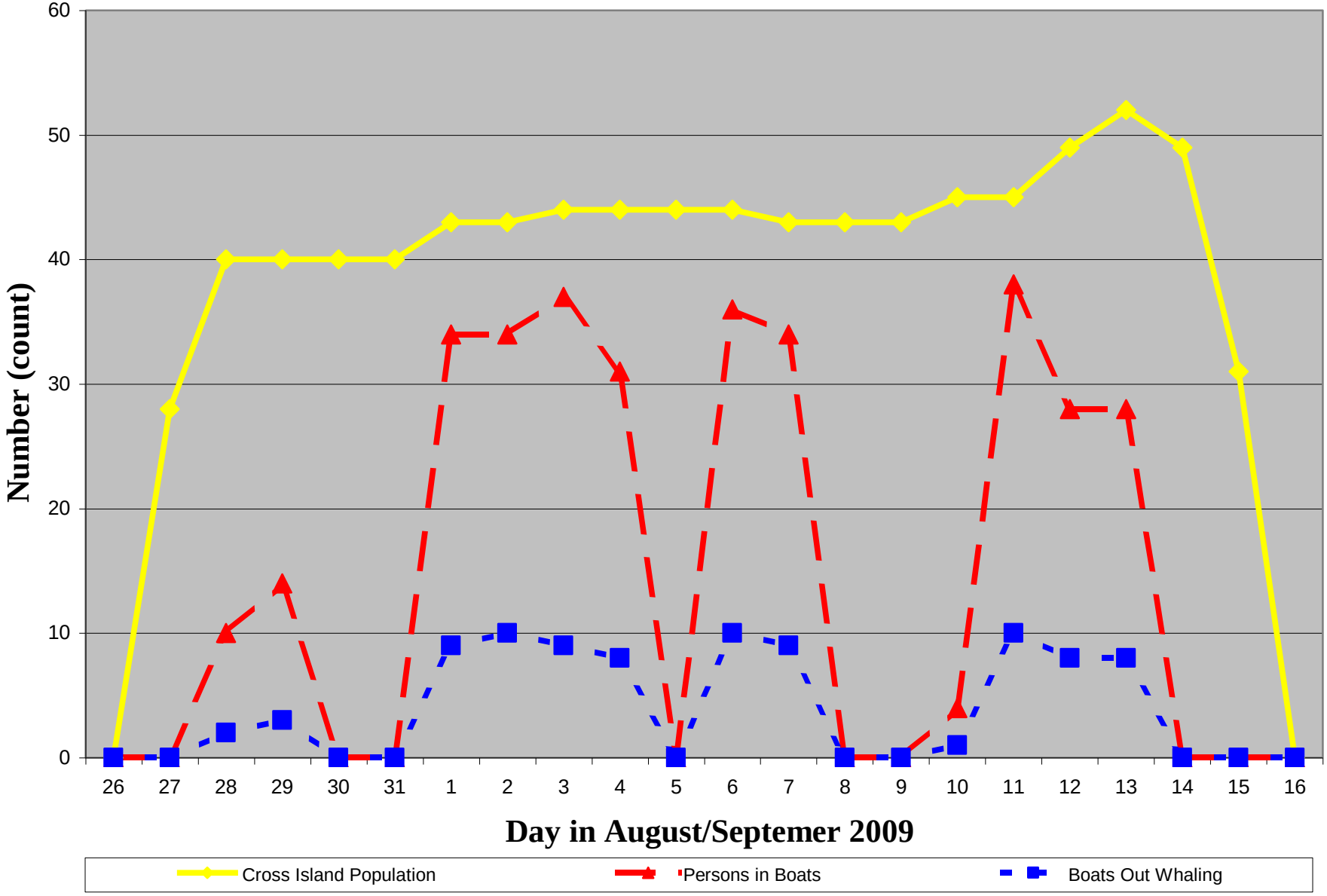
Two crews whaled with one boat, three whaled with two boats, and one whaled with three boats. In total, there were eleven different boats capable of scouting on Cross island for all but the first and last days of the 2009 whaling season, and for all twelve days when any scouting activity took place. The maximum number of boats that went scouting on the same day was ten, while the minimum was one (on a day with very marginal conditions). One boat was disabled for most of the season and only went scouting on two days. On nine of the twelve scouting days, at least eight boats went scouting (Figure 6). The average number of boats out scouting on the twelve days when such activity took place was 7.4 (Table 6). The mode was 9.

Table 6: Selected Measures of Cross Island Whaling, 2001-2009

Metric		Season								
Measure	Type	2001	2002	2003	2004[9]	2005[9]	2006	2007	2008[10]	2009[11]
Whales Landed/Whales Struck and Lost	count	3/0	4/1	4/0	3/0	1/0	4/0	3/1	4/0	2/1
Active Crews on Cross Island (maximum)	count	4	3	4	4	5	4	5	6	6
Scouting Boats on Cross Island (maximum)	count	7	9	10	8	8	7	9	12	11
Cross Island Population	average	27.7	26.6	20.4	18.9	29.8	29.2	26	22 (36)	41.85
Length of Season[1]	count	24	23	19	30	27	21	13	14 (7)	20
Average Length of Season/Crew (days on Cross Island)	average	22.5	19.34	13.25	19.25	21	21	10.4	7.3	19.2
Weather Days	count	8-9	4	8	10	11-15	4	3	6 (0)	5 (6)
# days scouting[2]	count	12	15	7	12	9	10	5	5 (5)	12 (10)
# days whales seen[3]	count	9	9	7	6	7	8	4	5	10 (10)
Boats scouting/day	average	4.8	4.3	4.9	3.4	4.0	4.8	3.2	4.8 (5.4)	7.4 (8.6)
# boat days[4]	count	57	65	34	41	35	48	16	29 (27)	89
# boat trips (possible # of GPS tracks)[5]	count	59	67	42	46	48	53	22	33 (31)	113
Actual # of GPS tracks collected	count	49	52	37	44	48	51	20	30	93
Length of trip (miles)	average	84.0	64.3	37.2	45.3	60.7	60.8	30.1	32.1	61.6
Duration of trip (hours:minutes)	average	9:43	7:58	4:31	6:51	7:07	8:13	5:39	5:03	6:43
Furthest point from Cross Island (miles)	average	23.6	19.5	11.6	12.1	19.1	22.2	10.4	8.3	15.8
Strike distance from Cross Island (miles)[6]	average	19.5	13.4	9.3	9.7	25.9	17.0	12	6.5	13.8
Strike Direction from Cross Island –degrees[6,7]	average	64°	67°	56°	36°	82°	59°	80°	05˚	70˚
Boat Crew Size	average	3.9	3.6	2.9	3.6	4.4	4.3	4.2	3.8	3.6
Total Seasonal Boat Effort (Boat-Hours)[8]	sum	572.9	533.6	162.9	301.2	341.3	427.1	124.3	158.0	751.7
Boat Hours/Strike	average	191.0	106.7	40.7	100.4	341.3	106.8	31.1	39.5	250.6

[1]Number of days with at least one crew on Cross Island - includes day of arrival at and departure from Cross Island.
[2]Number of days when at least one boat went out scouting for whales
[3]Number of days when at least one crew saw whales while scouting from a boat. Blows seen from Cross Island on non-scouting days are not included
[4]Each boat scouting for whales on any given day counts as one "boat day" – regardless of the duration of the trip or if whales are seen or not. *Thus if 2 boats scout on one day and 4 boats scout on the next, the total for the two days would be 6 boat days.
[5]Some boats made more than one scouting trip on a single day
[6]Includes "struck and lost" whales in 2002 and 2007
[7]Due north is 0 (and 360) degrees, due east is 90 degrees – includes struck and lost as well as landed strikes
[8]Yearly total equals aggregate sum of duration of all whaling trips by all boats. Includes estimates for missing information.
[9]One crew went to Cross Island well before other crews, so total season measures may be somewhat misleading. See 2004 and 2005 Annual Reports.
[10]Figures in parentheses ( ) are values for the 7 days when more than 1 crew was on Cross Island
[11]Figures in parentheses ( ) are values excluding 2 marginal scouting days (1 a "weather" and one a "travel/preparation" day).

Figure 6: Cross Island Population and Scouting Activity, 2009



The overall size and composition of the crews on Cross Island varies from year to year, and is most directly related to the number of whaling boats used by the crew. In 2009 the crews on Cross Island ranged from five to thirteen persons, although the thirteen-person crew actually had nine crew members to man their three boats, with the other four people arriving to help with butchering the whale they landed. Using nine as the metric for this crew, the average crew size was 8.0, with a crew member/whaling boat ratio of 4.4. The individual crews had crew member to whaling boat ratios ranging from 3.0 (the three-boat crew) to 6 (one of the one-boat crews). Four of the six crews had crew member/whaling boat ratios of 4 or 5. This compares to the average "boat crew" size (the average number of people who actually went out in a boat scouting for whales) of 3.6, meaning that on average a Cross Island whaling crew had a little less than one person per whaling boat who did not go scouting. Average boat crew size in prior years (2001-2008) ranged from 2.9 to 4.4 (Table 6).

Most crews displayed some degree of direct kinship relationships among a majority of members, The core of three of the crews was the male captain and two or more of his sons. The rest of their crew members were primarily relatives – ranging from very close (brother, nephew) to more distant. A fourth crew was composed principally of the absent captain's children and grandchildren. A fifth crew was composed of the captain, his young son, and mainly relatives through marriage. For the sixth crew, recruitment was based primarily on friendship and peer group, although one crew member is the captain's brother. The captain is the youngest in Nuiqsut, and he has only young children. Most people in Nuiqsut (and many across the North Slope) can trace indirect kinship relationships with each other, but some are more directly related than others, and the core of most whaling crews consists of blood relatives and/or close in-laws, with the possible additions of more distant relatives and some friends. There were two female crew members on Cross Island in 2009 for most of the season, on the same crew, with two others coming late in the season to help butcher. The line between "adult" crew member and those who are in their older teens or young twenties is sometimes difficult to define and tends to be somewhat flexible in practice. Of the 52 crew members, at least 38 were adults, while another 9 were "young adults" who functioned as adults, but may not have maintained individual households in Nuiqsut. Only 5 were minor children, and 2 of these came to Cross Island only to help butcher near the end of the season. As for past seasons, Cross Island whaling is primarily an adult activity, with the exceptional minor usually being the son of a captain or very experienced senior whaler.

There were 52 crew members who were present on Cross Island for at least part of the 2009 whaling season, plus "visitors." Only one visitor stayed overnight (the others being crew members of vessels on day trips to the island), so 53 people were "resident" on Cross Island for some part of the 2009 whaling season. The number of people actually present on Cross Island at any one time varied from 28 to 52, and was usually in the low 40s (Figure 6). The average number of people on Cross Island during the 2009 whaling season was about 42, significantly higher than for any of the prior eight years. While the number of crews matched the largest number for any prior study year, and the number of whaling boats was the second highest value for the study years, the primary reason for the larger average population was that all crews were on the island for most of the season. The only other season for which this was true was 2001, when only 3 crews whaled. For all other documented seasons, the "average length of season/crew" was significantly shorter than the overall "length of season" (Table 6).

Whaling Days

During the 2009 whaling season there were 12 days when Nuiqsut whalers went scouting for whales. The first two scouting days were early in the season when the crews had just arrived at Cross Island. Most crews still had preparations to finish, and only 2 boats scouted on the first day, and 4 on the second. On one other day, with marginal conditions, only 1 boat went out scouting. On each of the other 8 scouting days, at least 8 and up to 10 boats went scouting. There were a total of 89 "boat days" and 113 total scouting trips (since there were 24 cases where boats made two trips on the same day – usually returning to Cross Island to refuel). Both were the highest values for the nine study years (Table 6).

Two crews had a whaling season of 20 days, three crews were on Cross Island for 19 days, and one crew for 18 days. The "average" crew was thus on Cross Island for 19.2 days in 2009. Ice cover was mostly absent, which exacerbated the effects of the wind that was always a factor and the swells that persisted throughout the season (independent of the wind speed at any given time). These factors combined to make scouting for whales difficult in general. Whales were difficult to see, and when they were seen, difficult to follow and approach. The situation in 2009 was in marked contrast to that in 2008, when the "average" crew was only on Cross Island for 7.3 days and conditions for scouting were much better than in 2009. In 2007 there was a 13-day season (10.4 days for the "average" crew; Galginaitis 2009a), in 2006 a 21-day season (21 days for the "average" crew; Galginaitis 2007a), and in 2005 a 27-day season (21 days for the "average" crew; Galginaitis 2006b). For 2001–2007, the average length for the overall whaling season was 22.4 days, while the length of season for the "average" crew in this period was 16.4 days (Galginaitis 2009b). Thus the 2009 season was a little shorter than the average 2001–2008 season in terms of overall length, but a little longer in terms of "average" crew season length.
The researcher (MSG) was on Cross Island for the entire 2009 whaling season except for the last day, and was able to collect GPS tracks and whaler accounts for all scouting days. For the overall season, there were 89 "boat days" with 113 different scouting trips (since there were 24 occasions when a boat made two different trips on a single day). Of these 113 tracks, 93 are represented by GPS information (83 percent). One captain who declined to participate in the research accounted for most of these "missing" tracks: 12 tracks from 8 different days (two tracks on each of 4 days). In addition, eight other tracks were not collected. For six of these either "tracking" had been turned off or the GPS itself was off. The systematic lack of information from one crew is unfortunate and places some limits on the interpretation of the data, but does not substantially change the overall understanding of the 2009 whaling season.

The number of boats scouting on any given day ranged from 1 to 11, but was eight or more on most scouting days, and the number of whale sighting reports each day with scouting varied from 0 to 15 (Table 7). (There were zero sightings on the two days when conditions were marginal but 1 or 2 boats went out scouting anyway.) Some of the sightings reported for the early days in the season (9/01-9/03) may have been "false positives", because of the difficult conditions of the 2009 season. As an example, on August 28 some whalers thought that they saw a whale from Cross Island, and the IP2 boat went out to investigate. They reported that it was not a whale, but instead was an *analuq* (explained as "a shallow area where waves come together from different directions and raise a spray that looks like a blow, and the backwash exposes the shallow land

TABLE 7. Summary of "scouting days," 2009 Cross Island whaling season.

Date	Average Wind Speed While Scouting (mph)	Boats Scouting	Whales Seen (#)[a]	Whales Seen (%)
8/28	5.2	2	0	0.0
8/29	6.6	4	2	3.8
9/01	6.6	9	8	15.1
9/02	4.0	10	15	28.3
9/03	10.0	9	8	15.1
9/04	5.4	9	3	5.7
9/06	6.3	10	5	9.4
9/07	11.1	9	2	3.8
9/10	4.5	1	0	0.0
9/11	12.3[b]	10	2	3.8
9/12	0.32	8	4	7.5
9/13	4.5	8	4	7.5
Totals (Boat Days/Whales)		89	53	

[a]"Whales Seen" is an estimate based on the reported sightings from the whalers, radio reports from the whalers, and Communications Center log entries. These have been compared with GPS tracks, where available, to judge whether sightings are of the same or different whales, or if some sightings may not have been reported. It is likely that not whale sightings were reported, and that some reported sightings (especially for days of many such reports) were not "real" sightings (see discussion in text).

[b]"Wind Speed" for September 11 is the average from when the first boat left Cross Island to go scouting until the whale was struck. Average until whale was killed - 13.3 mph. Average until towed to Cross Island - 15.1 mph.

and looks like the black of a whale"). Some whalers suggested that swells seen from a distance by personnel in a small boat in the open ocean could give the same illusion.

The NAP boat was the only other boat scouting on August 28 (for about 4 hours) and that crew reported no whale sightings. For the first days when most boats went out, some boats reported seeing several whales while other boats reported seeing none, while chasing after the boats that did. They referred to it as "chasing boats". It seems likely that for September 1–3 at least some of the reported sightings were actually more examples of *anaɬuq* or a similar thing. While some crews saw a few blows, most of the whalers agreed that most of the possible whales that they were seeing did not exhibit blows — and blows are usually the most noticeable feature of a whale unless the whale is very close. The blow is generally light in color ands thus contrasts with its surroundings. In the absence of blows, whalers must rely on actually seeing the black whale ("seeing the muktuk"). After the first several days when there were relatively many reported single sightings of possible whales that were not resighted, whalers reported fewer sightings as whales. Thereafter, the whalers tended to refer to them as "something black" and. reported a whale sighting only if they went to investigate and saw something again. Similarly, after September 3, boats did not tend to "chase" other boats until there was a fairly strong indication that there had been a more definite sighting. In essence, this was a recalibration as to what constitutes a "sighting" under difficult conditions. An alternative interpretation is that there were more whales in the area on September 1–3 than on the other days, however, this was not apparent from the hourly whale call detection rate from the BPXA DASAR array near Northstar (Blackwell et al. 2010). Thus, the few days with a higher number of reported whale sightings likely did not mean that there were actually a large number of whales in the area on those days

The whalers described the entire season as one where they saw few whales because of several factors:

- They believed that there were relatively few whales in the area, in that they seldom saw more than one whale at a time, and never saw a large number of whales at the same time;
- The whales that were present were considered "spooked" in that they were, in general, swimming fast (for bowheads), did not emit a visible blow when they surfaced, and usually surfaced only once and then went down without showing their flukes;
- Physical conditions (large swells, lighting that minimized contrast) made spotting the whales that were present difficult;
- Non-whaling vessel traffic may have been a factor affecting whale behavior; and
- Other factors, such as the possible presence of killer whales, could also have affected the whales.

Some whalers drew a comparison to 2001 and 2002, when whales had also been described as skittish or spooked. One remarked that, just as in 2001/2002, they had seen sheens of oil or grease, as if killer whales had been eating marine mammals. No one had reported seeing a killer whale during any of the study years, however.

GPS Track Information and the 2009 Distribution of Whales Near Cross Island.

Figure 4 (above) displays all the boat tracks for the 2009 whaling season, color-coded by day. Figure 7 (below) displays all the boat tracks from 2001-2009, with each year color-coded to facilitate year-to-year comparisons. As discussed above in the "overview" section, the pattern of the 2009 GPS tracks clearly shows that whalers traveled farther NW from Cross Island than in any other documented season except 2001 and 2002 (2005 and 2006 were years when ice significantly affected where the whalers could scout for whales). Table 6 supports this visual judgment in terms of average length of trip (distance), average farthest point reached from Cross Island, and average strike distance from Cross Island (but not average duration of trip).

The frequency and distribution of whale calls detected by the DASARs deployed by BPXA offshore of Northstar in 2009, also support this general observation (Blackwell et al. 2010). Blackwell et al. 2010 indicates that the number of whale calls was lower in 2009 than in 2008, 2004, and 2003. The number of whale calls detected in 2009 was similar to 2007 and higher than in 2001, 2002, 2005, and 2006. The years 2005 and 2006 may not be directly comparable to the other years due to the presence of ice for the entire or most of the season. This trend is consistent with the Nuiqsut whalers' overall characterization of their whaling seasons. The whalers reported that in 2001 and 2002 the whales were farther from Cross Island and fewer in numbers than they had typically encountered in years prior to 2001, as well as in subsequent years up to 2008. They also explicitly characterized the 2003 and 2004 seasons as a return to more typical patterns, and 2005 as a season where ice packed against the barrier islands kept the whales far offshore. For the first half of the 2006 whaling season ice also prevented the whalers from finding whales because they were relatively far from Cross Island. Weather complicated

Figure 7: Cross Island Subsistence Whaling Tracks, 2001-2009, coded by Year

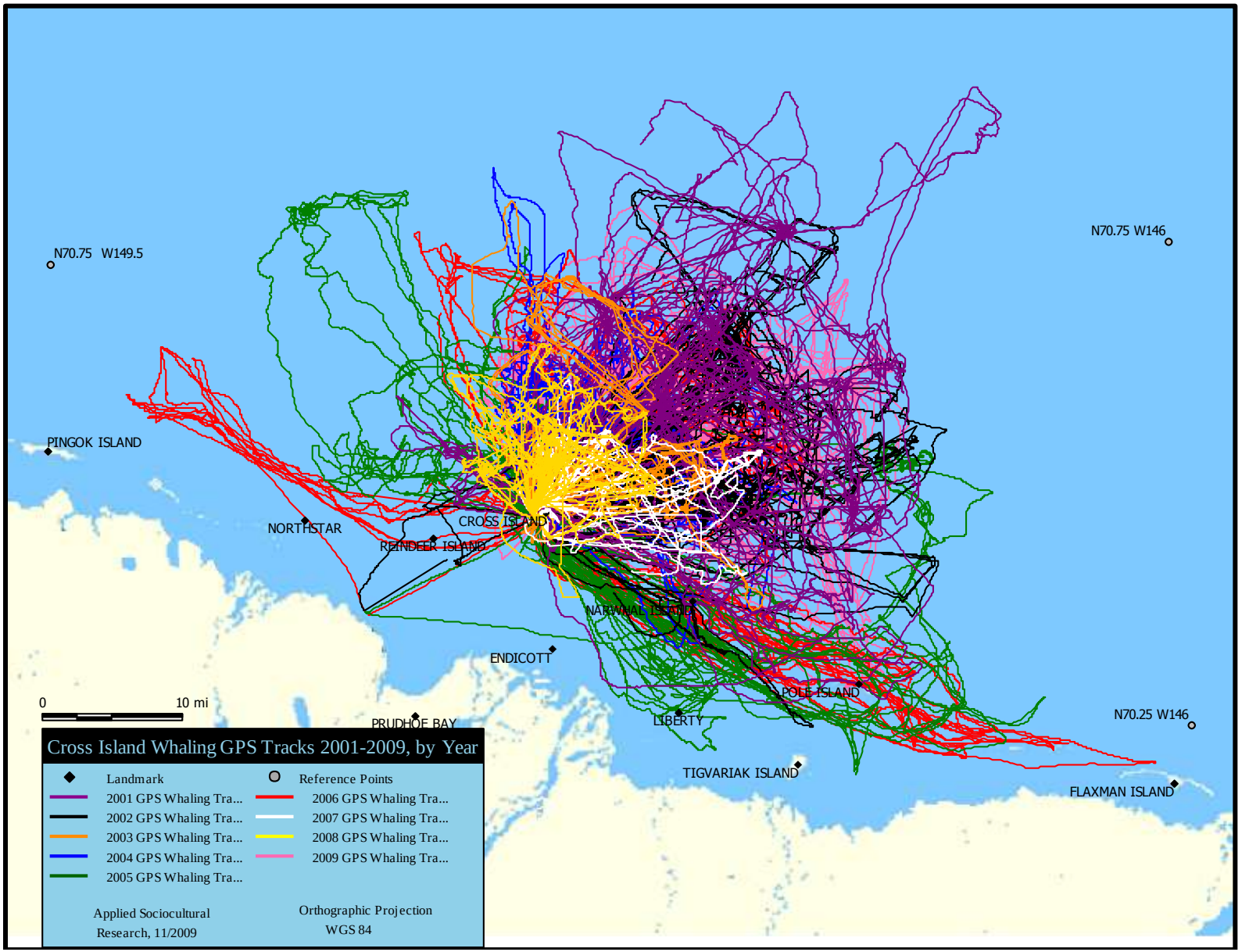


Plate 2: Cross Island Photographs (all 2009 except "Boxed up Whale")


Determining *tavsi*, *niniq*, and *uati* (*muktuk* for *unalik* already cut)


Peeling Muktuk


Preparing *Unalik*


Taking Intestines


Crew Shares


Boxed up Whale

All photos taken by M. Galginaitis

the 2007 and 2008 hunting seasons, but the whales were close to Cross Island, especially in 2008 (Figures 4 and 7).

The contrast between the 2009 and 2008 seasons is especially apparent. Whalers explicitly noted the similarity in distribution, number, and behavior of whales encountered during the 2009 season and those of the 2001 and 2002 whaling seasons. The overall pattern of the whalers' 2009 GPS tracks graphically supports this characterization (Fig. 5.5). The 2009 whaling tracks encompass almost the entire quadrant northeast of Cross Island within which most of their documented landed whales were found. Only a few tracks of the 2001 and 2002 season that are most distant from Cross Island extend beyond the 2009 tracks. The 2008 tracks, on the other hand, are much more compressed and indicate that in 2008 the whalers stayed closer to Cross Island than in any other year during which the Cross Island hunt was studied. This is consistent with the 2008 and 2009 whale call data from the Northstar DASAR array, with a record high call detection in 2008 and a much lower call detection in 2009 (Blackwell et al. 2010).

As described above, during the season the Nuiqsut whalers frequently discussed among themselves why they were seeing so few whales. Multiple factors were no doubt in play, and those they posited included poor sighting conditions (weather and sea state conditions), "spooky" whale behavior, commercial vessel activities in or to the east of the whaling area, and a "late" migration (usually expressed as "we may be too early"). In this regard, it is interesting to note that the Northstar acoustical monitoring stations display only two or three high peaks of whale detections, on September 14 and September 28-29 (Blackwell et al. 2010) The whalers closed their season on September 13, and the last crew left Cross Island September 15. The bowhead whale migration may have only peaked only after the whalers had closed their 2009 season.

The other measures documenting the 2009 Cross Island whaling season are fairly consistent with this conclusion, but require some explication. The total number of reported whales during the 2009 whaling season was comparable to most prior study years – but in 2009 they rarely saw more than one animal at a time, and never any large groups of whales. The average strike distance, length of trip (both in terms of distance and time), and the maximum distance that boats traveled from Cross Island in 2009 were very similar to the averages of all seasons combined. Cross Island whalers scouted for whales on 12 days during the 2009 season. They reported whale observations on 10 of these days. For the two days when they did not report any whales, only one or two boats went out scouting and conditions for whaling were marginal. Thus, while whalers saw whales on most days during the 2009 season, they did not see large numbers of whales — an average of ~5 whales on the days when they did see whales. Most whales were seen as single individuals and encountered only once. A few whales were seen in pairs, but no large groups of whales were observed. No "schools of whales" such as were seen in 2007 or 2008 were seen in 2009.

About half of the reported whale sightings were encountered at distances of more than 10 mi (16 km) from Cross Island. Given that the data of whale sighting reports is at best partial, and that several other measures of 2009 Cross Island whaling activity (average strike distance from Cross Island, average length of whaling trip in terms of both distance and duration, average maximum distance of whaling trips from Cross Island) are "average" compared to previous years (rather than exceptional), these measures do not strongly support the conclusion that whales may have been relatively farther from Cross Island in 2009 than in other years. The information on

"whaling success" and physical conditions of the 2009 whaling season provides more clarification to this issue. The years for which Nuiqsut whalers did not use their full quota of four strikes were 2001, 2004, 2005, and 2009. These years rank 1, 3 and 5 in terms of effort (in terms of "boat hours" measured as the total number of hours boats were on the water engaged in whaling activities) per landed whale, and 1, 3 and 6 in terms of effort per strike. This information supports the observation that whales were hard to find in 2009, and the more general statement that Cross Island whalers will travel as far from Cross Island as conditions permit to find whales. For some years conditions limit this range much more than for other years. For example, in 2001 there were few whales and they were far from Cross Island, but the whalers were able to scout 25 mi (40 km) or more from Cross Island (Galginaitis 2009d). Even so, they only used three strikes (average distance 19.5 mi [31 km]). In 2008, whalers were restricted to about 8–10 mi (13–16 km) of Cross Island, since beyond that point swells and other physical conditions made it difficult, if not impossible, to see and follow whales (Galginaitis 2009b). Since whales were found close to Cross Island they were able to land a full quota of four whales (average distance 6.5 mi [10.5 km]). Measures of "whaling success" and "whaling on-the-water effort" clearly indicate that 2009 was far from an average season, and have direct implications for a discussion of the offshore distribution of whales in 2009. For 2009, total effort was 752 boat hours or 251 boat hours/strike used. Previously the season with the highest level of expended effort had been 2001, with 573 total boat hours and 191 boat hours/strike used, and whalers on average traveled 39 km (24 mi) from Cross Island. The year 2009 contrasts especially with the seasons with the lowest documented level of expended effort, which were also the most recent. "Total boats hours" was 158 in 2008 and 124 in 2007, and "boat hours/strike used" was 40 in 2008 and 31 in 2007. Whalers on average traveled 8 mi (13 km) from Cross Island in 2008, and 10 mi (16 km) from Cross Island in 2007. A more detailed discussion of the "whaling effort" measurement for 2001–2008 can be found in Galginaitis (2009d, p.76-81), and in the "whaling effort" section below.

GPS Point Information

The methodology of point collection has been discussed above. In summary, the whalers marked relatively few points. Most of the points in Table 8 are thus in some sense derived. Some are located fairly precisely in time (either by events heard on the radio in "real time" or as documented in the Deadhorse Com Center log). Others were placed in an approximate way by the whalers after they came in from scouting and were reviewing the GPS tracks of their trip(s) with the researcher. As discussed above, even the most "precise" marked points are at best approximations, and should be interpreted as such.

To repeat, not all waypoints listed in Table 8 were actually marked by crews while they were out on the water. Some were described by crews during their reviews of GPS tracks, and others were derived from radio reports of the Deadhorse Com Center log. Waypoints that were marked by crews during their trips have labels with capital letters (and others in lowercase letters). The whalers did not mark all whale sightings, and not all unmarked whale sightings were later described to the researcher. The daily boat report forms may include some additional likely whale sightings that are not included in Table 8, but these additional points are based on whalers' general accounts, with no specific locational information. It is likely that not all whale sightings

Table 8: All Waypoints Marked or Located, 2009

Date	Crew	Waypoint	Lat/Long	Time	Notes	Type
8/28	Napageak	nap_082809A	N70.58 W147.78	1512	Possible scouting area	Tr
8/28	Napageak	nap_082809B	N70.6 W147.64	1536	Possible scouting area	Tr
8/28	Napageak	nap_082809C	N70.61 W147.56	1557	Possible scouting area	Tr
8/28	Napageak	nap_082809D	N70.55 W147.53	1630	Possible scouting area	Tr
8/28	Napageak	nap_082809E	N70.53 W147.86	1706	Possible scouting area	Tr
8/28	Napageak	nap_082809F	N70.54 W147.9	1711	Possible scouting area	Tr
8/28	Napageak	nap_082809G	N70.55 W148	1726	Possible scouting area	Tr
8/28	Napageak	nap_082809H	N70.56 W148.05	1736	Possible scouting area	Tr
8/28	Napageak	nap_082809I	N70.55 W148.1	1743	Possible scouting area	Tr
8/28	Napageak	nap_082809J	N70.52 W148.08	1753	Possible scouting area	Tr
8/29	Ipalook	ip1_082908A	N70.62 W147.63	834	Whalebirds	Tr
8/29	Ipalook	ip1_082908B	N70.65 W147.31	1321	Whalebirds	Tr
8/29	Ipalook	ip2_082909A	N70.61 W147.66	834	Whalebirds	Tr
8/29	Napageak	nap_082909A	N70.61 W147.3	1310	Large bearded seal	Tr
8/29	Napageak	nap_082909B	N70.48 W147.36	1520	Dead Krill in current near Narwhal Island	Tr
8/29	Oyagak	BO2_082909A	N70.56 W147.98	829	Reported "whale smell"	Tr
8/29	Oyagak	BO2_082909B	N70.56 W147.97	831	Blow 4.5 miles from Cross Island	W
8/29	Oyagak	bo2_082909C	N70.59 W147.93	854	Reported "whale smell"	Tr
8/29	Oyagak	BO2_082909D	N70.62 W147.87	915	Blow 8.5 miles N of Cross Island	W
8/29	Oyagak	bo2_082909E	N70.5 W147.21	1446	Dead Krill in current near Narwhal Island	Tr
9/1	Aqarguin	ian_090109A	N70.56 W147.71	908	Whale about 8 miles from Cross Island - seen only once	W
9/1	Ipalook	ip1_090109A	N70.58 W147.74	852	IP1 turned back to Cross Island, injured crew member	Tr
9/1	Ipalook	ip1_090109B	N70.62 W147.7	1026	Searched this area (reported others had seen whales here). No sightings reported	Tr
9/1	Ipalook	IP1_090109C	N70.57 W147.48	1149	Searched this area (reported others had seen whales here - NUK3 saw 2 whales). IP boats did not see these whales.	Tr
9/1	Ipalook	IP1_090109D	N70.56 W147.45	1441	Coordinates marked for NUK3 sighting (resighting) of whale. Time when NUK3 boat first saw this whale uncertain (mapped as nuk3_090109b).	Tr
9/1	Ipalook	ip1_090109E	N70.48 W147.33	1419	Two whales "playing around"	W
9/1	Ipalook	IP1_090109F	N70.51 W147.37	1444	Position of IP1 when it turned towards NUK sighting - lost track of "their" whales	Tr
9/1	Ipalook	IP1_090109G	N70.52 W147.39	1446	Position of IP1 when it turned towards TAL2 or IAN resighting of NUK3 whale	Tr
9/1	Ipalook	IP1_090109H	N70.55 W147.35	1521	Position of IP1 when it turned towards NUK3 or IAN sighting , then N	Tr

Table 8: All Waypoints Marked or Located, 2009 (Continued)

Date	Crew	Waypoint	Lat/Long	Time	Notes	Type
9/1	Ipalook	ip1_090109I	N70.63 W147.21	1644	current (and the S to other boats because of no sightings?)	Tr
9/1	Ipalook	ip1_090109J	N70.55 W147.34	1717	current (and the W towards CI)	Tr
9/1	Ipalook	IP1_090109K	N70.61 W147.56	1137	"Something" sighted	Tr
9/1	Ipalook	IP2_090109A	N70.4 W147.53	1438	Marked leaving Narwhal Island after a break onshore of about 11 minutes	Tr
9/1	Ipalook	IP2_090109B	N70.56 W147.61	NA	Area of many whalebirds, few sea mammals - oint not associated with tracks as such	Tr
9/1	Nukapigak	nuk3_090109A	N70.63 W147.64	1025	Whale sighting	W
9/1	Nukapigak	nuk3_090109B	N70.58 W147.44	NA	Whale sighting (two whales) - tim euncertain, only roughly located by NUK co-captian	W
9/1	Nukapigak	nuk3_090109c	N70.56 W147.4	1144	Probable location of NUK3 when informed of NUK1 sighting of 2 whales - went at high speed to the north and then east	Tr
9/1	Nukapigak	nuk3_090109d	N70.57 W147.47	1151	Position where NUK3 slowed to search for 2 whales (and where IP boats joined them)	D
9/1	Nukapigak	nuk3_090109e	N70.58 W147.28	1702	Blow seen towards Narwhal Island	W
9/1	Oyagak	BO2_090109A	N70.52 W148	753	Whale 1.5 miles from Cross Island	W
9/1	Oyagak	bo2_090109B	N70.55 W147.3	1138	Turned towards IP1 in response to IP1_090109k	Tr
9/1	Oyagak	BO2_090109C	N70.59 W147.41	1150	Whale seen in front of them	W
9/1	Oyagak	BO2_090109D	N70.6 W147.45	1159	Position where BO2_090109c whale was last seen	C
9/1	Taalak	tal1_090109A	N70.55 W147.99	854	streak of whale food	Tr
9/1	Taalak	tal1_090109B	N70.58 W147.97	908	streak of whale food	Tr
9/1	Taalak	tal1_090109C	N70.57 W147.7	952	course change in response to reported sighting	Tr
9/1	Taalak	tal1_090109D	N70.57 W147.74	1011	course change in response to reported sighting	Tr
9/1	Taalak	tal1_090109E	N70.64 W147.64	1052	course change in response to reported sighting	Tr
9/1	Taalak	tal1_090109F	N70.66 W147.8	1138	course change in response to reported sighting	Tr
9/1	Taalak	tal1_090109G	N70.58 W147.5	1212	course change in response to reported sighting	Tr
9/1	Taalak	tal1_090109H	N70.65 W147.9	1432	course change in response to reported sighting	Tr
9/1	Taalak	tal1_090109I	N70.58 W147.43	1529	course change in response to reported sighting	Tr
9/1	Taalak	tal1_090109J	N70.62 W148	1822	possible 2 blows in the direction of Northstar - not confirmed	W
9/1	Taalak	tal1_090109K	N70.6 W148.13	1841	Turn towards Cross Island at scouting speed	Tr
9/1	Taalak	tal2_090109A	N70.6 W147.59	NA	Two whales seen, thought to be the same as NUK3 sightings	D

Table 8: All Waypoints Marked or Located, 2009 (Continued)

Date	Date	Date	Date	Date	Date	Date
9/2	Aqarguin	ian_090209A	N70.58 W147.82	901		W
9/2	Aqarguin	ian_090209B	N70.64 W147.42	1010		W
9/2	Aqarguin	ian_090209C	N70.57 W147.39	1040		W
9/2	Aqarguin	ian_090209D	N70.45 W147.14	1405		W
9/2	Ipalook	ip_090209A	N70.67 W147.66	857	Estimated location of whale IP boats sighted 8:57	W
9/2	Ipalook	ip1_090209B	N70.71 W147.46	946	Something seen, but not reported as a whale sighting	Tr
9/2	Ipalook	ip2_090209A	N70.48 W147.69	2034	IP2 turned towards CI, went to high speed	Tr
9/2	Ipalook	ip2_090209B	N70.57 W147.88	2040	Estimated position of vessel when seen by IAN and IP2	Tr
9/2	Nukapigak	nuk1_090209A	N70.63 W147.47	1613	Whale seen 14.6 to 15.6 miles from CI (location approximate)	W
9/2	Nukapigak	nuk2_090209A	N70.63 W147.47	1629	NUK2 in the area of whale seen by NUK3 @ 16:13	Tr
9/2	Nukapigak	NUK3_090209A	N70.59 W147.99	633	Location of NUK3 when whale seen, 6.3 miles N of CI	Tr
9/2	Nukapigak	nuk3_090209A'	N70.59 W147.98	635	Estimated location of whale seen at 6:33	W
9/2	Nukapigak	nuk3_090209B	N70.72 W147.87	748	Location of NUK3 when whale seen 16 miles N of CI	Tr
9/2	Nukapigak	nuk3_090209B'	N70.73 W147.85	749	Estimated location of whale seen at 7:48	W
9/2	Nukapigak	nuk3_090209C	N70.5 W147.7	2051	Whale seen, but only once	D
9/2	Nukapigak	nuk3_090209C'	N70.51 W147.71	2054	Estimated location of whale seen by NUK3 @ 20:48	W
9/2	Oyagak	bo1_090209A	N70.6 W147.49	910	Saw "Something over there" but no sighting reported	Tr
9/2	Oyagak	bo1_090209B	N70.5 W147.15	1249	Reached area of boats looking for a whale	Tr
9/2	Oyagak	BO1_090209C	N70.41 W147.05	1413	Point marked looking for BO2 whale seen @ 14:05	C
9/2	Oyagak	BO1_090209D	N70.54 W147.79	1708	Whale about 5.5 miles from CI. Seen @ 1659 but marked 1708	W
9/2	Oyagak	bo1_090209E	N70.5 W147.65	1925	BO1, BO2, TAL2, IP1, and NUK3 chasing a whale	W
9/2	Oyagak	BO2_090209A	N70.4 W147.01	1401	Whale sighting (may have been 14:01)	W
9/2	Taalak	tal1_090209A	N70.7 W147.57	1002	area of slow boat speed, no reported sightings	Tr
9/2	Taalak	tal1_090209B	N70.67 W147.66	1753	TAL1 joined IAN and NUK1 boats looking for whale	Tr
9/2	Taalak	TAL1_090209C	N70.61 W147.75	1849	Whale reported, may have been first seen 18:42	W
9/2	Taalak	tal1_090209D	N70.5 W147.66	1925	TAL1, IAN, NUK1 boats chasing a whale	W
9/2	Taalak	tal1_090209E	N70.5 W147.66	1946	harpoon thrown but apparently missed whale	C
9/2	Taalak	tal1_090209F	N70.49 W147.68	1947	Potential striking opportunity	C
9/2	Taalak	TAL2_090209A	N70.66 W148.07	758	Whale seen 11.2 miles WNW of CI	W

Table 8: All Waypoints Marked or Located, 2009 (Continued)

Date	Date	Date	Date	Date	Date	Date
9/3	Aqarguin	IAN_090309A	N70.53 W147.63	934	Whale seen, position only approximate	W
9/3	Ipalook	IP1_090309A	N70.55 W147.78	723	Whale see and marked	W
9/3	Ipalook	IP1_090309B	N70.52 W147.72	809	Last sighting of whale first seen @ 7:23	D
9/3	Ipalook	ip1_090309C	N70.54 W147.63	917	Area searched by IP1 boat for 40 minutes, no sightings reported	Tr
9/3	Ipalook	ip1_090309D	N70.58 W147.66	950	Whale spotted	W
9/3	Ipalook	IP1_090309E	N70.59 W147.66	958	Blow seen and marked from whale first seen @ 9:50	C
9/3	Ipalook	IP1_090309F	N70.62 W147.72	1017	Blow reported, thought to be same whale seen @ 9:50	C
9/3	Ipalook	ip1_090309G	N70.65 W148.03	1046	Resighting of whale	C
9/3	Ipalook	IP2_090309A	N70.55 W147.86	658	IP2 position when they saw barge	Tr
9/3	Ipalook	ip2_090309A'	N70.62 W147.86	658	Estimated position of barge seen @ 6:58 (5 miles N of IP2)	Tr
9/3	Ipalook	ip2_090309B	N70.56 W147.78	720	Whale seen, first seen by IP1	D
9/3	Ipalook	ip2_090309C	N70.53 W147.57	914	Blow seen, but only once, reported as a different whale	W
9/3	Ipalook	ip2_090309D	N70.54 W147.55	928	Blow seen, but only once, reported as a different whale	W
9/3	Ipalook	ip2_090309E	N70.68 W148.06	1112	Resighting of whale	C
9/3	Nukapigak	NUK3_090309A	N70.59 W147.73	1012	Unknown	Tr
9/3	Taalak	TAL1_090309A	N70.57 W147.95	947	Whale seen about 5.5 miles from CI	W
9/3	Taalak	TAL2_090309A	N70.6 W147.97	956	Whale seen about 6.9 miles from CI	W
9/3	Taalak	tal2_090309B	N70.64 W148.03	1031	Area where TAL2 and other boats were seeing whales	W
9/4	Ipalook	IP1_090409A	N70.6 W147.82	1803		Tr
9/4	Ipalook	IP1_090409B	N70.56 W147.8	1811		Tr
9/4	Ipalook	IP1_090409C	N70.65 W148.03	1955	Whale seen only once	W
9/4	Nukapigak	nuk1_090409A	N70.51 W147.75	1802		W
9/4	Nukapigak	nuk3_090409A	N70.56 W148.11	1805	Whale first seen by NUK3 (?)	D
9/4	Nukapigak	nuk3_090409B	N70.56 W148.08	1809	Whale seen only once (estimated position?)	W
9/4	Nukapigak	NUK3_090409C	N70.56 W148.03	1811		Tr
9/4	Taalak	tal2_090409A	N70.61 W148.13	1925	Reported as "something black" but not confirmed as a sighting	Tr

Table 8: All Waypoints Marked or Located, 2009 (Continued)

Date	Date	Date	Date	Date	Date	Date
9/6	Aqarguin	IAN_090609A	N70.57 W147.78	2014	IAN coordinates for a whale sighting	W
9/6	Ipalook	ip_090609A	N70.62 W147.83	1119	IP1 and IP2 boats meet	Tr
9/6	Ipalook	ip1_090609B	N70.56 W147.73	1411	Possible sighting, but not reported as such	Tr
9/6	Ipalook	ip1_090609B'	N70.55 W147.79	1417	Slowed in area of possible sighting, no report of sighting	Tr
9/6	Ipalook	ip1_090609C	N70.6 W147.79	1512	Possible sighting (slow speed) but no report of sighting	Tr
9/6	Ipalook	IP1_090609D	N70.64 W147.48	1648	Marked point, probably whale sighting	W
9/6	Ipalook	ip1_090609E	N70.59 W147.58	2031	Following whale	C
9/6	Ipalook	IP1_090609F	N70.6 W147.64	2121	Unknown	Tr
9/6	Ipalook	IP1_090609G	N70.6 W147.63	2204	First float came off whale	C
9/6	Ipalook	IP1_090609H	N70.61 W147.65	2234		Tr
9/6	Ipalook	IP1_090609I	N70.61 W147.64	2304	Marked as location where NUK3 tried to put another float on	C
9/6	Ipalook	IP1_090609J	N70.61 W147.64	2307	Marked as location where float came off	C
9/6	Ipalook	IP1_090609K	N70.61 W147.64	2325	Listening for the whale in the dark	C
9/6	Ipalook	IP1_090609L	N70.61 W147.64	2338	Last marked location for the whale	C
9/6	Ipalook	ip2_090609B	N70.65 W147.78	1121	Slow to scouting speed, report a walrus	Tr
9/6	Ipalook	ip2_090609C	N70.64 W147.68	1209	Whalebirds reported	Tr
9/6	Ipalook	ip2_090609D	N70.64 W147.67	1212	Whalebirds reported	Tr
9/6	Nukapigak	nuk1_090609A	N70.59 W147.63	2127	Chase event - preparing to use shoulder gun	C
9/6	Nukapigak	NUK3_090609A	N70.55 W147.79	750	NUK3 position when whale sighted	Tr
9/6	Nukapigak	nuk3_090609A'	N70.53 W147.82	757	Estimated position of whale sighted @ 7:50, not resighted	W
9/6	Nukapigak	nuk3_090609C	N70.59 W147.63	2107	Near whale	C
9/6	Nukapigak	nuk3_090609D	N70.59 W147.63	2109	Change of direction towards whale	C
9/6	Nukapigak	nuk3_090609E	N70.6 W147.63	2111	Strike on whale	S
9/6	Nukapigak	nuk3_090609F	N70.6 W147.62	2144	Still tracking whale	C
9/6	Nukapigak	nuk3_090609G	N70.6 W147.63	2203	Float came off whale	C
9/6	Nukapigak	nuk3_090609H	N70.61 W147.63	2231	NUK3 heard the whale blow	C
9/6	Nukapigak	nuk3_090609I	N70.61 W147.63	2259	NUK3 saw whale behind their boat	C
9/6	Nukapigak	nuk3_090609J	N70.61 W147.64	2301	NUK3 tried to put another float on the whale	C
9/6	Nukapigak	nuk3_090609K	N70.61 W147.64	2308	NUK3 report that the float had come off (or they had missed)	C
9/6	Nukapigak	nukl3_090609B	N70.53 W148.13	1938	Large bearded seal reported	Tr
9/6	Oyagak	BO1_090609A	N70.58 W147.59	2024	Following whale	C
9/6	Oyagak	BO2_090609B	N70.59 W147.58	2032	Coordinates for whale seen by TAL1 from BO2	D

Table 8: All Waypoints Marked or Located, 2009 (Continued)

Date	Date	Date	Date	Date	Date	Date
9/6	Oyagak	BO2_090609C	N70.59 W147.58	2056	Resighting of whale	C
9/6	Oyagak	BO2_090609D	N70.59 W147.59	2057		Tr
9/6	Oyagak	bol2_090609A	N70.58 W147.62	2011	BO2 saw whale to the east (resighting)	C
9/6	Taalak	tal_090609C	N70.58 W147.59	1958	Whale resighted	C
9/6	Taalak	tal1_090609A	N70.54 W147.58	1941	TAL1 position when they saw a whale or something	Tr
9/6	Taalak	tal1_090609B	N70.56 W147.63	1945	Estimated position of whale seen @ 19:42	W
9/6	Taalak	tal1_090609D	N70.57 W147.62	2019	Following whale	C
9/6	Taalak	tal1_090609E	N70.59 W147.6	2034	Following whale	C
9/6	Taalak	tal1_090609F	N70.59 W147.58	2042	Following whale	C
9/6	Taalak	tal2_090609A	N70.55 W147.9	700	"Something splashed over there" but no reported sighting	Tr
9/6	Taalak	tal2_090609B	N70.49 W147.76	1901	TAL2 "saw something black" but made no sighting report	Tr
9/6	Taalak	tal2_090609D	N70.58 W147.59	2004	Whale resighted	C
9/6	Taalak	TAL2_090609E	N70.61 W147.64	2224	Marked by TAL2 as "last observed location of whale"	C
9/7	Ipalook	ip2_090709A	N70.51 W147.47	1254	Resighting of whale	C
9/7	Nukapigak	NUK1_090709A	N70.52 W147.52	1355	Possible whale sighting, not confirmed	Tr
9/7	Nukapigak	NUK3_090709A	N70.65 W147.74	1219	Marked point, posibly whale traveling east	W
9/7	Nukapigak	nuk3_090709B	N70.61 W147.65	NA	Point used by NUK3 as last position of struck whale	C
9/7	Oyagak	BO1_090709B	N70.51 W147.48	1248	Resighting of whale	C
9/7	Oyagak	BO2_090709A	N70.52 W147.44	1224	Whale sighting	W
9/7	Oyagak	bo2_090709A'	N70.52 W147.44	1224	Actual area BO2 slowed to look for whale	Tr
9/7	Oyagak	BO2_090709B	N70.52 W147.46	1234	Resighting of whale	C
9/7	Oyagak	bo2_090709C	N70.52 W147.47	1242	Resighting of whale	C

Table 8: All Waypoints Marked or Located, 2009 (Continued)

Date	Date	Date	Date	Date	Date	Date
9/11	Ipalook	ip1_091109A	N70.53 W147.49	758	IP1 boat arrives to help sight/chase "NUK1" whale	C
9/11	Nukapigak	nuk1_091109A	N70.52 W147.53	710	NUK1 position when whale seen	D
9/11	Nukapigak	nuk1_091109A'	N70.54 W147.52	713	Estimated position of whale seen by NUK1 @ 7:10	W
9/11	Nukapigak	nuk2_091109A	N70.54 W147.49	720	NUK2 position when whale resighted	C
9/11	Nukapigak	nuk2_091109A'	N70.54 W147.5	721	Estimated position of whale resighted @ 7:20	C
9/11	Nukapigak	nuk2_091109B	N70.55 W147.51	727	NUK2 position when whale resighted	C
9/11	Nukapigak	nuk2_091109B'	N70.55 W147.53	729	Estimated position of whale resighted @ 7:27	C
9/11	Oyagak	bo1_091109A	N70.57 W147.66	727	Probable whale sighting	D
9/11	Oyagak	BO1_091109B	N70.57 W147.65	729	Where BO1 marked the whale sighting (confirmed)	W
9/11	Oyagak	bo1_091109C	N70.57 W147.7	804	Resighting of whale	C
9/11	Oyagak	BO1_091109D	N70.5 W147.48	854		Tr
9/11	Oyagak	bo2_091109A	N70.57 W147.7	759	Resighting of whale	C
9/11	Oyagak	BO2_091109B	N70.58 W147.54	819		Tr
9/11	Taalak	tal1_091109A	N70.55 W147.53	729	TAL1 slowed to scouting speed near whale seen @ 7:10	C
9/11	Taalak	tal1_091109B	N70.54 W147.55	739	Many boats scouting in the area for whale seen @ 7:10	C
9/11	Taalak	tal1_091109C	N70.53 W147.49	759	TAL1 reports striking whale (radio)	S
9/11	Taalak	TAL1_091109D	N70.5 W147.48	850	Coordinates given for kill site for TAL1 whale	K
9/11	Taalak	TAL1_091109S	N70.52 W147.49	800	Coordinates given for TAL1 strike (from TAL2 boat)	S
9/11	Taalak	tal2_091109A	N70.54 W147.57	729	TAL2 slowed to scouting speed near whale seen @ 7:10	C
9/12	Aqarguin	ian_091209A	N70.56 W147.47	945	Whale sighting, position approximate	W
9/12	Aqarguin	IAN_091209B	N70.61 W147.59	1154	Whale sighting, marked with coordinates	W
9/12	Ipalook	IP1_091209A	N70.61 W147.59	1156	Marked coordinates for whale IAN saw @ 11:54	D
9/12	Ipalook	IP1_091209B	N70.61 W147.59	1157	Marked coordinates for whale IAN saw @ 11:54	D
9/12	Ipalook	IP1_091209C	N70.51 W147.26	1627	Marked whale seen by NUK1 @1617	D
9/12	Ipalook	ip2_091209A	N70.67 W146.94	1618	Whale too far east of CI, gave up the chase	C
9/12	Ipalook	IP2_091209B	N70.5 W147.47	1718	Saw a big whale with no blow	D
9/12	Nukapigak	NUK1_091209A	N70.56 W147.18	1617	Boat position when they saw a whale	D
9/12	Nukapigak	NUK1_091209A'	N70.52 W147.26	1623	Estimated position of whale seen @ 1617	W
9/12	Nukapigak	nuk3_091209A	N70.72 W147.91	1412	reported seeing a boat	Tr
9/12	Nukapigak	NUK3_091209B	N70.72 W148.05	1425	Reported boat as the *Mikkelsen Bay* and gave his coordinates	Tr
9/12	Nukapigak	nuk3_091209C	N70.71 W148.06	1433	Westernmost point of NUK3 track, turned away from boat	Tr
9/12	Nukapigak	nuk3_091209D	N70.61 W147.98	1450	Bearded seal sighting	Tr

Table 8: All Waypoints Marked or Located, 2009 (Continued)

Date	Date	Date	Date	Date	Date	Date
9/12	Nukapigak	NUK3_091209E	N70.48 W147.45	1543	NUK3 joined other boats (in the general area)	Tr
9/12	Oyagak	BO1_091209A	N70.56 W147.45	957	Marked whale seen by IAN	D
9/12	Oyagak	BO1_091209B	N70.61 W147.58	1157	Marked coordinates for whale IAN saw @ 11:54	D
9/12	Oyagak	BO1_091209C	N70.58 W147.49	1223	Marked point when whale seen	D
9/12	Oyagak	BO1_091209D	N70.62 W147.53	1354	Resighting of whale	C
9/12	Oyagak	BO1_091209E	N70.64 W147.01	NA	Whale too far east of CI, gave up the chase	C
9/12	Oyagak	bo1_091209F	N70.65 W146.89	1600	Boats turned to SW	Tr
9/12	Oyagak	BO1_091209G	N70.49 W147.37	1658	Marked whale seen by NUK1 @1617	D
9/12	Oyagak	BO2_091209A	N70.58 W147.49	1219	Whale seen on way to whale seen by IAN	D
9/12	Oyagak	BO2_091209A'	N70.58 W147.48	1220	Estimated position of whale seen @ 12:19	W
9/13	Ipalook	IP1_091309A	N70.51 W147.63	1335	During tow saw a whale and left tow to go look	D
9/13	Ipalook	IP1_091309A'	N70.52 W147.66	1340	Estimated position of whale seen @ 1336	W
9/13	Nukapigak	NUK3_091309A	N70.55 W147.22	1000	NUK3 position when they saw a whale	D
9/13	Nukapigak	NUK3_091309A'	N70.55 W147.19	1001	Estimated position of whale NUK3 saw @ 1000	W
9/13	Nukapigak	NUK3_091309B	N70.55 W147.18	1008	NUK3 gave coordinates to other boats	Tr
9/13	Nukapigak	nuk3_091309C	N70.55 W147.15	1034	Likely NUK3 strike time	S
9/13	Nukapigak	nuk3_091309D	N70.55 W147.14	1035	Reported NUK3 strike time	S
9/13	Nukapigak	nuk3_091309E	N70.55 W147.13	1038	Likely time NUK3 used shoulder gun	C
9/13	Nukapigak	nuk3_091309F	N70.55 W147.13	1039	Reported time NUK3 used shoulder gun	C
9/13	Nukapigak	NUK3_091309G	N70.55 W147.13	1055	NUK3 whale determined to be dead	K
9/13	Oyagak	BO1_091309A	N70.56 W147.77	806	Whale sighting	W
9/13	Oyagak	BO1_091309B	N70.55 W147.13	1049	Whale sighting	W
9/13	Oyagak	BO1_091309C	N70.52 W147.68	1400	Saw "something" but no reported sighting	Tr

Source: 2009 GPS information, 2009 fieldnotes, 2009 Deadhorse Communications Center Logbook
Type Codes: W=Whale, S=Strike, K=Kill, D=Duplicate sighting, C=Chase Event (also a duplicate sighting), Tr=Track Point (reference point of some sort)

are included on the daily report forms, although most individual whales sighted are probably represented. There were no sightings of groups of whales or numerous but distant "blows" as had been seen in prior years. Multiple sightings of the same whale were usually reported as such by most crews, but most crews only marked a single position for a whale unless they followed it for a significant period of time and/or struck it. Different crews may mark or report the position of the same whale, but in general it has been possible to determine the number of different whale reports on any given day in 2009.

Waypoints in Table 8 are of several types – **W**hale sightings, **C**hase events (and the more specific **S**trikes and **K**ills), **D**uplicate points (usually whales already referenced by another waypoint), and **Tr**ack points (usually reference points of some sort). Whale sightings may have actually been marked by a crew, or may have been located on their track when reviewing it with the researcher at some point. Strike locations are relatively precise, but sometimes are not marked exactly when the strike is made, and boats are always in motion. Kill locations are similarly fairly well-located, but may not be exactly precise. Whale sightings are less precise and may be for a whale or blow located anywhere from 10 feet to several miles from the boat, and thus are less fixed in terms of position. Track points are either reference points (indicating the position of another boat, a position a boat is going towards, or some other stored point) or a "non-whale" observation tied to a specific time or general area of a GPS track. Each waypoint number consists of three parts: BoatID (upper case for points marked while out on the water, lower case for points located while discussing the GPS track with the researcher), Date(mmddyy), and Sequence Number.

Measurement of Whaling Effort

Much thought has been devoted to the measurement of whaling effort. The focus has been on measuring whaling effort related to searching for and locating whales, chasing and striking them, and towing them to Cross Island. The effort required to prepare for those activities has been documented by this project. The effort required to butcher and transport the whale has been only documented qualitatively by this project. The reasons for these restrictions are fairly simple and obvious. Those whaling activities that take place on Cross Island are more likely to be directly affected by oil and gas (and other) activities than are those that take place away from Cross Island. Concentrating on Cross Island whaling activities applies the limited budget available for the project in the most cost efficient way possible. Also, the Cross Island whaling activities are the most variable part of the overall whaling effort. Also, preparations for whaling are about the same, regardless of whaling "success," and other non-Cross Island whaling activities are generally directed related to the number of whales landed at Cross Island (transport, butchering and distribution in Nuiqsut, celebrations).

Butchering effort on Cross Island has not been quantitatively measured, although the information exists to make some rough estimates if this would be useful. The flux of people present at the butcher site, and the difficulty in determining who is actually working at any given time and for

how long, makes it very difficult to devise an objective measurement of "butchering effort" that it is possible for an observer to accurately observe and record. As a practical matter, the whalers have a general idea of how long it should take to butcher a whale of a given size and generally try to butcher as quickly as possible (at least to the stage where they cut off the head) so that at least some crews can go out scouting for another whale. That is, butchering effort is directly related to the number and size of whales landed. On the other hand, "on the water" effort can be (and has been) quite variable from year-to-year, and is relatively easy to measure.

The "total effort" measure still requires some additional refinement and analysis. In principle, it confounds a number of "effort components" that can be differentiated from each other. Such components would include:

- transit time (at high speed en route to a search area or on the way back to Cross Island)
- scouting time (when actually looking for whales)
- following and chasing time (after finding a whale)
- towing time (after killing a whale)
- other miscellaneous activities (assistance to other boats, mechanical breakdown, rest breaks, and so on).

A detailed breakout of such separate activities is not easily accomplished at present, and may not be worth pursuing. Although it is possible through close analysis of the GPS track information, it would require a great deal of time for only approximate results. Scouting for whales generally takes place at speeds of 6 mph or lower, but whales can be spotted at higher speeds as well. High speeds can indicate a desire to get to a search area quickly, with little concern for seeing whales during the transit, or could be a response to another boat seeing a whale or a request for assistance, or a return to Cross Island. An apparent stop could represent waiting for a whale to resurface, a lunch or coffee break, a mechanical breakdown, a kill site, or any of a number of other events. Reviewing GPS tracks in detail with willing whaling captains might result in this sort of detailed time accounting, but it is extremely doubtful if many whalers would be willing to devote the time required, or that the budget would be available to document a large enough sample of tracks for each season. Only rough breakouts could be compiled with a reasonable level of effort.

On the other hand, it appears that the rough estimate of "Total Seasonal Boat Effort (Boat Hours)" and the ratio of "Boat Hours"/"Strikes Used" are metrics that have the advantage of being relatively easy to compute and that display great variation from year-to-year (Table 6). "Strikes Used" rather than "Whales Landed" is used in the ratio since the effort expended on the water on a whale that is "struck and lost" (S&L) can be almost the same as for one that is landed (especially as the time between first strike and kill is reduced). The main difference is that a landed whale is towed, and towing time would be between two and ten hours times the number of boats towing. A landed whale may have been chased longer than a S&L whale, if the whalers did not look for the S&L whale very long. However, a landed whale could well have been chased for a shorter period of time than a S&L whale, if the landed whale were killed quickly, compared to a longer search for a S&L whale. Time spent towing could be separated out from "scouting"

and "chasing" time, but all are important and integral parts of the harvesting task, and would seem to contribute to the overall "on-the-water" effort in a consistent way from one season to the next, reflecting the combination of environmental conditions characteristics of any given season.

Perhaps the best indication that this sort of "whaling effort" measurement is useful is that, as discussed above in terms of whale distribution, it accurately reflects and distinguishes among the 2001-2009 seasons in the same way as the Nuiqsut whalers characterize them. Nuiqsut whalers reported that in 2009 whales were few, skittish, difficult to see and follow, and were relatively far from Cross Island. They compared 2009 to 2002 and 2001 – except that in 2001 and 2002 the conditions to see and follow whales were not so difficult. They were able to land 3 whales in 2001 and 4 in 2002. These were also the years when "whaling effort" was highest in terms of total boat hours, and also in terms of boat hours/strike used except for 2005, when ice conditions limited where the whalers could scout.

Based on all nine documented seasons, some generalizations about the factors influencing decisions to go whaling are possible, although no systematic model can yet be developed. If the weather is suitable for successful scouting of whales (slight or no wind, slight or no chop, good visibility), all boats physically capable of whaling will go out. That is, crews go whaling in suitable weather and any deviation from that pattern has a specific explanation. Some captains will go out in more marginal weather than others, and such decisions are quite situational in nature. A crew that has not been out recently seems more likely to go out in marginal weather than those crews that have been out more recently. Crews that have not harvested whales seem more likely to go out whaling than those crews that have landed whales. A captain may call a "rest day" for a crew that has been working hard, especially if conditions are marginal. Trips on days with marginal weather conditions tend to be shorter than on days with better weather. After the harvest of a whale the butchering must usually reach a well-defined point before whaling can resume. For Nuiqsut whalers this is normatively the next day for crews other than that which took the whale, and is often the next day for that crew as well. However, due to the experience of the last several seasons where weather has restricted the number of days with suitable conditions for whaling, Nuiqsut captains appear to be more willing to consider landing two whales on the same day and/or landing whales on successive days (that is, allowing most crews to try to land another whale before completing butchering a whale already landed).

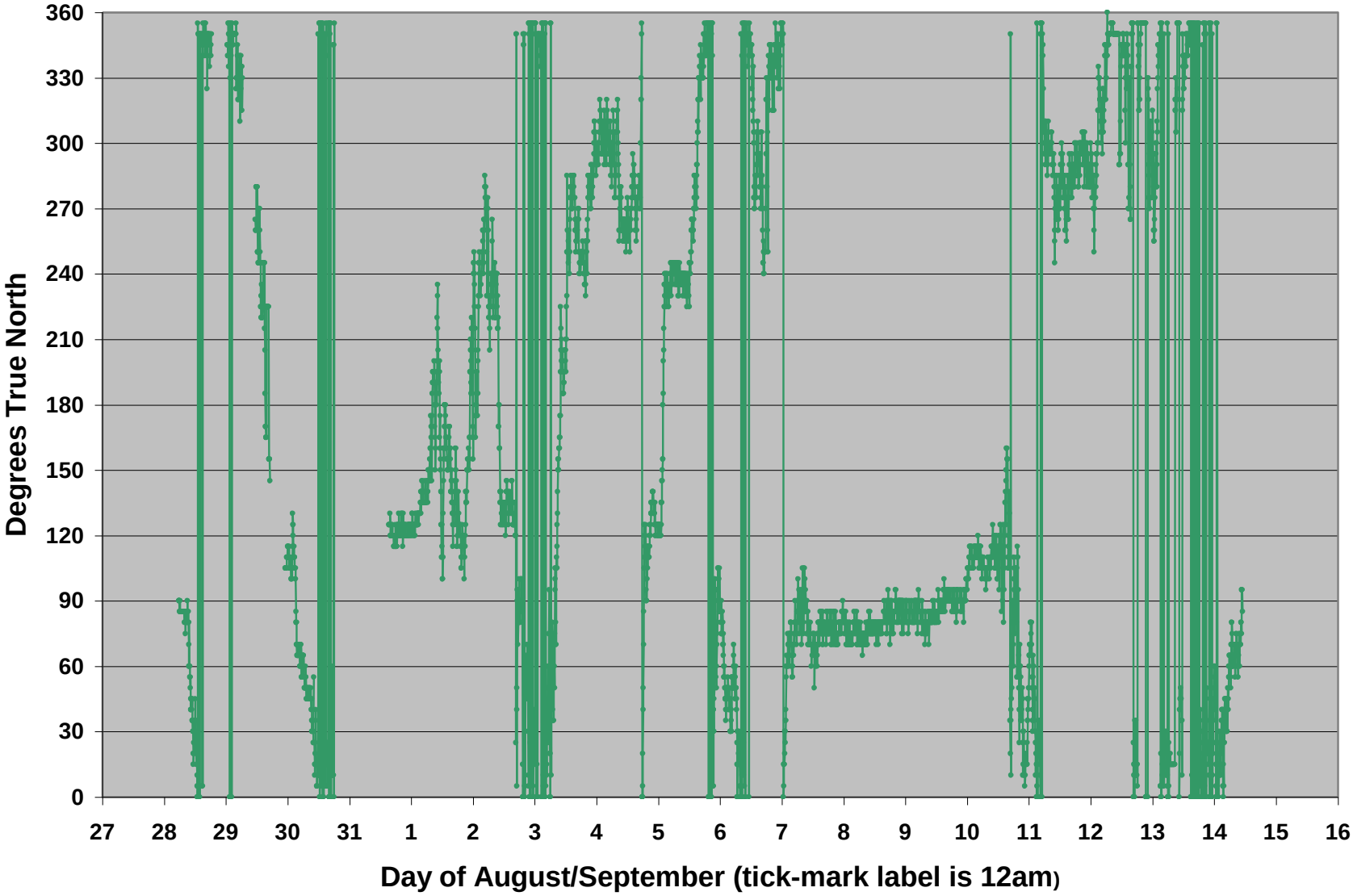
Apparently, barometric pressure, wind speed, and to a lesser extent, wind direction are the weather factors most directly related to when Nuiqsut whalers scout for whales. Wind speed and barometric pressure tend to be inversely related. Wind speed can be directly observed and can change quickly, while barometric pressure changes relatively slowly, and whalers often scout when it is in transition. Still, good scouting conditions tend to correspond with high barometric pressure or times of transition. Figure 3 (above) summarizes the 2009 subsistence whaling season by displaying barometric pressure, wind speed, the periods when whalers were out scouting for whales, and when whale strikes occurred. Since the weather station on Cross Island only operated for part of the whaling season (one crew went out about a week before the other crews), barometric pressure and wind speed for both the Cross Island weather station and the weather station at Deadhorse are displayed. The Deadhorse measurements are reasonable, although not perfect, proxies for the Cross Island readings, as Figure 3 demonstrates, so this

allows some level of documentation for the weather for the entire season. Periods when boats were out scouting are plotted at the average wind speed measured during the period of time that they were on-the-water (Cross Island measurements when available, otherwise Deadhorse measurements). Similarly, whale strikes were plotted at the wind speed measured at the time recorded for the strike. Wind direction, as measured at Cross Island, is displayed in Figure 8.

Nuiqsut whalers do not observe barometric pressure directly – or, at least did not do so until the start of this research and the appearance of a weather station on Cross Island. If the barometric pressure trend is available, whalers will take it into account when deciding whether to scout for whales or not. Since it is at best a rough predictive tool, however, and whalers know from experience that a (relatively brief – up to several hours) period of good scouting conditions can occur when the wind shifts directions, whalers will sometimes go out scouting even when the barometric pressure is falling. Figure 6 indicates that such periods of shifting (and lower) winds were important for whalers in 2008. Nuiqsut whalers rely much more on their direct observations of the wind and their experience as to what the future wind conditions will likely be. Whalers prefer days with no wind, though winds up to 5 mph, or even 10 mph, are generally acceptable. Scouting can occur even with higher winds, given the right circumstances (ice cover, whales close to Cross Island). Scouting activities generally correspond with periods of lower wind speeds. Conditions on Cross Island are not necessarily the same as experienced when scouting for whales, but the general trends are often the same (complete weather file in electronic appendix).

As is clear from Figure 3, the first crews traveled to Cross Island in relatively good conditions for travel. In terms of wind speed, the 2009 season exhibited a pattern of a few periods of high winds for 2 or 3 days, but more commonly with days with at least periods when the wind speed was 10 mph or less. Almost all scouting activities took place during such periods, with the exceptions being on 8/08 and 8/11. On 8/08 the average wind speed was just above 10 mph. On 8/11, wind speed was low when the whalers left Cross Island, but increased just before or just after they struck a whale, so that they had to tow in high wind conditions. Barometric pressure was falling (from a relatively high value) during some periods of scouting and rising during others. Generally, whalers prefer to scout when the barometric pressure is rising, as an indicator of improving weather, but will also go out scouting during barometric pressure declines, as indicators of the "lull" of low winds in the middle of a wind shift. Figure 8 displays wind direction on Cross Island during the 2009 whaling season. The most vivid aspect of this plot is that for almost the entire season the wind was quite variable and shifting, with the exception of mid-8/07 through mid-8/10. This period of a steady east wind corresponds with a period of high wind, peaking at just under 45 mph. Other high wind speed peaks during the 2009 whaling season were more transient and tended to correspond with short periods of more steady wind direction. Lower wind speeds tended to correspond with very variable wind direction.

Figure 8: Wind Direction at Cross Island, 9/28/09 – 9/14/09



"Non-Whaling" Boat Activity

In addition to searching for whales, several Nuiqsut whaling vessels made trips between Cross Island and West Dock. Most commonly, trips are made for logistical reasons – to pick up supplies, needed parts, or to drop off and pick up crew members. Generally, after the harvest of a whale, a certain portion is sent to Nuiqsut to "feed the village." In most cases the successful captain will designate one or more of his crew members to take one of his boats to Nuiqsut for this purpose. If conditions for boat travel are poor, the "*tavsi*" may be taken to West Dock and flown to Nuiqsut – but will still be accompanied by the captain's flag and a crew member.
This information collection effort focused explicitly on Cross Island whaling activity. No attempt was made to systematically collect information on preparation, support, or other crew member activities that occurred elsewhere (primarily in Nuiqsut). Whaling support activities from non-Nuiqsut sources (mainly oil and gas industry support through logistical barges) were evident, but mainly in terms of island infrastructure rather than the frequency of barge traffic. Of course, barges mobilized the Cross Island infrastructure before the first crew arrived, and demobilized this equipment over the two-day period during which whalers demobilized to return home.

Other Subsistence Activities

Little non-whaling subsistence activity was documented on or near Cross Island during the 2009 whaling season. Two polar bears were taken. The first was shot early in the season as a "nuisance" bear. The second was taken later in the season as a matter of choice. The hunter wanted a skin and his relatives in Nuiqsut wanted the meat. Although the whalers saw many ugruk and seal while out scouting for whales, none were taken. Such harvests are seen as diversions from the whale hunt, and in past years almost always took place only when a crew needed some fresh meat and was returning to Cross Island without striking a whale. No birds or fish were taken at Cross Island. All crews bring "subsistence food" (caribou, moose, fish, musk ox if they have it) with them to Cross Island so that they do not need to hunt for food (other than the bowhead whale) while they are out at Cross Island.

Nuiqsut Whalers' Observations and Perceptions of Whale Behavior in 2009

"Skittish" Whale Behavior

For several reasons, Nuiqsut whalers reported that whales were difficult to see and follow in 2009. First, there did not seem to be many whales near Cross Island. Second, large waves and swells (high sea states) and low contrast light conditions made it difficult to see whatever whales were present. Third, the behavior of the whales also contributed to making them harder to see. Whalers summarized these behaviors as whales acting "skittish or "spooked" and seemed to include a constellation of behaviors under this term:

- Swimming at a fast speed rather than staying in the area;
- Surfacing only one time between dives, and not exhibiting a visible "blow" when surfacing;

- Not showing flukes when diving, but simply sinking down under the water;
- Not being able to spot a whale again after it dives.

Note that this is only a general description of most whales seen in 2009, and does not necessarily contradict the reports of two feeding whales and several that were sleeping or resting when they were first seen.

In the context of skittish behavior, one captain remarked on the evening of September 2 that all the whales seen up to that point had behaved in a similar way to the only whale landed in 2005. He described this as a whale that appeared to be coming from the Camden Bay area and as exhibiting spooked behavior (fast speed, single surfacings). The whalers had also encountered a barge in the area where they chased this whale. During the 2009 season the whalers experienced several vessel encounters while scouting (see section below) and so were quite sensitive to the possibility that whales were spooked by this vessel traffic.

Other whalers compared the 2009 season to 2002 and 2001, in terms of skittish (and more general) whale behavior. These were seasons that whalers characterized as years when they saw few whales, with whales farther from Cross Island than "normal", and with whales exhibiting skittish behavior–the same way that they characterized the 2009 season. For 2001 they suggested several possible explanations for the skittish behavior (Galginaitis 2006c). Although Nuiqsut whalers cited industry activities as one possible explanation or factor, they said that other explanations were also possible. These other factors or possible factors were ice conditions to the east of Cross Island, possible presence of natural predators such as killer whales, barge traffic related to the Kaktovik water and sewer project, or other air or vessel traffic to the east of Cross Island. Note that two of these, while not related to oil industry activities, are related to other human economic activities. For 2009, the whalers directly observed more barges and other vessels in their immediate whaling area than in 2001 or 2002, and some whalers believed that the vessel activity was likely a cause of skittish whale behavior in 2009. Other whalers were not convinced that this vessel activity was the most important factor, although it certainly was considered a possible contributing factor, and one that they wanted eliminated

Whale Feeding

Whalers reported seeing whales feeding on the surface with their mouths open on two different days in 2009, but did not mark these locations at the times of the observations. The fieldnotes are somewhat confused, and it may be that this is two different reports of one whale, given the relative rarity of such reports during prior seasons. However, the information currently available supports two separate observations. On September 1, feeding was seen about 14 mi (22.5 km) ENE of Cross Island, and on September 2 it was seen about 6.5 mi (10.5 km) ENE of Cross Island. In addition, one boat reported seeing "whale food" in a streak or stream so red that it almost looked like blood. This observation was at a location about 2.5 to 4 mi (4 to 7 km) north of Cross Island on September 1. However, that crew did not spot any whales in the area with concentrated whale food. On August 29, one boat reported "dead krill" in the current NE of Narwhal Island, but did not report seeing any whales in that area. Whale birds (phalaropes), which are commonly associated with the presence of zooplankton concentrations near the surface and are used by the whalers as a sign that whales may be in the area, were explicitly noted on

two days – August 29 and September 1. No whales were reported in association with them, but on 1 September it was noted that where whalers saw many whale birds, they saw few seals, and vice versa. It is likely that whale birds were also seen on other days, as whalers tend not to report them as systematically as they do whales and other marine mammals (either to the researcher or the Communications Center operator).

No stomach samples were taken from bowheads landed in 2009, although two whales were landed. The first whale landed was large and the butchering process required that emphasis be placed more on speed than delicacy when removing the viscera, in order to prevent spoilage of the parts intended for human consumption. Thus, the stomach for this whale was never available for sampling. The second whale landed was small and the stomach would have been available, but the researcher was not at the butcher site when the viscera were removed and disposed of in the bone yard. Attempts to find the stomach in the bone yard, at night, were not successful as the remains of the small whale were mixed with those of the older (and riper) large whale.

That feeding whales were observed during the 2009 season was somewhat surprising. There had been few such reports in the previous years of the research. This does not necessarily mean that feeding did not occur in those prior seasons, but it is an indicator that whale feeding activity is generally not very obvious around Cross Island. In 2009, whalers saw relatively few whales and were usually unable to determine the activity of the whales since most whales were seen only once and not seen again. Most whale sightings were of single whales, and no large groups whales were seen at the same time. Conditions were not favorable for seeing whales in general, due to factors such as swells, waves, lack of contrast, and skittish whale behavior. Thus to recognize one or two cases of feeding whales was extraordinary (and the whalers themselves described it as "a rare sight". Previous reports have listed the following factors as contributing to the relative lack of whaler observations of whale feeding:

- whale feeding is not commonly observed (or at least not reported) by Nuiqsut whalers near Cross Island (only one incident during the previous eight years);
- most feeding by bowhead whales is known to occur below the surface (e.g., Würsig et al. 1989) where it would be invisible to people in small boats;
- on most or all days when scouting was possible, swell and waves (due to wind) made spotting and observing whales difficult;
- barge and other vessel activity may have "spooked" whales (and Nuiqsut whalers reported seeing more non-whaling vessels in 2009 than in previous years, at least several of which they thought affected whale behavior or subsistence whaling activity); and
- a major part of the migration may have bypassed the area accessible to the whalers.

For the eight years of the study previous to 2009, only one observation of whale feeding was reported and recorded. This was a spectacular sighting of a whale feeding on the surface with its mouth open, about 7.8 mi (12.6 km) from Cross Island, bearing 34º True. The captain, a very experienced whaler, remarked that this was the first time he had seen this. This does not necessarily indicate that Nuiqsut whalers observed no whale feeding behavior on other occasions in 2001–2008 when scouting for whales. It probably means that such observations were not common or that it is not easy to determine if whales are feeding. Nuiqsut whalers tend not to

speculate on what an animal ***may*** be doing – if they are unsure they will usually not say anything. If other obvious feeding behavior had been observed during 2001–2008, it probably would have been reported. Nuiqsut whalers do believe that whales feed near Cross Island, especially when whales appear to be staying in the area rather than swimming directly through it. When whaling, however, they are often not in a position to make such observations due to less than ideal weather and sea conditions, or the need to focus on the immediate tasks of whaling.

Most feeding by bowhead whales is below the surface and difficult to recognize via surface observations. There have been some previous observations of bowheads feeding actively at the surface in the Canadian and Alaskan Beaufort Sea, with mouths open (Würsig et al. 1985, 1989; Richardson and Thomson [eds.] 2002). The first whale taken by a Nuiqsut crew, in 1973, was reported to have been feeding on the bottom near Flaxman Island. Some other whales landed at Cross Island have been found to have recently-consumed food in their stomachs (Lowry and Sheffield 2002; Lowry et al. 2004). One of the whales taken in 2006 was also reported to have had mud on its jaw, and one of the two stomachs that were examined was quite full (Galginaitis 2007a). Nuiqsut whalers report that Camden Bay is regularly used as a feeding area by bowhead whales when migrating, and as a resting area when there are high winds and rough water. One whaler recounted that in 1997 there were many gray whales feeding near Reindeer Island, and that year a Nuiqsut crew landed a bowhead whale close to where Northstar now is. He said that since the development of Northstar the whalers have not seen any feeding whales in those areas. Also, Nuiqsut whalers report that since the development of Northstar they rarely scout for whales in that area, and certainly Figures 5 and 7 demonstrate that has been the case since 2001.

Non-Whaling Vessel Activity in 2009

Nuiqsut whalers have some generalized perceptions as to how industrial activities affect their hunt, based on their experiences of such activities. The proximity of onshore development facilitates the logistical support of Cross Island whaling, and Nuiqsut whalers make frequent supply runs (weather permitting) between Cross Island and West Dock. Logistical support and emergency assistance from industry are at times requested by the whalers. However, whalers perceive offshore oil and gas activities as potentially harmful to whaling, primarily because of noise and/or potential spills and accidents. One clear expression of this, based on their past experience, is Long (1996):

> A lot of times there is controversy between the whalers and the oil industry. … A little sound, east of Cross Island, where the Kuvlum Prospect, Hammerhead, and Galahad development units are located, will affect the bowhead whale. … As I stated before, when there is industry activity, we have to go very far out for whales … [sentences reordered, but meaning not altered].

Appendix B summarizes the specific observations of non-whaling vessel activities by Nuiqsut whalers during the 2009 Cross Island whaling season. It also includes observations on whaling activities. Table 9 compiles this information in a more compact form. Note that Table 9 (and Appendix B) only report vessel interactions reported to or otherwise known to the researcher. All references to "vessels" in this section refer to vessels other than whaling vessels. The researcher (MSG), who was staying with the whalers on Cross Island, recorded this information, and also checked it with the Deadhorse Communication Center Call Log. Summaries are included only for those days on which vessel activity was reported, or for days on which whale scouting

activity occurred. Based on the daily information in Appendix B, the following summary has been compiled, attempting to draw some generalizations about the reported effects of vessel traffic and industrial activities on the 2009 Cross Island subsistence whaling season.

In strong contrast to the 2008 season, there were two instances in 2009 when the whalers filed Vessel Conflict Incident reports about vessels that they encountered while out scouting for whales. These incidents occurred on September 1 and September 2. Whalers did report other instances when they observed vessels while they were out whaling (September 3 and September 12), but in those cases did not file Vessel Conflict Incident reports through the Deadhorse Com Center. It is not clear why reports were not filed in the latter cases, or if such reports were filed directly with AEWC. It may be that the whalers were frustrated by the process of logging complaints to no apparent purpose, since the complaints did not seem to affect the non-whaling

TABLE 9: Non-whaling vessels encountered by Cross Island whaling boats.

Date	Time	Vessel or Incident	Other Notes
9/01	12:19	*Seneca* barge (Crowley)	NE of Cross Island, traveling to the west. Vessel Conflict Incident report filed with Deadhorse Com Center and AEWC about 12:38pm (Hickey 2009a). First seen from Cross Island and then reported by whaling vessels out on the water.
9/02	05:59	*Avik* barge (Crowley)	Several miles south of Cross Island, reported by whaling vessels out on the water and Vessel Conflict Incident filed (Hickey 2009b).
9/02	20:40	*Begger* (private yacht)	Roughly 10 km (6 mi) north of Cross Island, reported by whaling vessel on the water. Vessel Conflict Incident files with the Deadhorse Com Center about 21:13 (Hickey 2009b).
9/03	06:58	Unidentified barge	Whalers reported that the barge was about 8 km (5 mi) away from them, straight North, and was "kind of loud", so they went east away from the barge. They think that the barge was going toward Barrow (west overall) and was moving pretty fast. They reported it to the Deadhorse Com Center but no Vessel Conflict Incident was filed.
9/12	14:12	*Mikkelsen Bay* (ACS vessel)	Reported by whaling vessel on the water. The *Bay*-class vessel was moving west, so the whaling vessel turned around and went the other way (SE) to join the other whalers. Reported to the Deadhorse Com Center who in turn contacted the *Mikkelsen Bay*. The *Mikkelsen Bay* immediately aborted its activities in the Northstar DASAR array and returned to West Dock, with a short stop at Northstar. It is not clear from the researcher's notes whether the other boats had also encountered a vessel (or seen this one) earlier in the day.

Note: This table lists only those vessel encounters made known to the researcher and so is not necessarily complete. It also is not a complete listing of all non-whaling vessel traffic in the Cross Island area during the 2009 whaling season.

vessel traffic. It should be noted that one incident listed in Table 8 involved Northstar activities. A whaling boat encountered the *Mikkelsen Bay* on September 12 when it was servicing the DASAR array offshore Northstar. The whaling boat contacted the Deadhorse Com Center, which in turn contacted the *Mikkelsen Bay,* who upon this notification aborted its activities and returned to West Dock, with a short stop at Northstar to retrieve an acoustic recorder. The other incidents all involved vessels whose owners and operators were not parties to the Conflict Avoidance Agreement (CAA).

The estimated positions all five of these vessel sightings are displayed in relation to the reported whale sightings for the 2009 Cross Island subsistence whale season (Figure 9). A precise location was obtained only for the Mikkelsen Bay. For the other four, positions were estimated from the location of the whaling boat from which they were seen, or from nearby boats when no track was available for a given whaling boat. The position for the *Avik* was estimated by one of the captain's but no track was available as a possible reference for this position. The position of the *Seneca,* seen on September 1, is also only roughly approximated. The specific location of this vessel when it was seen was not provided, and no tracks for nearby boats are available. The point of Figure 9 is to indicate that the observed non-whaling vessels were in the area where Cross Island whalers were looking for, and spotting, whales, although no whales were seen in these areas at the specific times when non-whaling vessels were present.

Cross Island whaling was potentially more affected by commercial, industrial and private vessel traffic in 2009 than in any previously documented season (2001-2008), in terms of the number of encounters and the volume of vessel traffic observed. In 2005, there was an incident that probably directly and adversely affected the active pursuit of a bowhead whale. During 2009, none of these incidents affected the immediate pursuit of whales, but more generally potentially contributed to the disturbance of whales and their skittish behavior, making it more difficult to see and approach them. AEWC and the whalers have long been aware that the vessels operated by entities that are not parties to the CAA may have adverse effects on whaling activities. Until a mechanism is developed to include such vessels in at least the reporting and communication requirements (via the Deadhorse Com Center), this will continue to be the case. Most whalers seemed to think that the September 1 incident, and vessel traffic to the NE of Cross Island in general, were the most important concern.

Nuiqsut whalers have some generalized perceptions as to how industrial activities affect their hunt, based on their experiences of such activities. The proximity of onshore development facilitates the logistical support of Cross Island whaling, and Nuiqsut whalers make supply runs between Cross Island and West Dock. Logistical support and emergency assistance are at times requested by the whalers. However, whalers perceive offshore oil and gas activities as potentially adverse to whaling, primarily because of noise and/or potential spills and accidents.

Insofar as Northstar activities are concerned, whalers report experiencing some immediate and direct effects on their choices of where to scout or look for whales from Northstar's development and production activities, although oil spills and noise are their major concerns, because of the potential disruptive effects they could have. Nuiqsut whalers avoid searching for whales near Northstar, although in years with adverse ice conditions they will search in that area since it

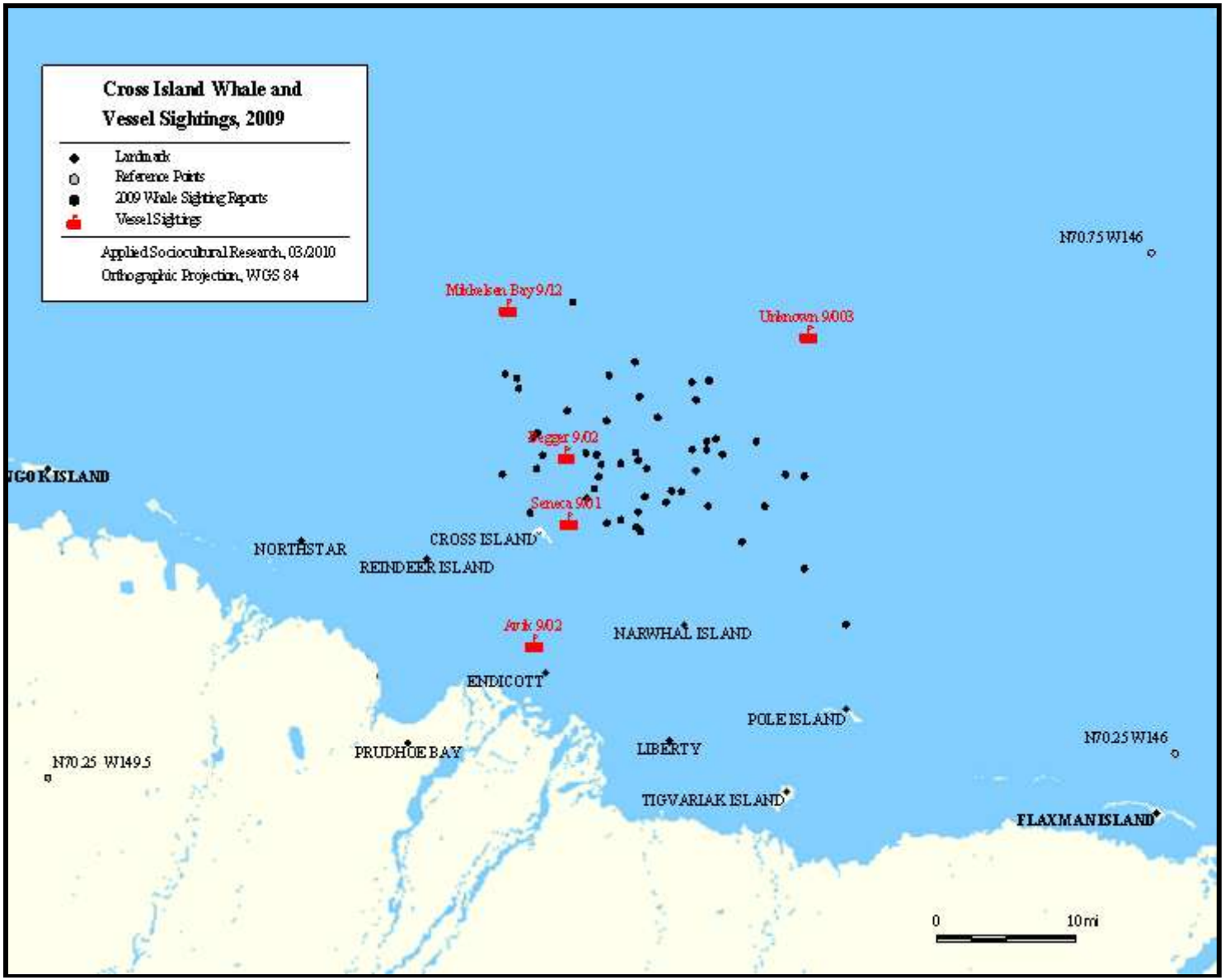


FIGURE 9: Cross Island whale and vessel sighting report locations, 2009

tends to be accessible when other areas are not (e.g., in the 2005 and 2006 season). In 1997(prior to the construction of Seal/Northstar island), they had to hunt in this area west and NW of Cross Island because ice and other conditions had prevented them from accessing the area to the NE of Cross Island. They landed a whale that year not far from the current location of Northstar. Nuiqsut whalers also report that, prior to the development of Northstar, they had observed whales feeding in the area of Reindeer Island (especially numerous in 1997), but that they have not seen this since the development of Northstar. During 2009, one whaling boat encountered the ACS boat the *Mikkelsen Bay* offshore of Northstar while scouting by itself, and turned back to the east after the encounter. Such incidents may reinforce the whalers' preference not to whale near industry facilities, if they can avoid doing so. Nuiqsut whalers report that this preference has had the effect of making the area around Northstar a "no whaling" zone for them.

BP has made efforts to decrease the risk of spills and to reduce the effects of vessel and air traffic to Northstar as much as practicable. Northstar is west of Cross Island and "downstream" of the westward bowhead migration and where Nuiqsut whalers normally hunt. Thus, the hunters do not expect Northstar to be as problematic, in terms of direct disturbance and interference to whaling, as would be development to the north and east of Cross Island (Ahmaogak 2002: 5, 14).

Planned Future Activities

As this is written, plans for the 2010 field season are being discussed with the Nuiqsut whalers. Given some of the concerns whalers expressed during the 2009 field season, modifications in the implementation of the project are probable. It is to be hoped that these modifications, developed in consultation with the Nuiqsut whalers, will result in the continued success of the project. This draft report will also be presented to the Nuiqsut Whaling Captains' Association and their comments incorporated into the final version, which should be completed in April. A short presentation of the results of the 2009 field season was given at the Open Water Meeting in Anchorage the week of March 22.

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Electronic Appendices (files that will appear on accompanying CD-ROM for final version of this report)

Annual Assessment of Subsistence Bowhead Whaling Near Cross Island, 2009 Annual Report – PDF file "AnRpt2009.pdf"

PDF format files containing displays of combined whale boat GPS tracks for all days in 2009 on which at least one boat went scouting for whales: "AppendixA.pdf"

PDF format file containing all boat report forms for 2009: "AppendixB.pdf"

Data Logger file from Cross Island weather station for 2009 in Excel format: "AppendixC.xls".

Appendix A: GPS Tracks by Day, 2009

Appendix A contains Figures for all GPS tracks collected from whaling boats during the 2009 Cross Island subsistence whaling season. In the interest of space, and to more clearly indicate the day-to-day coordination between the boats, all tracks collected for the same day are shown in one figure. However, this sometimes makes it difficult to see the individual boat tracks, and one of the whaling captains requested that fewer tracks be displayed on the figures. As a compromise between 12 daily figures and 93 individual boat figures, Appendix A contains the 12 daily boat figures and 18 additional figures that each contains half of the tracks for the 9 days when more than 5 boats went scouting for whales. On the 3 days when fewer than 6 boats went scouting, the "daily" figure seemed sufficiently clear that additional figures were not required. The two groupings of crews have been kept consistent for these 18 additional figures, reflecting the general pattern of coordination between the Oyagak and Ipalook crews on the one hand, and the Nukapigak and Taalak crews on the other. Of course, this is only a division of graphical convenience, and all boats coordinated with all other boats at one time or another.

The color coding on the figures was chosen only for the sake of contrast and clarity, while the order of the boats displayed in the legends is basically alphabetical (by acronym). In most cases, the color and location of the legend boxes differentiates the 12 figures that contain all tracks for the days they represent (legend with a blue background located on the bottom of the figures) from the 18 figures with about half the tracks for the days they represent (legend with a baize background located on the top of the figures).

The NAP boat was disabled for most of the season, making scouting trips only on 8/28/09 and 8/29/09. The NAP crew also went scouting on 9/03/09, but used the IP1 boat for a short trip in the afternoon. The IP1 boat crew only went out on one trip on 9/03/09, in the morning. BO1, BO2, NUK3, and TAL1 also made only one trip on 9/03/09. IAN, IP2, NUK1, and TAL2 all made two trips on 9/03/09. IP2's second trip was coordinated with NAP's (using the borrowed IP1 boat).

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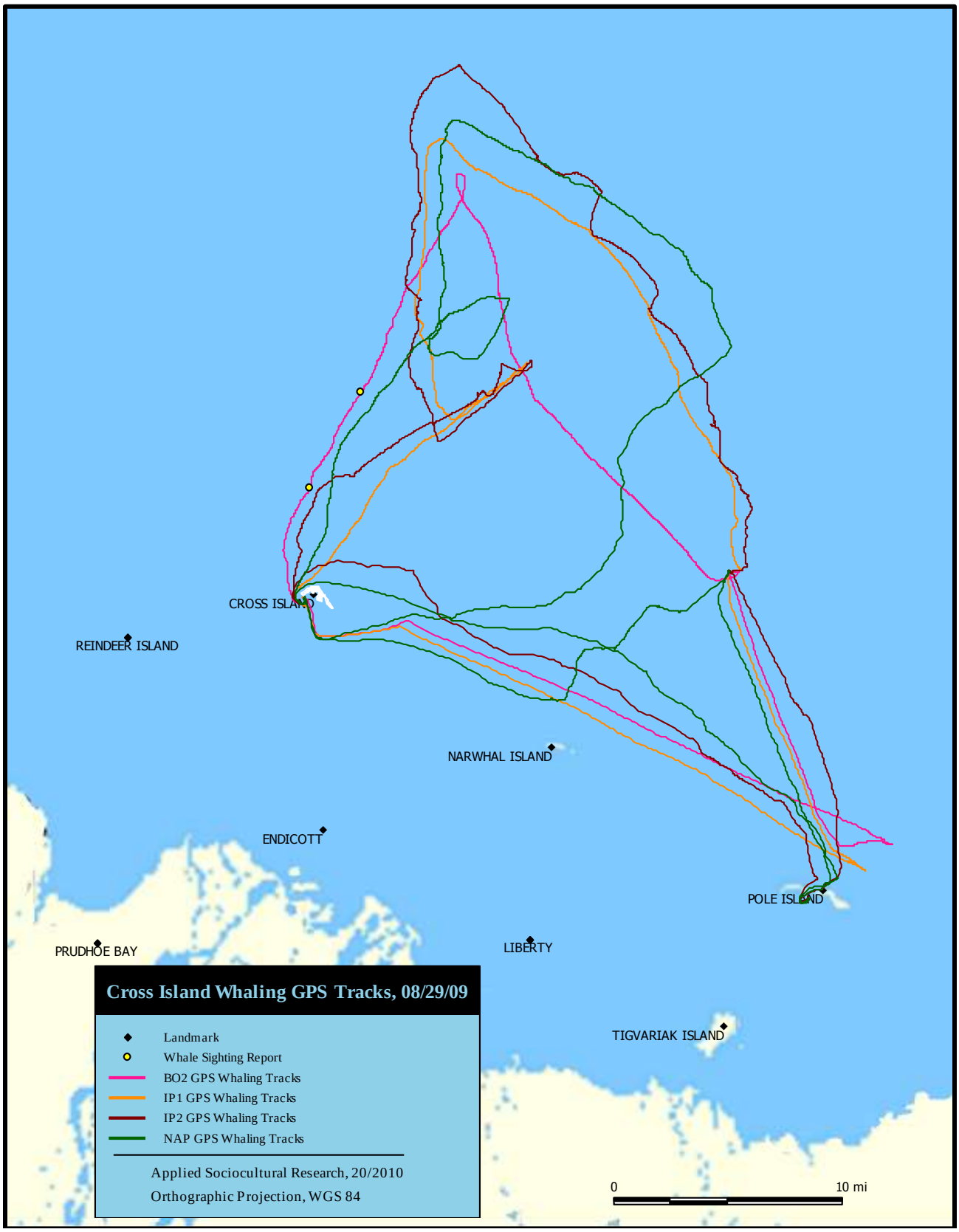
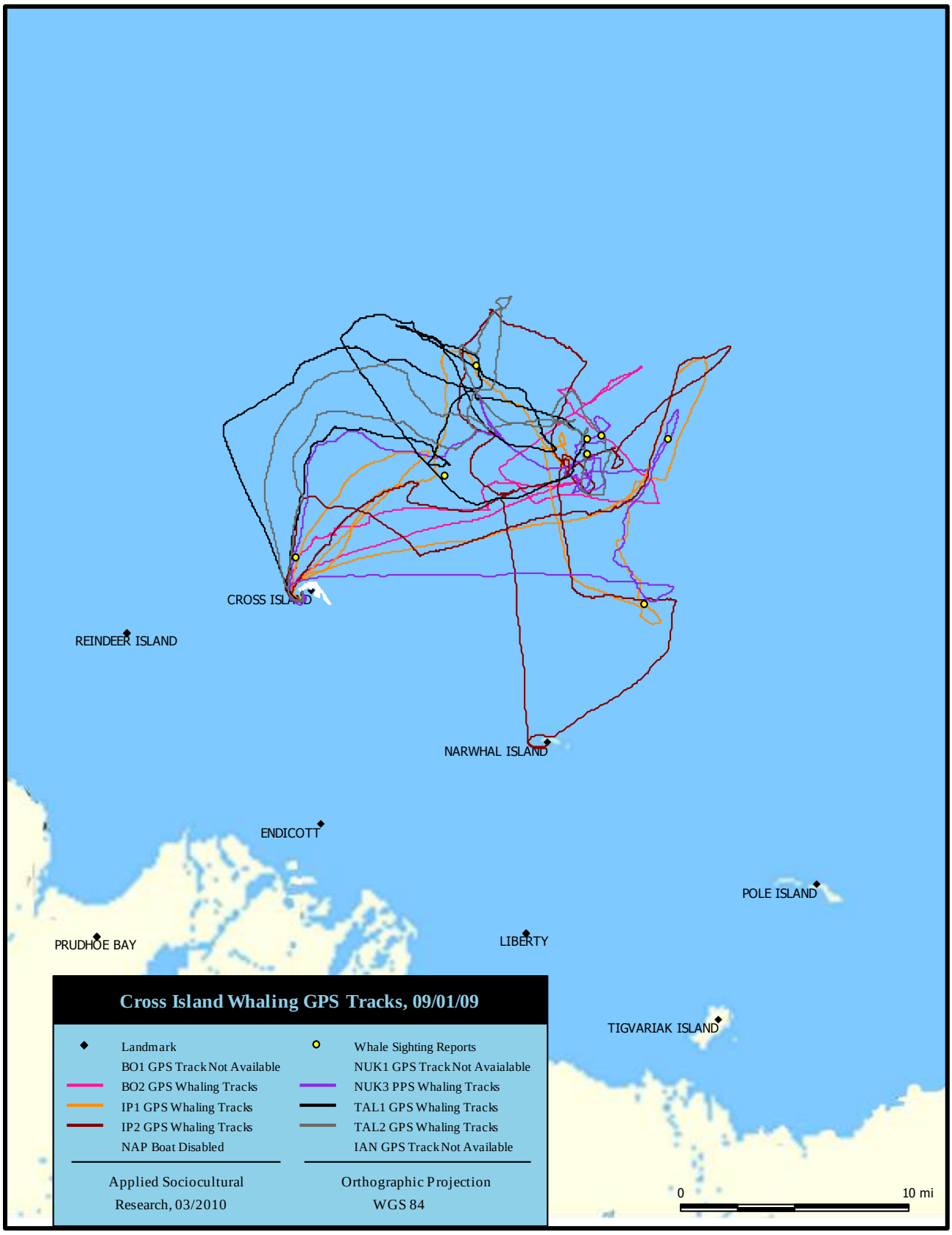
Appendix A: GPS Tracks by Day, 2009
08/28/09 – All Tracks

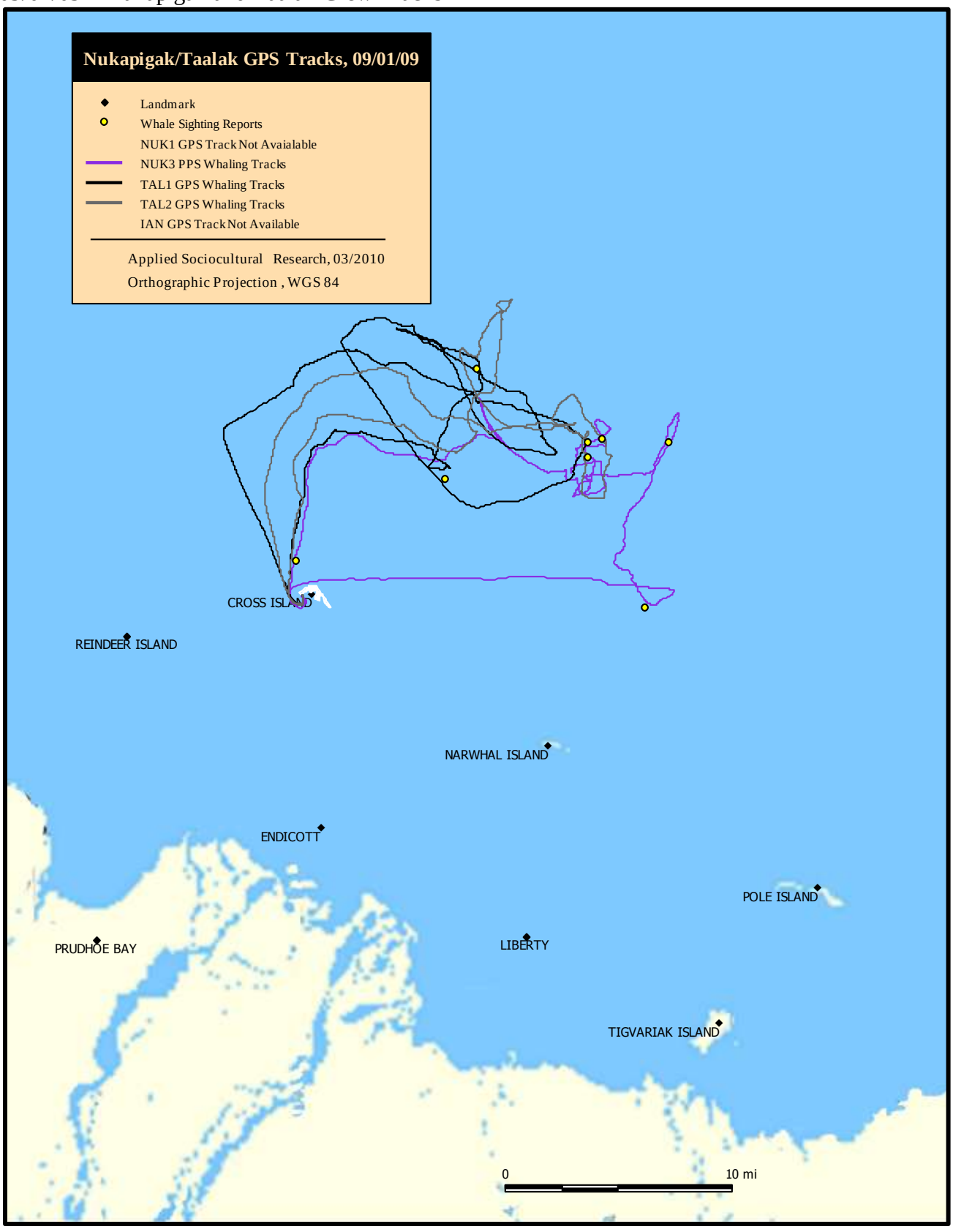
08/29/09 – All Tracks



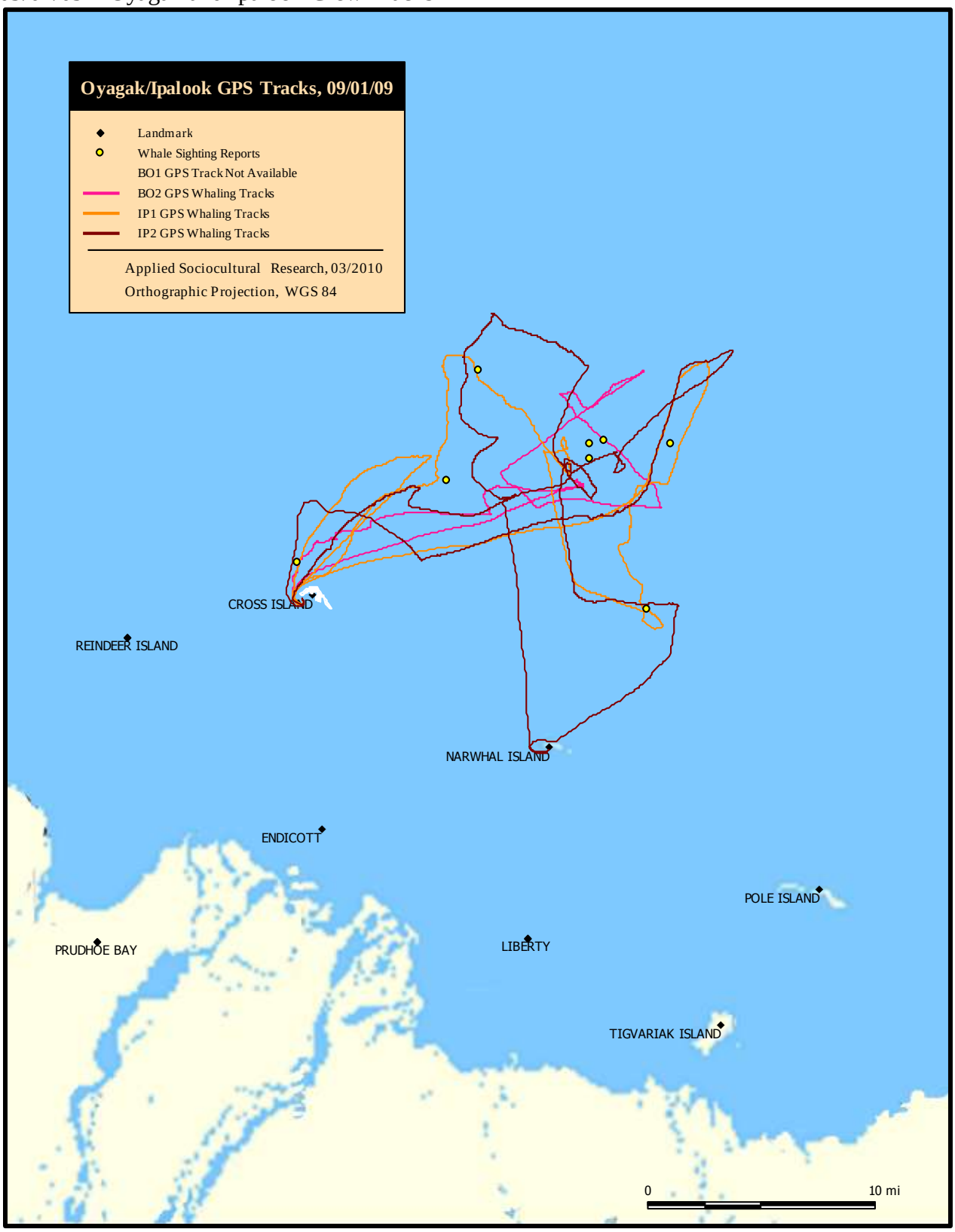
09/01/09 – All Tracks



09/01/09 – Nukapigak and Taalak Crew Tracks



09/01/09 – Oyagak and Ipalook Crew Tracks



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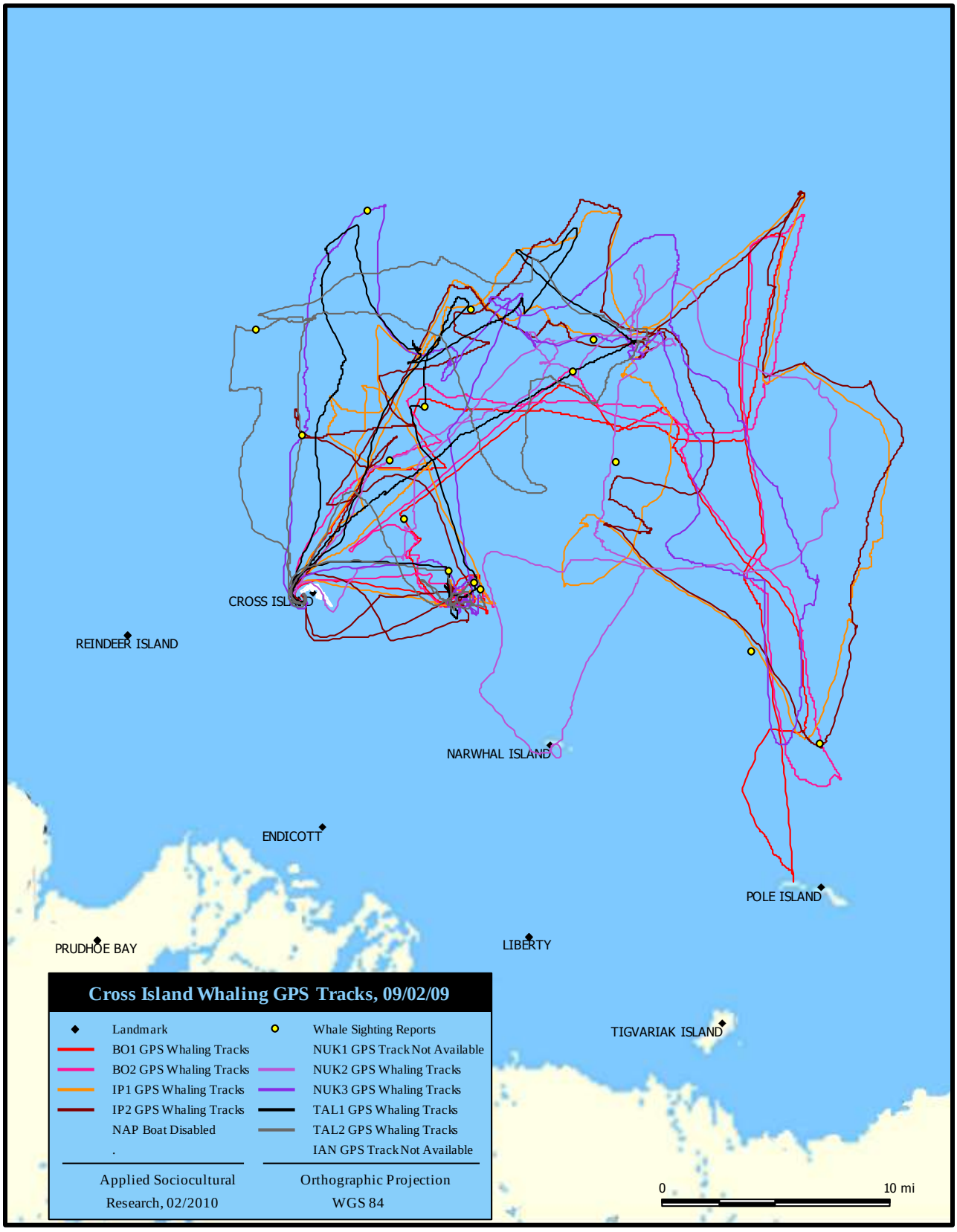
09/02/09 – All Tracks



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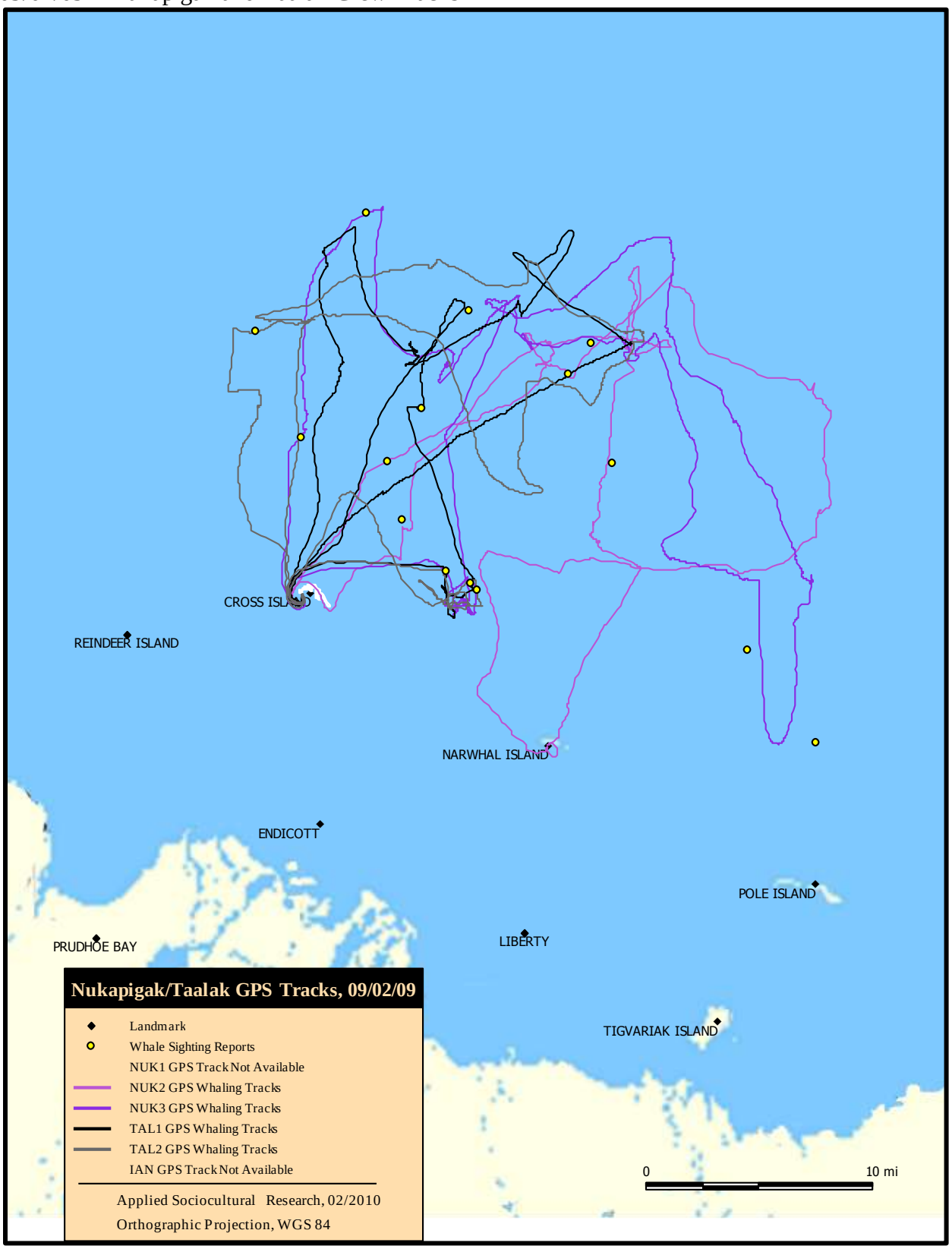

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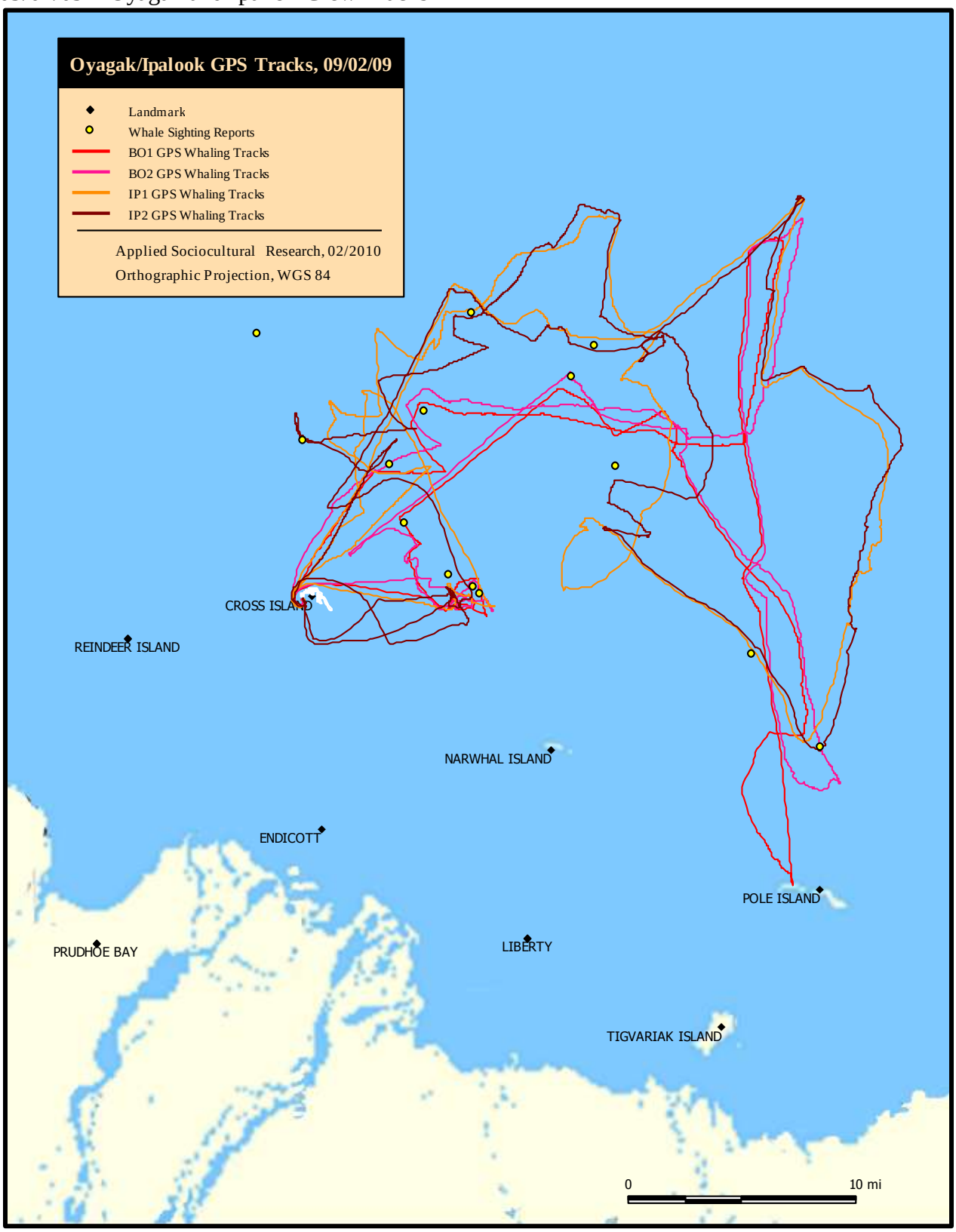

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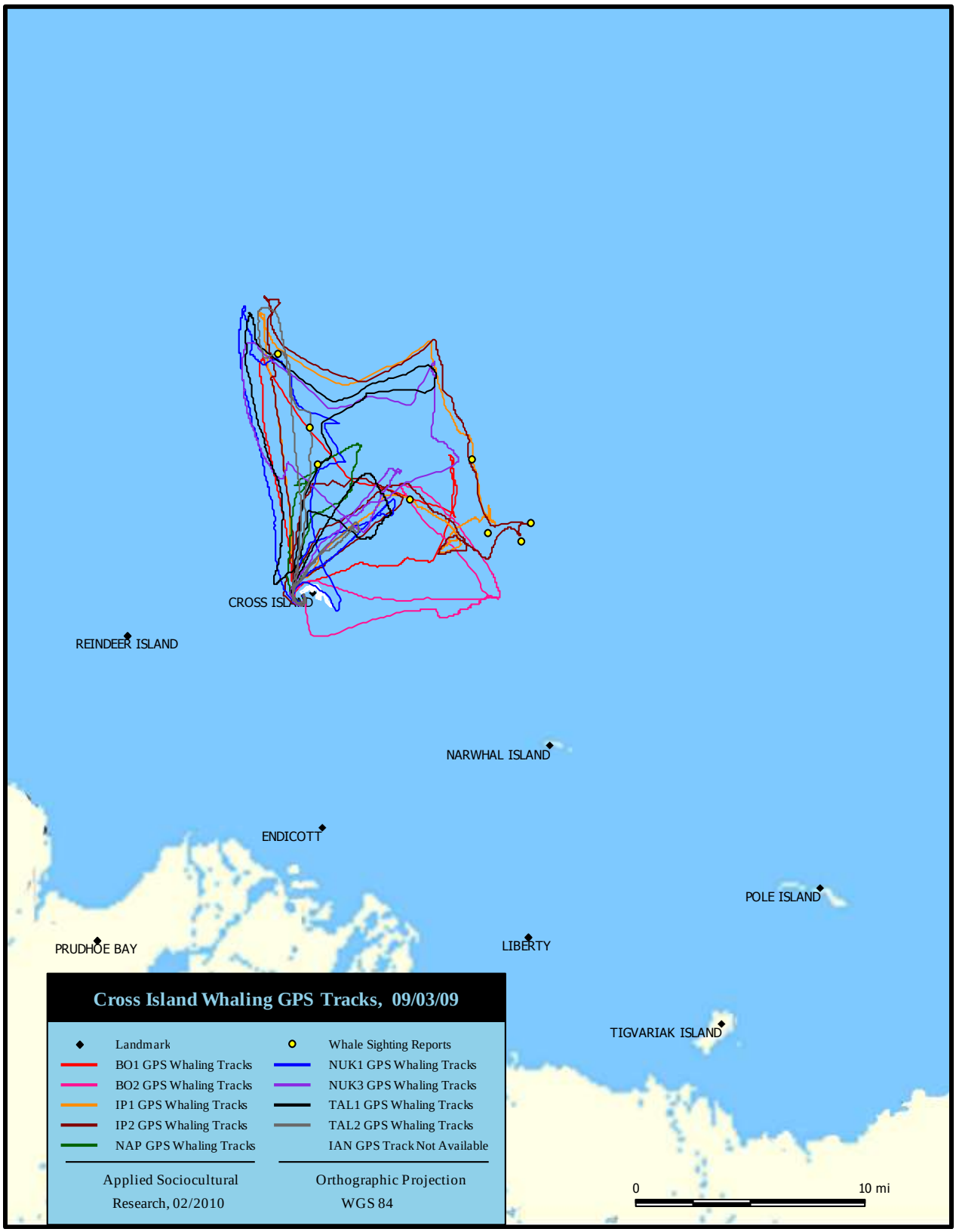
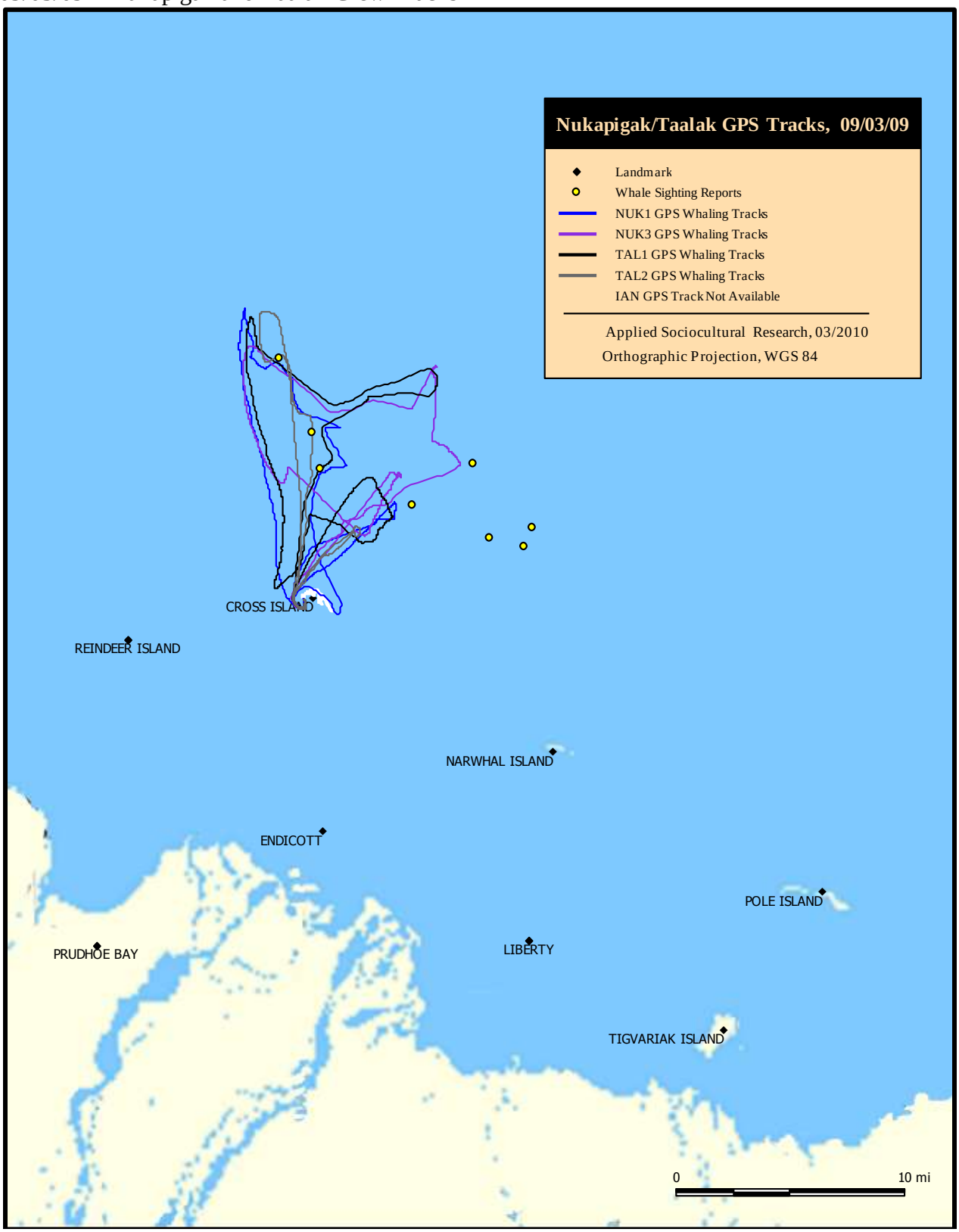
09/03/09 – All Tracks



Note: NAP boat was still disabled – the NAP crew used the IP1 boat for their scouting trip

09/03/09 – Nukapigak and Taalak Crew Tracks



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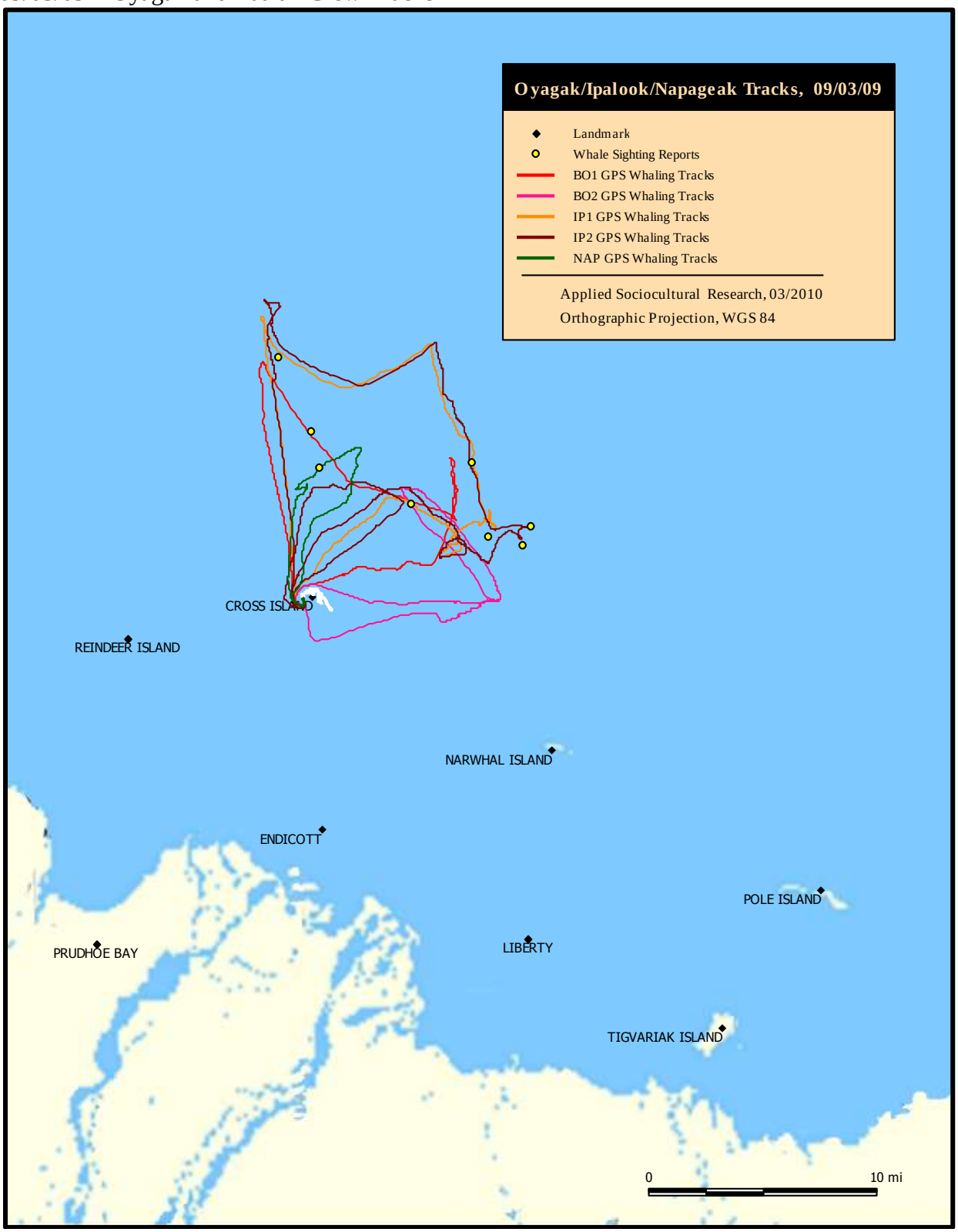

Note: NAP boat was still disabled – the NAP crew used the IP1 boat for their scouting trip

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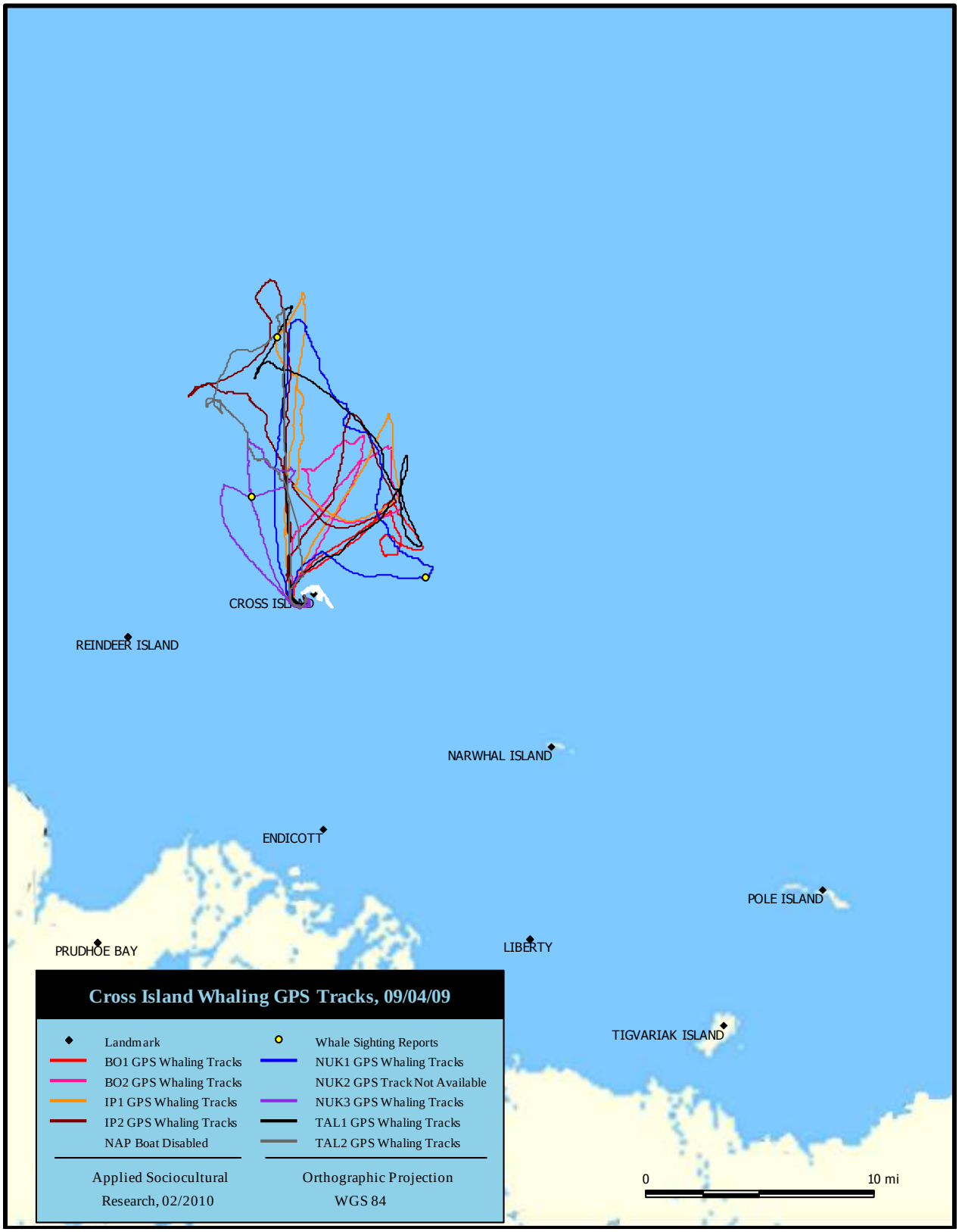
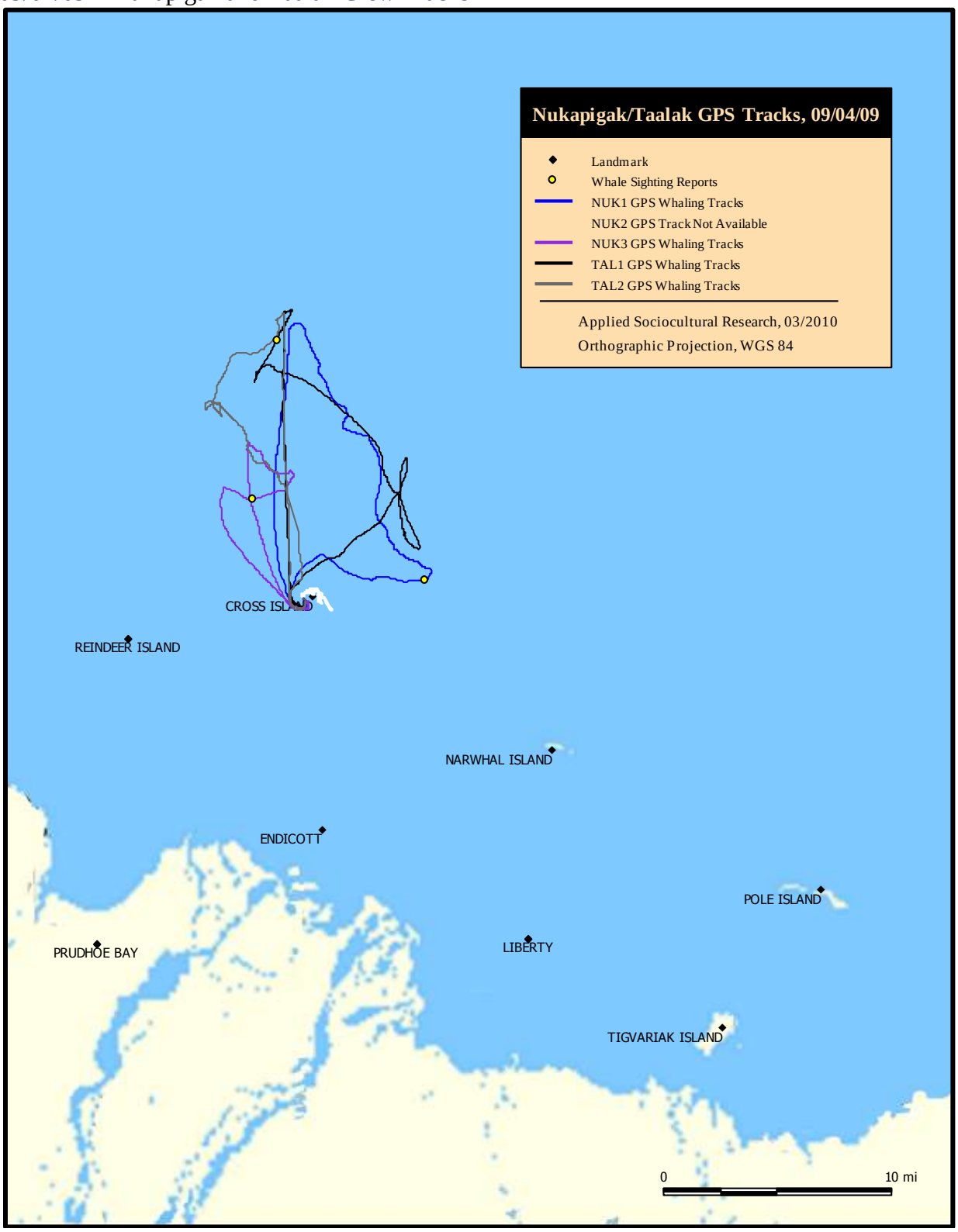
09/04/09 – All Tracks



09/04/09 – Nukapigak and Taalak Crew Tracks



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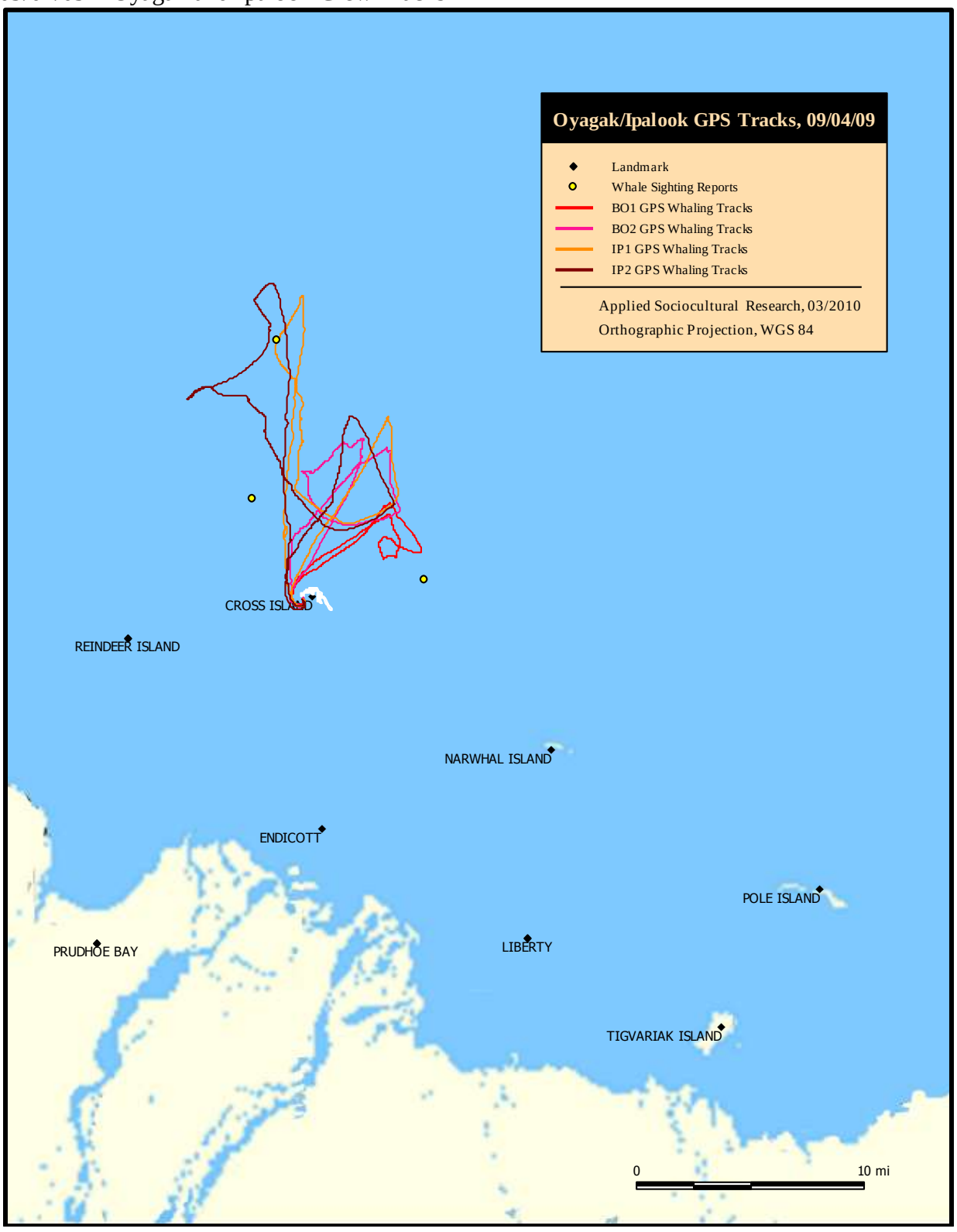

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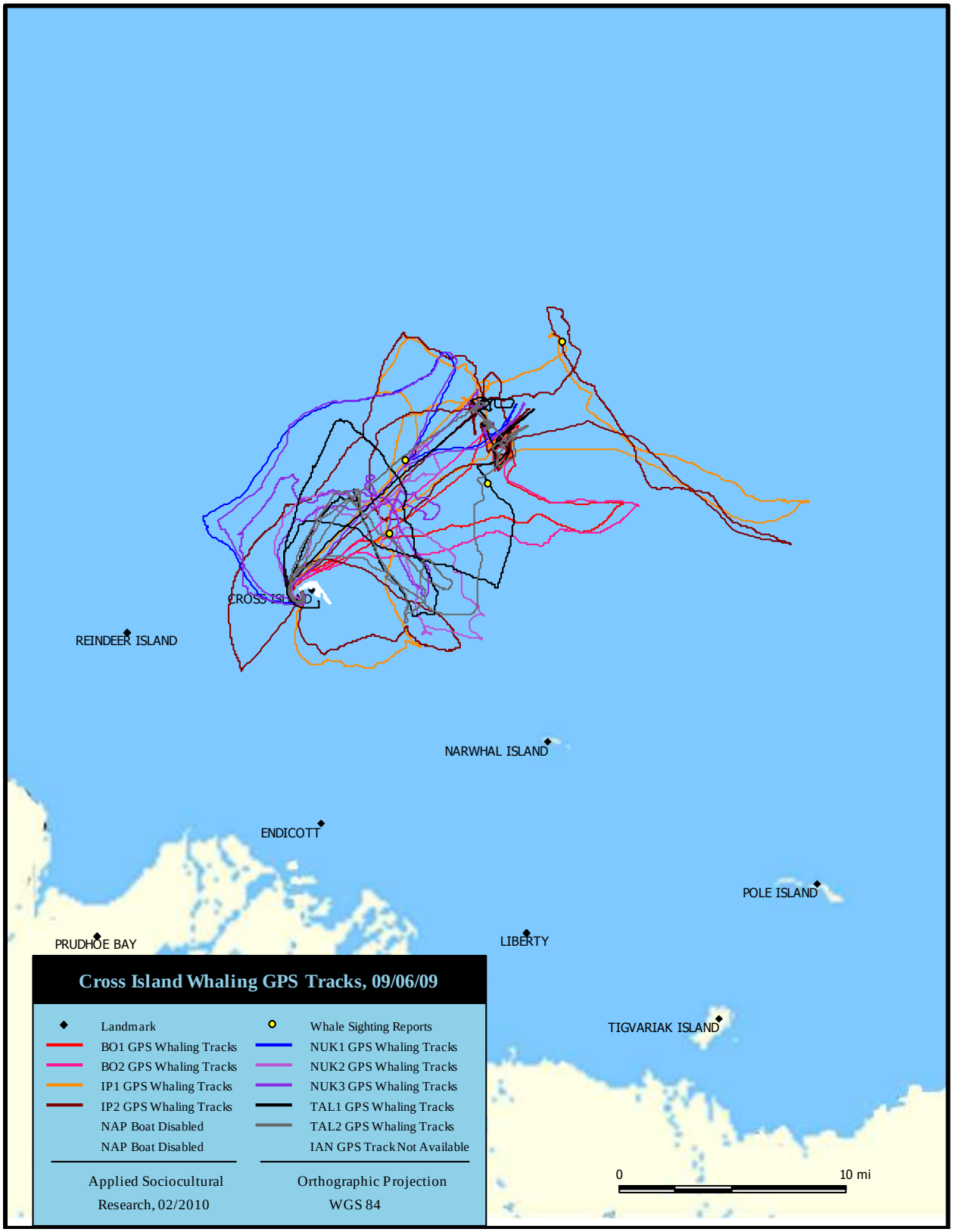
09/06/09 – All Tracks



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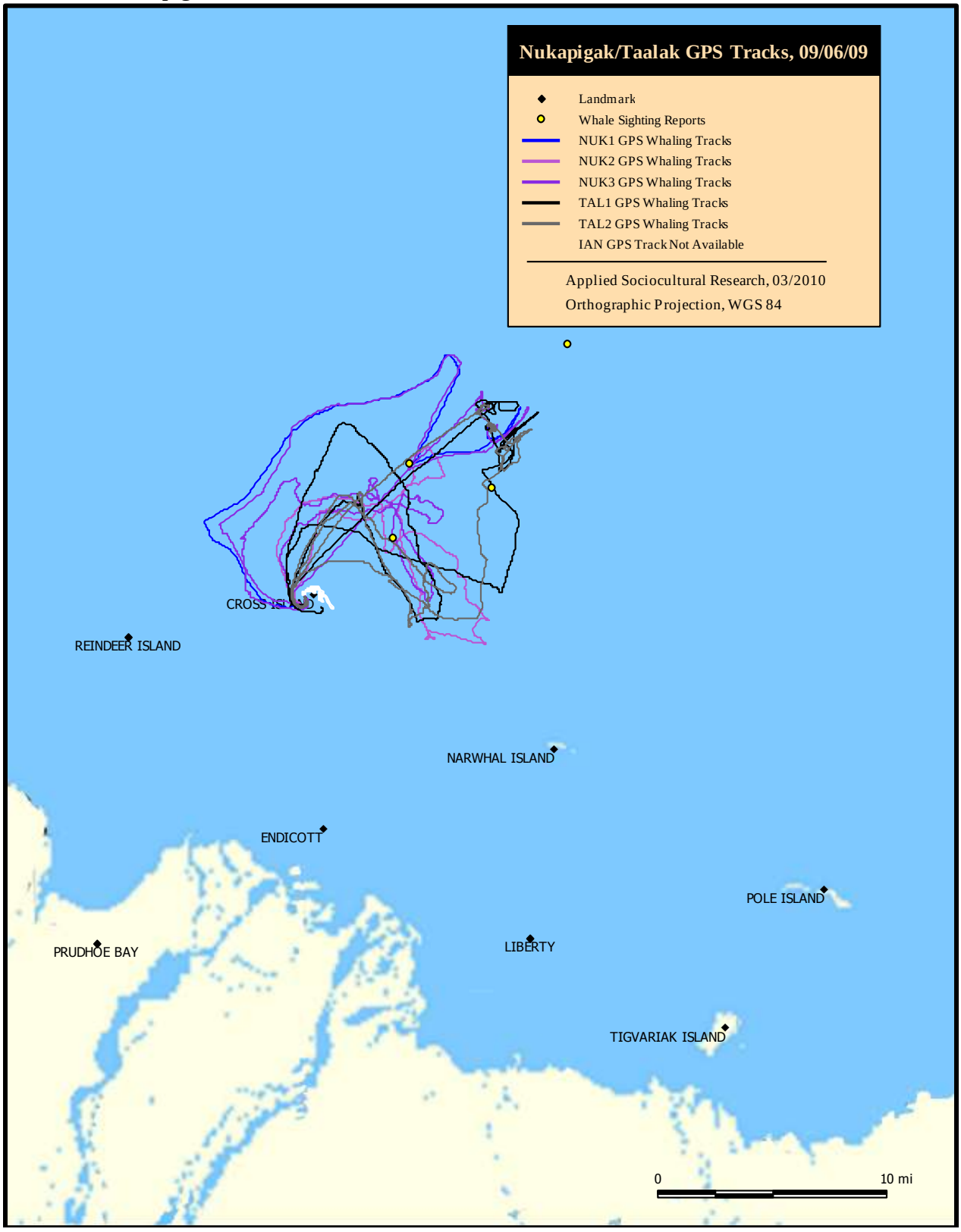

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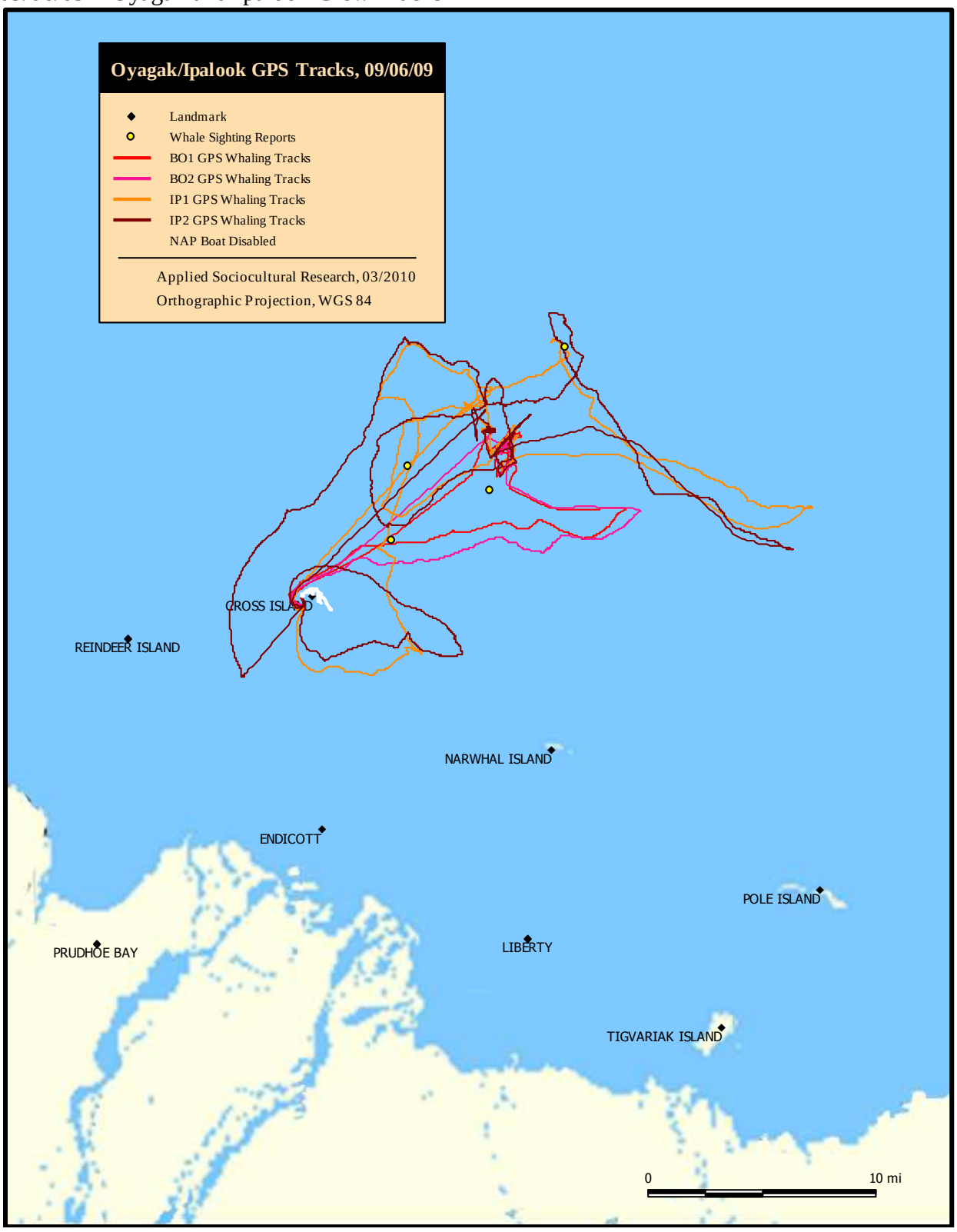

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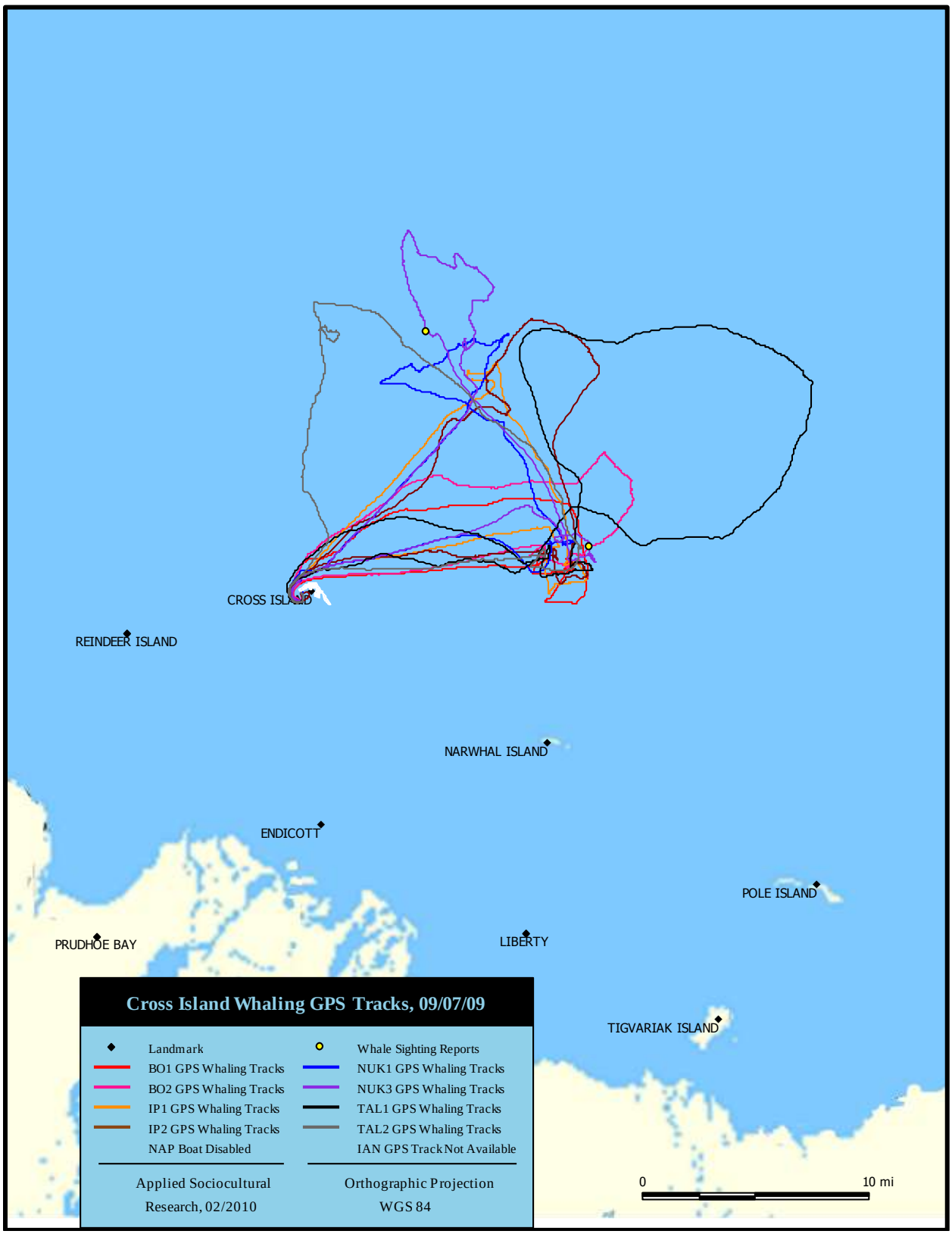
09/07/09 – All Tracks



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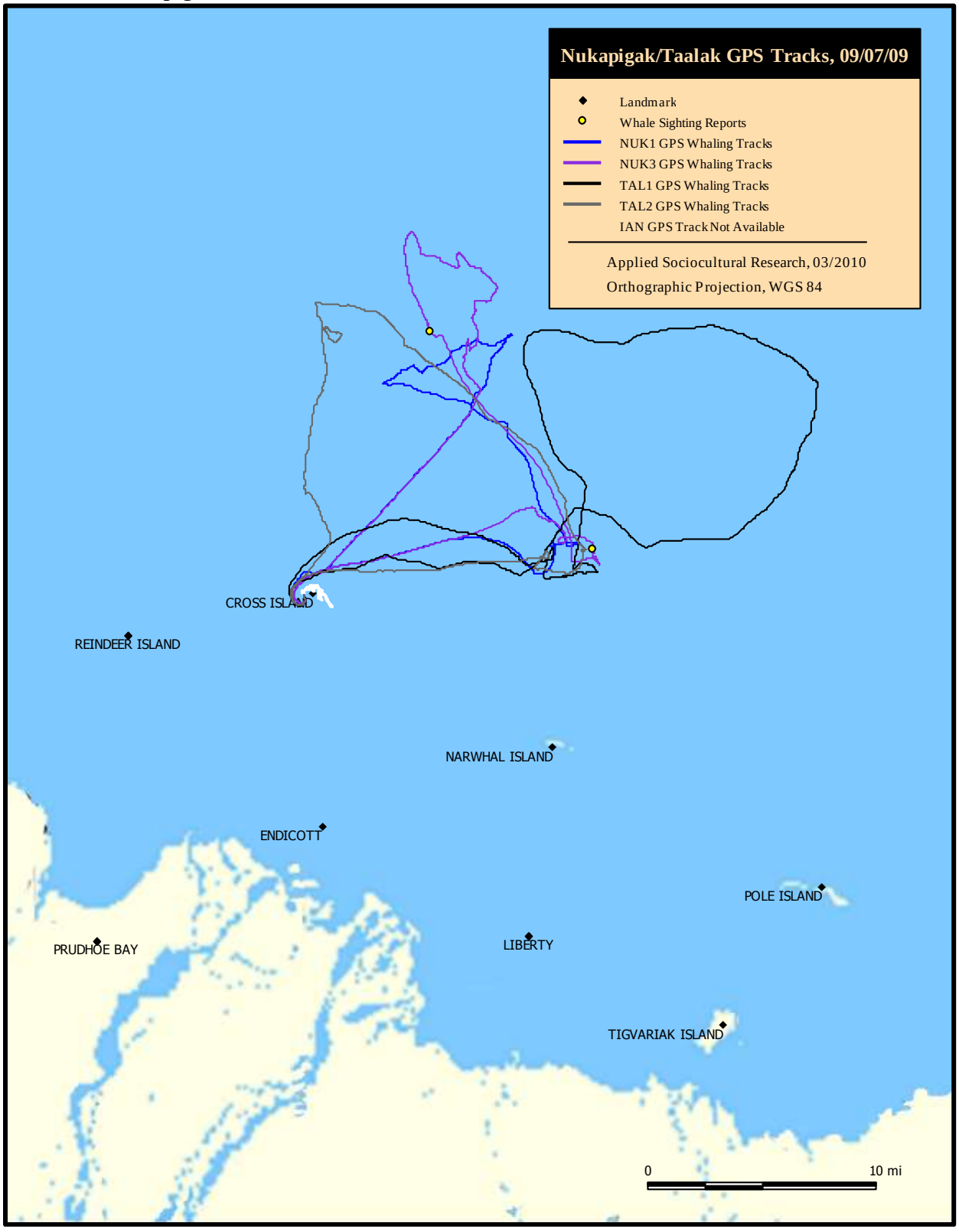

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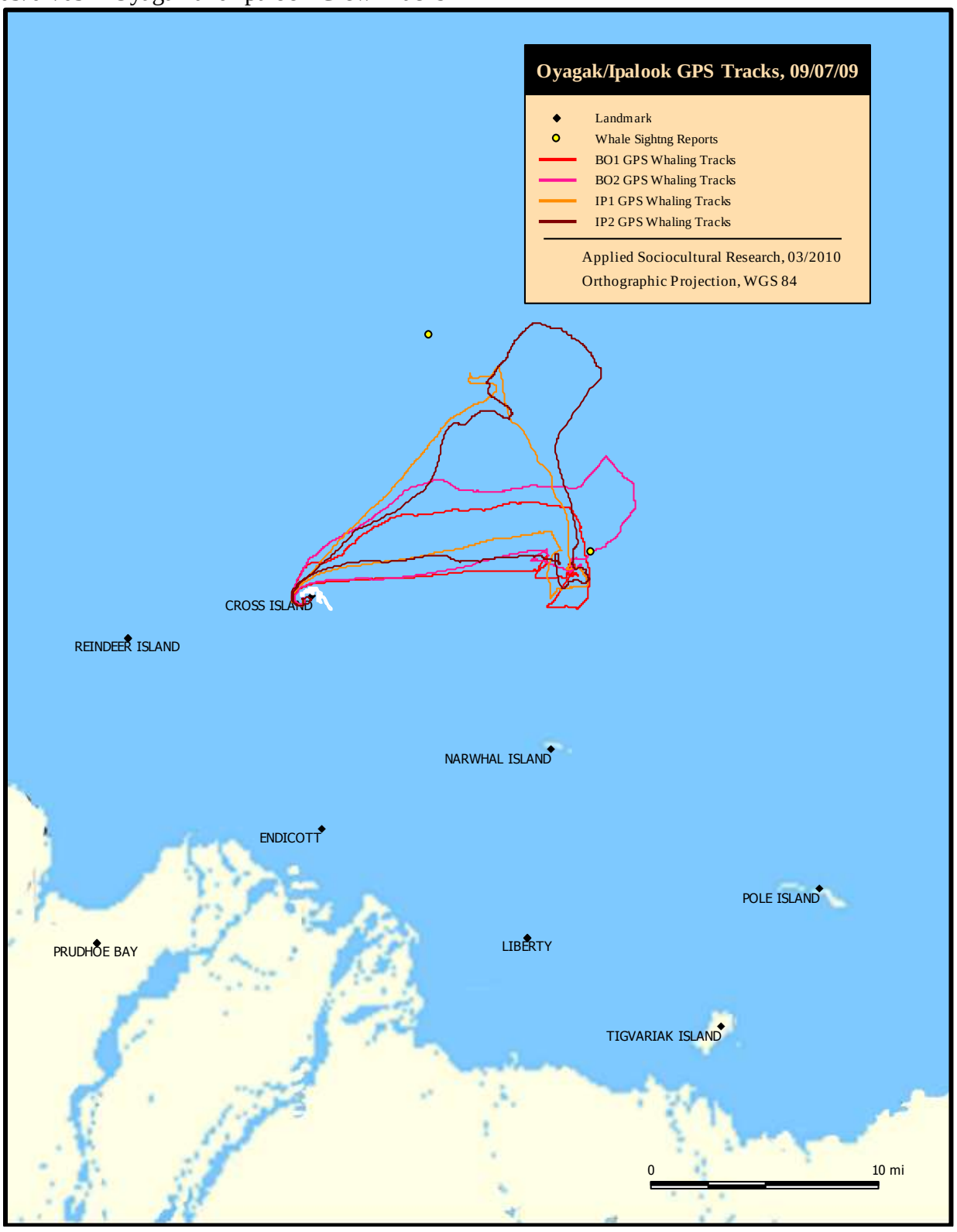

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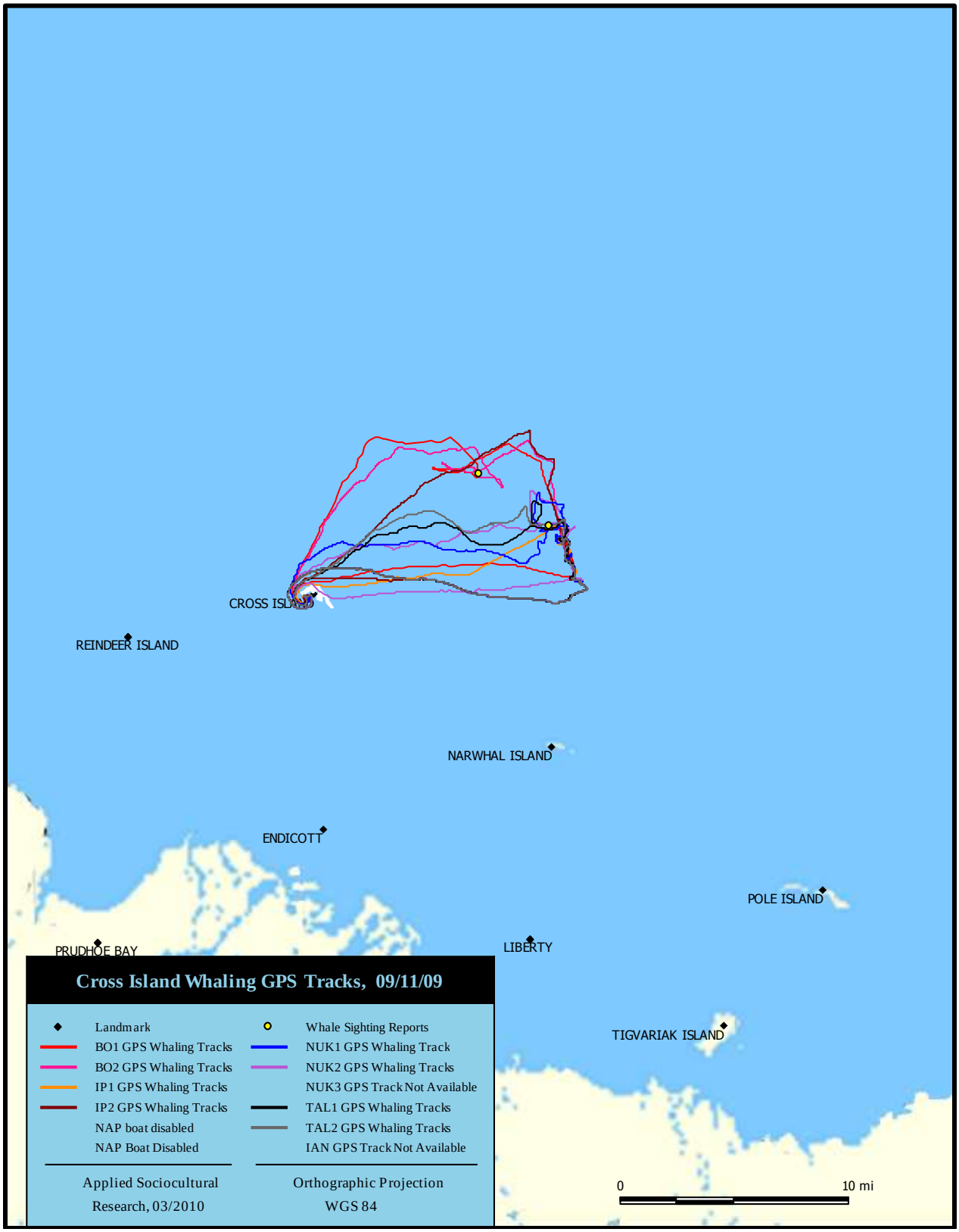

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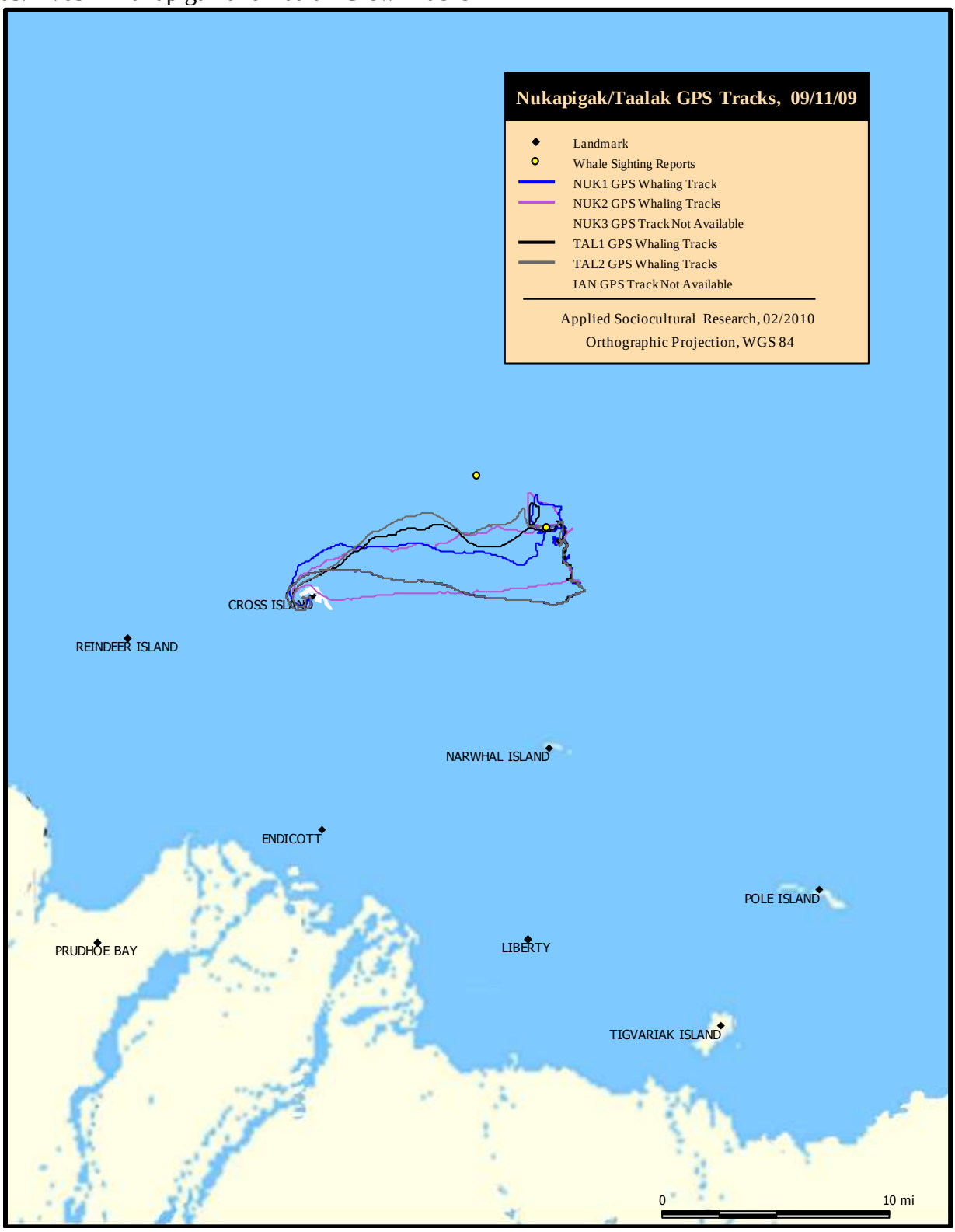

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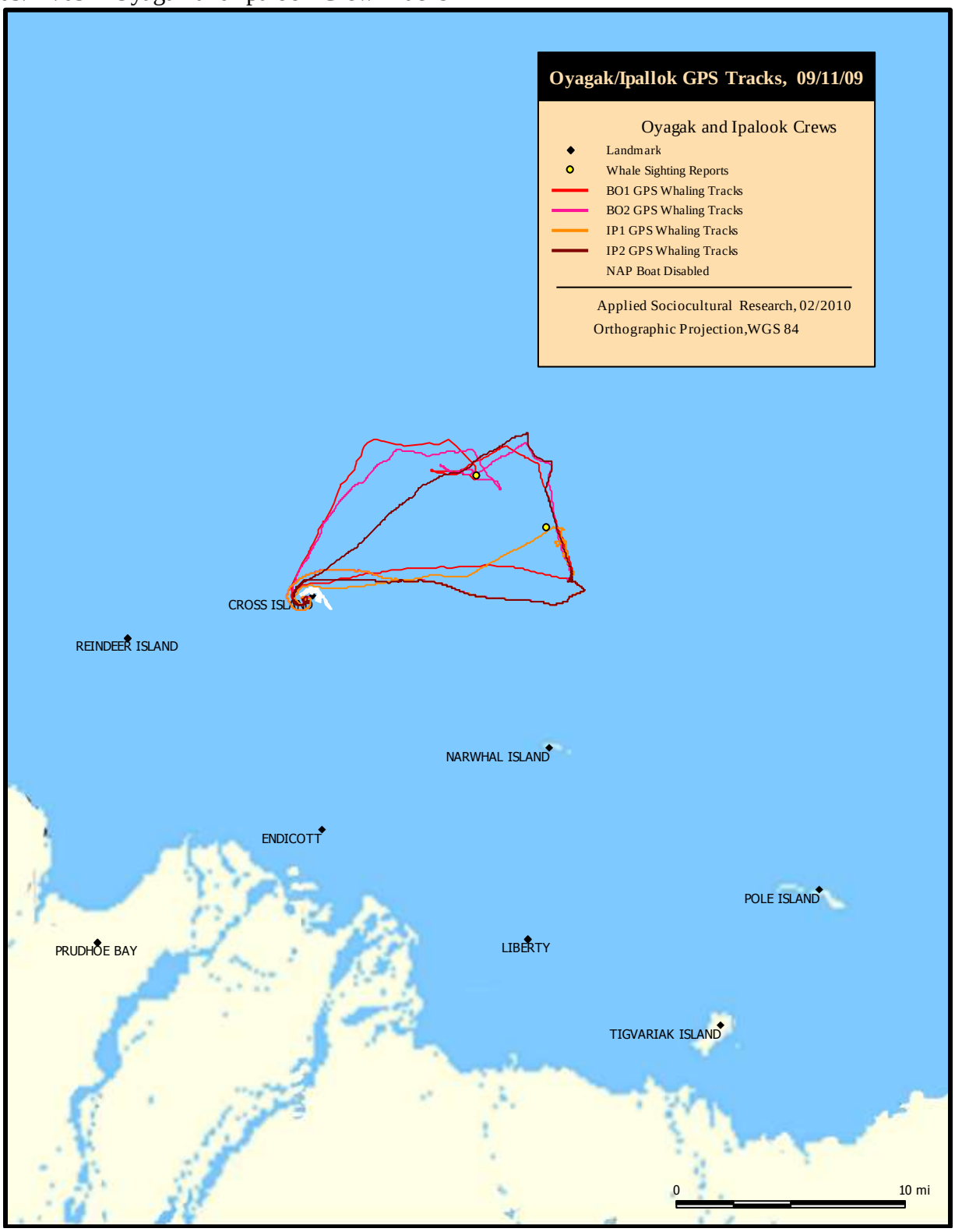

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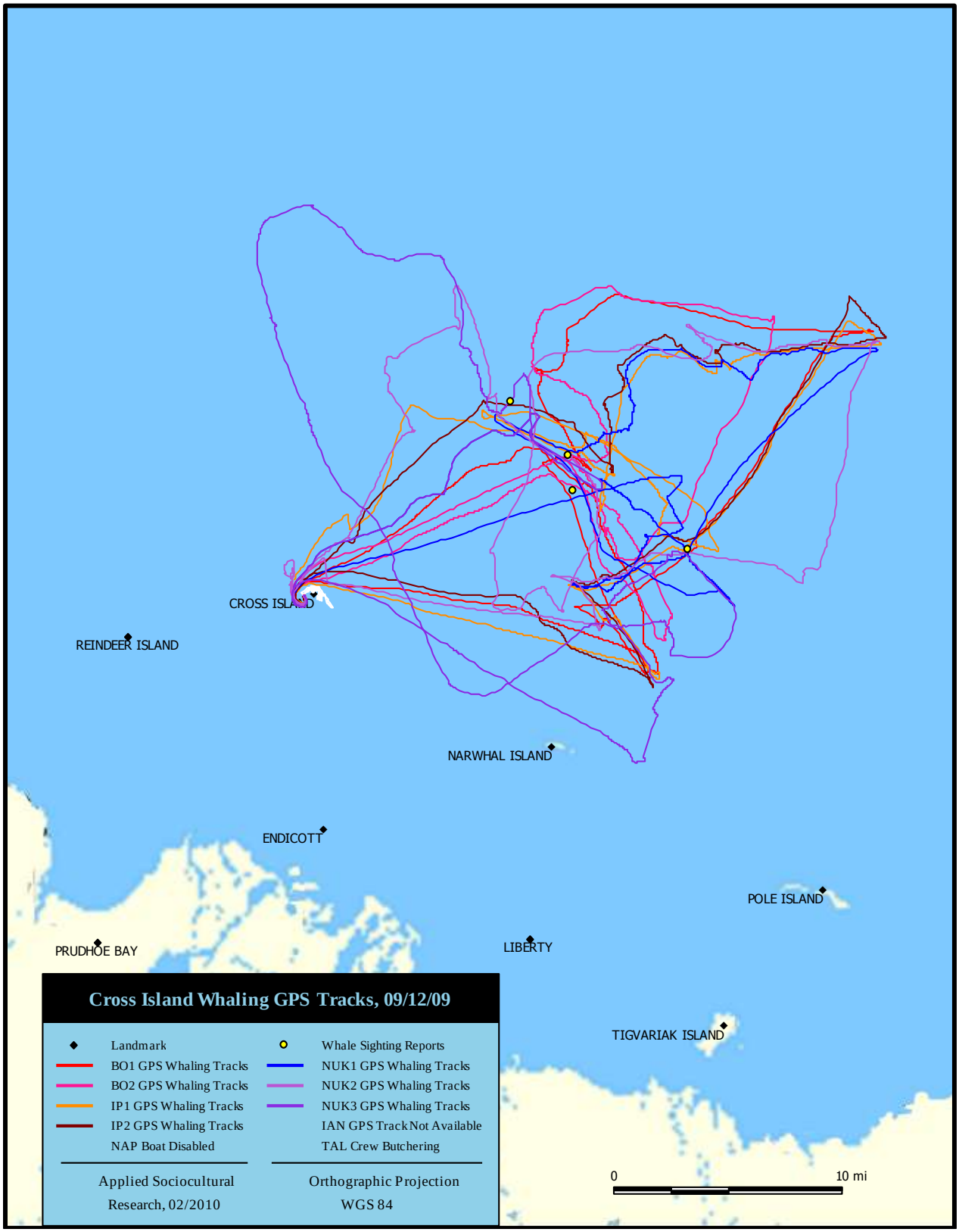

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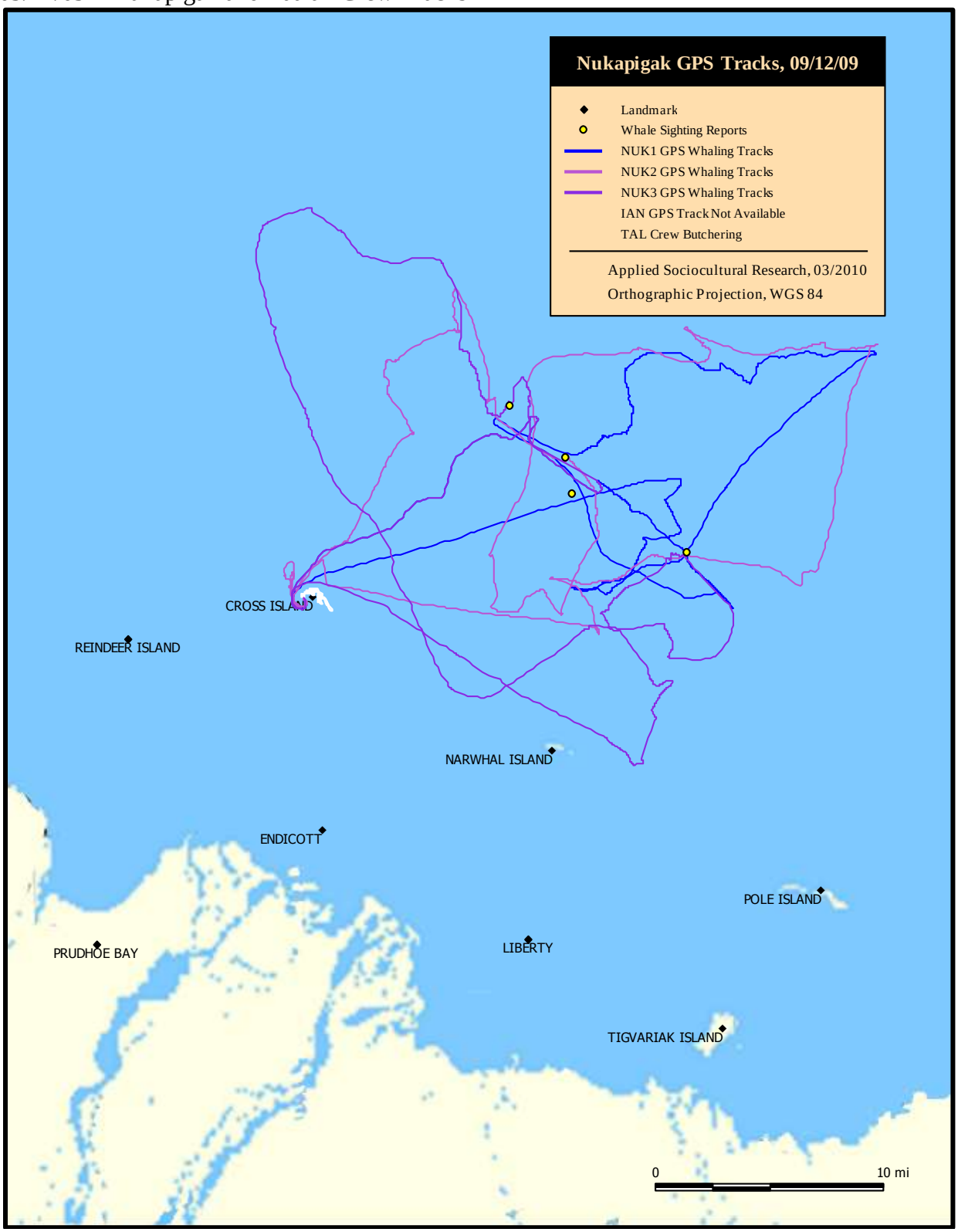

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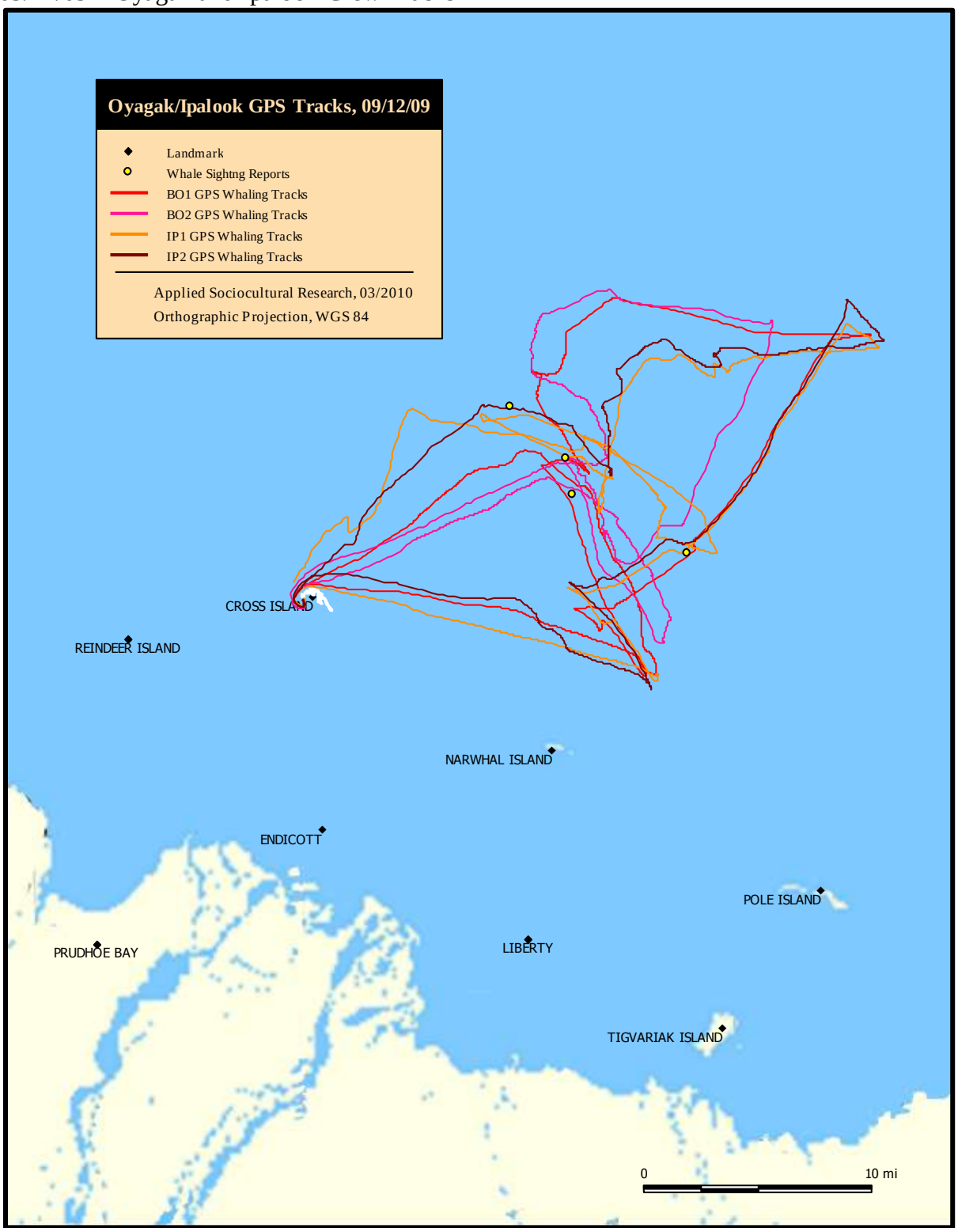

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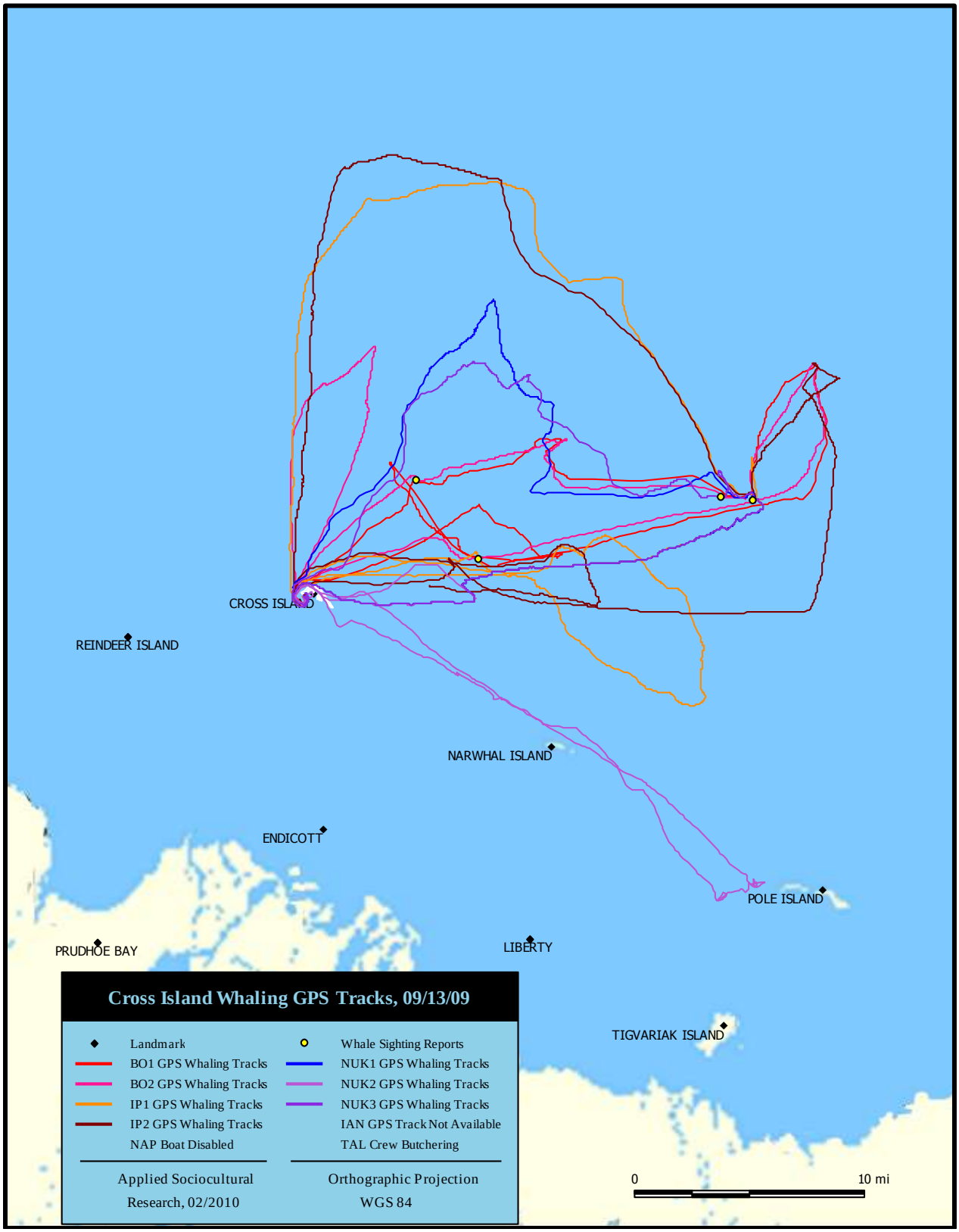

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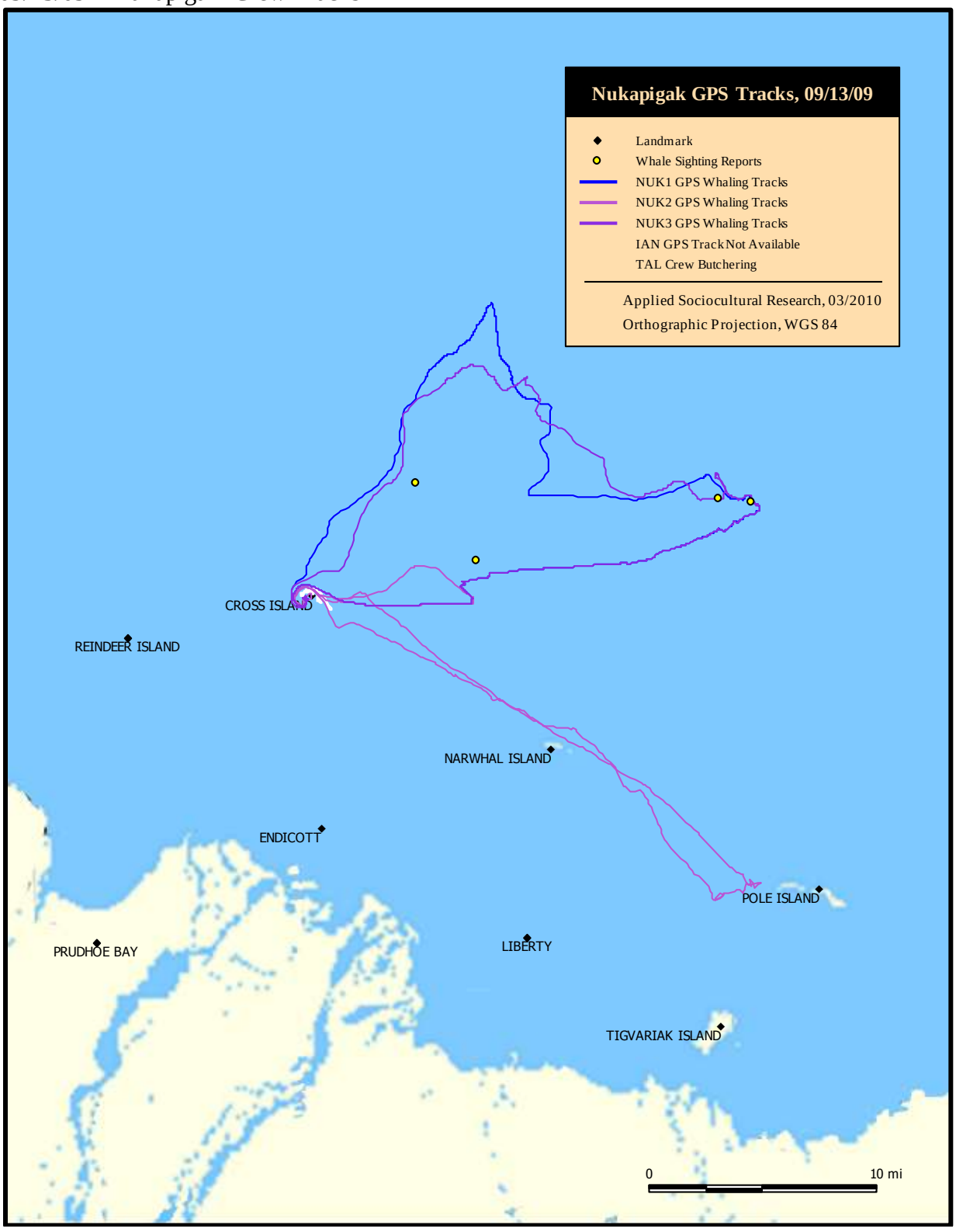

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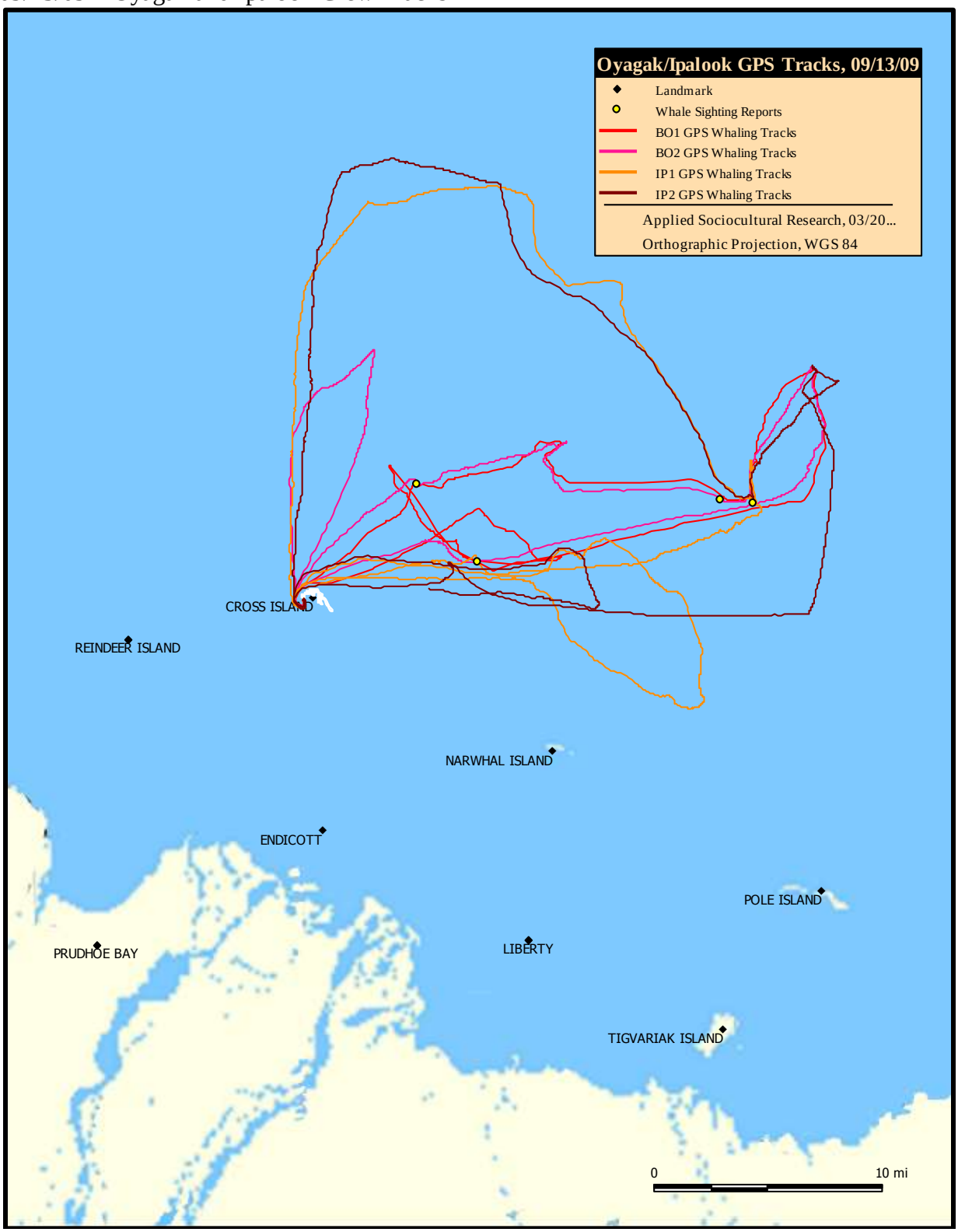

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Appendix B: Boat Report Forms for the 2009 Season

Printed copies of the boat report forms are not included in this report, in the interests of report size. They are provided in electronic form on the CD-ROM included with this report. Much of the information contained in the forms is summarized in the "Boat Trip" Excel file included on the CD-ROM and the "Supplement" Word file (narrative summaries of 2009 Cross Island boat accounts)

Appendix C: Weather Measurements, Cross Island, 2009

A printed copy of this database is not included in this report, in the interests of report size. It is included in electronic form on the CD-ROM included with this report. Unlike past annual reports, the weather measurements reported here include not only those recorded by the Cross Island weather station, but also comparative measurements available for the deadhorse weather station on the National Oceanic and Atmospheric Administration NOS/CO-OPS website (http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=9497645%20Prudhoe%20Bay,%20AK&type=Historic+Tide+Data or on the same website but with a different page reference http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=9497645%20Prudhoe%20Bay,%20AK&type=Meteorological+Observations). This enables the use of pertinent weather information for the entire Cross Island subsistence whaling season, whereas if only the Cross Island weather station measurements were used there would be several gaps in the time series. These gaps are due to the delay in setting up the weather station upon arrival on Cross Island, the need to dismantle the weather station before actually leaving the Cross Island, and various sorts of measurement failures (of varying lengths of time) during the season. The weather measurements presented in this appendix were used in compose Figure 3, with the Cross Island readings being used for the periods of time for which they were available. The comparison of Cross Island and Deadhorse weather measurements shows that one is not a perfect indicator of the other, but that in terms of overall trends they are fairly close, so that when Cross Island measurements are not available, Deadhorse measurements are reasonable proxies. It was most convenient to use hourly measurements for the Deadhorse readings, versus readings every five minutes for the Cross island weather station. This is also an additional source of difference between the graphs of the two time series.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.