UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

NOV 17 2006

1503-16(a)

(S) 10-20-11

Edric Vinson
Environmental Project Manager
Federal Highway Administration
P.O. Box 21648
Juneau, Alaska 99802

Dear Ms. Vinson:

The National Oceanic and Atmospheric Administration (NOAA) has reviewed the August 2006 Knik Arm Crossing Draft Environmental Impact Statement (DEIS). Our review focused on the potential impacts of the project on the depleted stock of Cook Inlet beluga whales and marine and anadromous fish. We have very serious concerns about the environmental consequences of the project, especially for beluga whales.

The latest survey (June 2005) information indicates that just 278 animals comprise the Cook Inlet population of beluga whales. The population depends heavily on habitat in Knik Arm, including the immediate vicinity of the proposed bridge. The belugas are very susceptible to impacts from habitat disturbance, including construction-related noise and other forms of habitat alteration that would result from building the proposed bridge. NOAA's National Marine Fisheries Service is currently undertaking a status review of the Cook Inlet beluga stock to determine whether this population should be listed under the Endangered Species Act. We are concerned that the proposed project may threaten the viability and recovery of this small beluga population.

Based on the information in the DEIS, NOAA recommends the No Action Alternative as the best option for promoting the recovery of Cook Inlet belugas and sustaining upper Cook Inlet salmon runs. There may be other design alternatives that provide for the project's stated purpose and need that are compatible with the goal of recovering this depleted stock of beluga whales. We offer the enclosed comments for your consideration, including recommendations to further evaluate measures to reduce the effects of the proposed bridge on beluga whales and salmon. We look forward to working with you during development of the Final Environmental Impact Statement to determine whether the impacts of any of the action alternatives can be reduced to an acceptable level.

Sincerely,

for

Rodney F. Weiher, Ph.D.
NOAA NEPA Coordinator

Enclosures (2)

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
NATIONAL MARINE FISHERIES SERVICE (NMFS)
COMMENTS ON THE KNIK ARM CROSSING
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

NOAA offers the following comments on the DEIS for the proposed Knik Arm bridge.

Effects on Marine Mammals

We have reviewed the material and analyses presented in the DEIS, along with supporting documents and applicable scientific literature concerning beluga whales and the potential effects of the recommended alternative. The DEIS, and our review, clearly establish the importance of Knik Arm to the Cook Inlet beluga. The upper reaches of Knik Arm, beginning just north of the proposed alignment, provide important feeding habitat to these whales. It is not unusual for one third or more of the entire population of Cook Inlet belugas to occur here. This area also supports cow/calf pairs and may be considered as nursery habitat. The shallows found here and within Turnagain Arm may provide important escape terrain for belugas in avoiding predation by killer whales in the upper Inlet. Studies by the Knik Arm Bridge and Toll Authority (KABATA), described in the DEIS, indicate that areas on Knik Arm provide important habitat for beluga whale feeding, resting, and predator avoidance. The DEIS also describes areas here as nursery habitat. While we have no direct evidence of calving in Knik Arm, young of the year calves are regularly observed here, suggesting such activity is likely. The lower portions of Knik Arm provide a corridor for whales regularly traveling between upper Knik Arm and the upper Inlet, and may also serve important habitat functions. Feeding belugas are often observed near Ship Creek, south of the Port of Anchorage.

In the enclosed October 2006 white paper produced by the National Marine Fisheries Service (NMFS) National Marine Mammal Laboratory (NMML), NMFS scientists evaluated survey data from 1993 through 2005 and found an average of 24 percent of the Cook Inlet beluga population occurred in Knik Arm. It was not uncommon for greater than 50 percent of these whales to be found in Knik Arm during annual abundance surveys in June, and even higher use (up to 100 percent) occurred in September and October. The NMML paper assessed the percentage of Knik Arm beluga whales found in the upper, middle, and lower reaches during surveys between 1993 and 2005. That assessment found that about 50 percent of these whales occurred in the middle Arm, 29 percent in the upper Arm, and 21 percent in lower Knik Arm. These data demonstrate that beluga use of Knik Arm is not primarily above (north of) the bridge alignment, but exists throughout that water body. Beluga presence in upper Knik Arm is limited somewhat to high tides when the areas are flooded; accordingly, belugas are more likely to be found in the lower Knik Arm during low tide when most of the upper Arm consists of exposed mud flats.

Many of the potential impacts of the proposed Knik Arm bridge to the Cook Inlet beluga

population are understood, predictable, and significant. A 2002 acoustic research effort[1] found that the waters of Knik Arm beyond Cairn Point had the lowest in-water noise levels of any Cook Inlet area then studied. Bridge construction noise would occur during a six year period when in-water noise levels would be significantly elevated, particularly during pile driving and other in-water work. Operationally, the bridge and its supports may present a source of continuous noise, at lower levels but which may be readily detectable to the sensitive hearing of beluga whales, especially the higher frequency components of such noise.

Scientific research on both captive and wild beluga whales has demonstrated their behavioral reactions to in-water noise. Research has established noise thresholds at which these whales' hearing may become impaired or injured. Potentially-harassing noise from pile driving would extend approximately 11,450 feet from the source (DEIS p. 4-243). At such range, this sound would reach important beluga feeding sites within Knik Arm (e.g. Eagle Bay). Sound transmission and receipt is very important to Cook Inlet belugas. These animals spend their lives in the turbid and regularly darkened waters of Cook Inlet and are almost wholly dependent on their acoustic environment. Man-made noise has the capacity to harass or injure these whales. It may also interfere or compete with their ability to communicate or locate prey (echolocation). Subtle changes in whale behavior due to noise would include avoidance of the noise sources. Any change in the use of Knik Arm by beluga whales, and especially the upper Arm, due to the Knik Arm bridge would be expected to have direct and measurable adverse effects on this population. Abandonment of this habitat presents a worst-case scenario, and would at times displace more than half of the remaining Cook Inlet belugas from this preferred and important habitat. The nutritional effects due to the loss of Knik Arm salmon as a prey resource and the increased competition for the few remaining preferred feeding habitat areas in the upper Inlet could substantially reduce the potential for recovery of this depleted population. The effects of the loss of predator-avoidance areas and nursery habitat are less predictable, but may also be significant.

Other impacts to Cook Inlet beluga whales are attributable to the proposed bridge project. NMFS has recorded numerous stranding events by beluga whales in Knik Arm, the most recent of which was when 12 live belugas stranded on September 12, 2006 (NMFS unpublished data). The causation for these strandings is not well understood, but any project that alters the hydrology of Knik Arm will warrant concern in this regard. The bridge would also add a source of pollutants to Knik Arm waters as road salts and petroleum products come off the bridge crossings and approaches. Bridge icing may predispose the crossing to vehicle accidents, and the possibility for fuel spills exists. The bridge would lead to increased development along upper Knik Arm resulting in unquantifiable indirect impacts to these whales. Even the bridge lighting may be detectable to beluga whales. The DEIS concludes the preferred alternative will contribute significantly to the cumulative adverse impacts to Cook Inlet beluga whales.

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1 S.B. Blackwell and C.R. Greene, Jr. 2002. Acoustic measurements in Cook Inlet, Alaska, during August 2001. Greeneridge Sciences, Inc., Santa Barbara, CA. 41p.

Some evidence exists of tolerance and habituation of beluga whales to man-made disturbances. Belugas are regularly seen at the Port of Anchorage, however, there is recent evidence their behavior has changed here (surfacing intervals have decreased). The DEIS states that beluga whales "are often seen under and near the vehicular bridge at Knik River at the head of Knik Arm." This statement is not supported by reference, however, and we are aware of only one such observation: a lone beluga whale close enough to the Knik River bridge to be seen by motorists on September 10, 2003.

Beluga whales are reported to coexist with an intensive commercial fishery in Bristol Bay. This behavior may also simply reflect the need for these whales to occupy the waters for important feeding purposes, and does not necessarily indicate the whales are undisturbed. Conversely, Native hunters of Kivalina have reported beluga whales avoid a pile-supported dock constructed at the Red Dog Mine port. Cook Inlet Native hunters have often described the hearing sensitivities of the belugas, and NMFS researchers report avoidance of vessels by beluga whales at distances up to a quarter mile. A study of beluga whales in Quebec found a more than 60 percent decline in passage rates, coinciding with increased vessel traffic (noise).[2]

After consideration of the above factors, we conclude that the preferred alternative could threaten the recovery and conservation of the Cook Inlet beluga whale. This conclusion is reinforced by consideration of the cumulative effects of the Knik Arm bridge and the many other past, present, and reasonably foreseeable actions which may occur here and which may impact these whales. Indeed, KABATA's Cumulative Effects Technical Report finds the following:

- "The combination of these new coastal activities at the narrow entrance to Knik Arm could deter passage of beluga whales or inhibit them from approaching the construction zone, at least during the busiest construction periods."
- "The proposed Southern Alignment 8,200-Foot Bridge Alternative and its associated approaches and roadway would constitute a substantial addition to the cumulative amount of solid fill structures in tidal areas of Knik Arm and would therefore contribute to the long-term effects of coastal development on beluga whales."
- "...the (preferred alternative), when added to the past, present, and reasonably foreseeable future actions in the Study Area, would likely have adverse cumulative effects on this population."

That technical report found the 14,000 foot bridge alternative would have a similar effect during construction, but less cumulative effect during operation.

In summary, the DEIS understates the effect of the preferred alternative on the Cook Inlet population of beluga whales and their recovery. The proposed work would have significant adverse effects on belugas, and at a magnitude from which the small existing population might not recover. Many major adverse effects to beluga whales cannot be quantified, such as the extent to which a bridge crossing would impact movement and access by belugas into important habitat areas of upper Knik Arm, but the effects clearly would be detrimental to the beluga

2 L.M.J. Capron and D.E. Sergeant. 1988. Yearly variation in the frequency of passage of beluga whales (*Delphinapterus leucas*) at the mouth of the Saguenay River, Quebec, over the past decade. Nat. Can. 115:11-116.

population. Given that this population has been severely reduced from its historic levels, and today numbers fewer than 300 animals, the most conservative strategy is necessary to foster their recovery.

Effects on Fish

The proposed bridge would adversely affect habitat for Pacific salmon in Knik Arm. Recent site specific data collected for this project and the proposed Port of Anchorage expansion indicate that juvenile and adult salmon use the intertidal and shoreline area as a migration corridor. Other fish species use the intertidal area, but the dependence of those fish on the local habitats is not well understood. Salmon in Cook Inlet are an important commercial, recreational, and traditional-use resource, and a significant prey resource for beluga whales.

The preferred bridge design calls for more than 5,000 feet (1 mile) of intertidal fill for the bridge approaches. The other design alternative is for a 14,000 foot pile supported bridge. Any substantial fill into the intertidal area would change the hydrology of Knik Arm and could significantly impact fish migration. Therefore, NMFS disagrees with an inference made in Section 2.3 Preferred Alternative which implies that a shorter bridge is better for the environment because construction impacts are minimized. A shorter bridge may have less short term impacts to salmon, but the long term impacts would be much greater and could potentially impact living marine resources in upper Cook Inlet for decades. Increased construction impacts associated with building a longer bridge (with less fill) would be preferable to the long term impacts resulting from significant fill, as proposed in the preferred alternative.

NMFS has reviewed the Knik Arm Crossing Essential Fish Habitat (EFH) Assessment of the Proposed Action. NMFS agrees with all of the proposed EFH Conservation Measures in the EFH Assessment, with one exception. NMFS recommends modifying the EFH Conservation Measure specific to the use of the Anchorage Debit/Credit Methodology. This measure should specify how appropriate mitigation projects would be identified. Compensation for impacts associated with the north end of the project should occur in the Matanuska/Susitna Borough. Likewise, compensation for impacts associated with the south end of the project should occur in Anchorage. Compensation for impacts to intertidal and marine areas should be applied to restoration activities in Anchorage, particularly those already identified by the Municipality of Anchorage Salmon Task Force.

NMFS also recommends adding a Conservation Measure that addresses pile driving. In addition to pile driving restrictions intended to protect beluga whales (see below), NMFS requests that pile driving during the juvenile salmon peak abundance period (May 15 to July 15) be restricted to no more than six (6) hours per day to assure that large numbers of salmon can pass through the pile driving area without being subjected to significant noise impacts.

In summary, the proposed bridge effects on Cook Inlet salmon runs could be substantial due to the large amount of fill on both ends of the bridge and the associated changes in hydrology. Any decrease in salmon abundance could have indirect effects on belugas whales by reducing an

important prey resource, and could also impact recreational and commercial salmon fisheries. An alternative that places the entire 14,000 foot bridge on piles could minimize these impacts, and warrants additional consideration in the Final EIS.

Conclusion and Recommendations

The preferred alternative would have substantial long term adverse effects on fish in upper Cook Inlet, and NMFS is particularly concerned about effects on the depleted population of Cook Inlet beluga whales. The proposed project may threaten the viability and recovery of this small population, which NMFS is presently evaluating for listing under the ESA.

Based on the information in the DEIS, NMFS recommends adoption of the No-Action Alternative. We find that alternative is the best option in terms of the recovery of Cook Inlet belugas and the conservation of upper Cook Inlet salmon runs. NMFS recommends that the Federal Highway Administration and KABATA further evaluate measures to reduce the effects of the proposed bridge on beluga whales and salmon to determine whether the impacts of any action alternative can be reduced to an acceptable level. Specifically, NMFS recommends that the Final Environmental Impact Statement examine the following issues:

1. The Final EIS should analyze bridge construction techniques and discuss in detail the feasibility of various methods to reduce sound transmission through the water column as a result of pile driving and related activities. The analysis should consider double cofferdams and other techniques to ascertain whether it is feasible to attenuate construction noise to levels that would be insignificant for beluga whales and salmon.

2. The Final EIS should present a plan to minimize beluga exposure to construction noise resulting from the Knik Arm Crossing. The plan should ensure that belugas are not exposed to sound levels in excess of 180 dB re: 1μPa. The radius surrounding such noise sources should be determined empirically and established based on propagation loss equations fit to site-specific data. (Although KABATA has applied for a Small Take Authorization under section 101 (a)(5) of the MMPA, if an authorization is not issued because NMFS determines that the taking will have a more than negligible impact on the Cook Inlet beluga, to avoid taking in violation of the MMPA, KABATA will need to ensure that the Cook Inlet beluga not be exposed to noise in excess of 160 dB re: 1μPa).

3. The Final EIS should evaluate technologies for eliminating, reducing, or quieting the bridge piers (piling) so that beluga whales are not adversely affected by traffic noise and vibration from the bridge.

4. The Final EIS should present a more thorough discussion and analysis of a fully pile supported alternative and alternatives that involve lesser approach fills, in terms of their potential benefits for belugas and salmon, as compared to the preferred alternative.

5. The Final EIS should include a mitigation requirement to prohibit untreated runoff from the bridge crossing from entering Knik Arm.

6. The Final EIS should include a mitigation requirement to prohibit ships and boats associated with construction of the Knik Arm bridge from traveling north of the bridge area.

Additional Specific Comments

Notwithstanding our recommendation for adoption of the no action alternative, we present these specific comments on the DEIS along with recommendations regarding the preferred alternative.

Pg. 2-17, Expandable Commuter Ferry Alternative.
The DEIS states one reason for rejection of this alternative is the fact that revenue from tolls from a ferry would be insufficient to cover the expected annual operating and maintenance costs. The DEIS should provide background on this assessment, and demonstrate revenues from the preferred alternative would be sufficient for these purposes.

Pg. 2-136 (Table 2-9).
We recommend changing the words "limited loss of habitat" to "potential restriction into Knik Arm, resulting in potential loss of important feeding and rearing habitat." Installation of piers (pile driving) could potentially result in beluga avoidance or lack of access to Knik Arm for two or three years (southern alignment bridge alternatives), resulting in potential loss of calving success and important summer feeding.

Pg. 2-141 (Table 2-10).
This table identifies one consequence of the preferred alternative as a "Narrower opening into Knik Arm" which could result in the potential loss of important habitat if whales are restricted or don't move into Knik Arm. This table should also reflect that 2 or 3 seasons of pile driving could impair calving and feeding if the area is avoided by belugas.

Construction impacts from fill are not addressed. Belugas may avoid the noise and sediment plume from fill dumping. This could impair calving and important summer feeding if the area is avoided by belugas. Change in flows due to fill and potential impacts to beluga movement is not addressed.

Pg. 3-209.
The text states that the beluga population is thought to have stabilized. An analysis of recent data has shown a potential downward trend. In fact, based on the 1994-2005 aerial surveys done by NMML, Lowry et al.[3] suggest there is a 71 percent probability that the population growth rate of

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3 Lowry, L., O'Corry-Crowe, G., and Goodman, D. In press (2006). *Delphinapterus leucas* (Cook Inlet population). In: IUCN 2006. 2006 IUCN Red List of Threatened Species.

Cook Inlet belugas is negative, with the best estimate indicating that the population is declining by 1.2 percent per year.

Pg. 3-210, paragraph 2.

We disagree with the characterization here that belugas occur in Knik Arm in late summer and autumn. NMFS aerial surveys each June have often recorded hundreds of beluga whales in Knik Arm. Satellite tag data demonstrate belugas may occur year round in these waters. This paragraph also states that beluga whales reside in Knik arm, moving between Six-Mile Creek and the upper Arm and that they "occasionally leave Knik Arm in the fall." NMFS aerial surveys have regularly observed beluga whales moving in and out of Knik Arm during tidal cycles, and it is probable that such behavior is very common, rather than occasional.

This section also describes important beluga whale habitat which is used for rearing of calves, for feeding, for resting, and possibly for predation avoidance. Specific sites such as the mouth of Six-Mile Creek and Eagle Bay are identified, but the DEIS does not provide the distance between these sites and either the bridge crossing or its zone of impact. Later, in DEIS Section 4, this information would be valuable in understanding how these areas may be affected by bridge construction and operation. The DEIS says that the 160-dB isopleth (a standard NMFS has used to identify the onset of harassment) may extend 11,450 feet from the bridge. What in-water noise levels would occur at Six-Mile Creek or Eagle Bay? How might low ambient noise conditions affect these areas?

Pg. 3-211.

This discussion should expand using available information in the Draft Conservation Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*) (70 FR 7 30697, March 16, 2005). Data on the Cook Inlet beluga's winter diet are limited to a necropsy on one whale found on April 1, 2003 which had thinner blubber than beach cast beluga whales found in summer. The stomach contained saffron cod (*Eleginus gracilus*), walleye pollock (*Theragra chaloogramma)*, Pacific cod (*Gadus macrocephalus*), eulachon *(Thaleichthys pacificus)*, tanner crab (*Chionoecetes bairdi*), bay shrimp (*Crangon franciscorum*), and polychaetes (*Nereidai* spp or *Nephtyidae* spp.). A whale necropsied on October 15, 2003 contained saffron cod, Pacific staghorn sculpin (*Leptocottus armatus*), yellowfin sole flounder (*Limanda aspera*), and starry flounder (*Platichthys stellaatus*); indicating a change from the summer diet of salmon and eulachon. This diet is consistent with other beluga populations that are known to feed on a wide variety of food.

Pg. 4-240.

NMFS has serious concerns about the unrestricted movement of belugas into and out of Knik Arm. On page 4-241 the document states that the Knik Arm bridge approaches extending into Knik Arm could create barriers for beluga whale transit and could change their movement patterns. We agree. In addition to the physical presence of these approaches, they may also increase tidal currents which might have some additional effect; although it appears most belugas move with, rather than against the tide. The analysis in the DEIS should include changes in water flow and peak velocities due to the bridge. What plans exist if belugas do not readily negotiate the bridge crossing or if the bridge limits or restricts free movement into and out of Knik Arm?

Pg. 4-242, paragraph 3.
Under construction impacts the DEIS states that beluga whale displacement by noise would not be permanent and would not be expected to have long-term effects. If beluga movement into Knik Arm stops for two years because of construction (pile driving, fill, boat traffic, etc.), the overall population health and fitness may decrease due to lack of free access to important feeding areas. Reproductive success may be reduced due to lack of free access to nursery areas. Increased predation from killer whales may occur due to lack of free access to escape cover in Knik Arm.

Additionally, the presence of a pile supported bridge may have permanent impacts to these whales. Traffic noise is likely to be introduced into the water column through the pile supports, and ice would also grind against the pile supports. The bridge structure would be lighted. We cannot know with certainty whether this bridge would diminish beluga movement into Knik Arm, but it is likely that operational noise from the structure will be detected by these animals.

Pg. 4-243.
According to the DEIS, construction would require between 150 and 220 hours of pile driving. This section states that because the range of 180 dB due to pile driving is given at 820 feet radius, it would not completely block the beluga whales from moving along the lower Arm. We disagree with this conclusion. It is unknown at what level belugas will react to, or avoid sound-saturated areas. The radius of 11,450 feet is given for 160 dB, completely covering the width of Knik Arm at the project area. NMFS normally recognizes 160 dB as the threshold for harassment and behavioral reactions with significant biological effects. If belugas avoid this sound range, they would not enter or leave Knik Arm during this construction time. This avoidance behavior would severely restrict access to Knik Arm, impacting beluga feeding, rearing, and escape from predation.

Pg. 4-244, Fill placement.
The DEIS here should identify a mitigation option for this work which would have piles driven on only one side of Knik Arm at any time. Such a measure would reduce any acoustic gauntlet effect.

Pg. 4-245.
The document states that although vehicle traffic across the bridge may cause belugas to avoid the area, it is expected that beluga whales would adapt to the changes in the Study Area [bridge and fill] and continue to frequent Knik Arm. This is a gross assumption. As discussed above, there is evidence of avoidance by beluga whales to anthropogenic noise, and large questions remain on the proposed bridge effects to beluga movements and behavior. Any restriction or diminished use of this important habitat could have severe impacts on the Cook Inlet beluga population and their recovery. References should be provided for the DEIS statement that beluga whales are often seen under and near the Knik River Bridge.

Pg. 4-246, Mitigation
We strongly support the mitigative measures identified here. Additionally, the adoption of the 14,000 foot alternative that eliminates the approach fills and the adverse effects associated with this fill, is an important mitigation measure for any build alternative. We agree that in-water pile driving impacts can be partially mitigated by stopping this work for 1.5 hours on either side of low tide. However, we request this mitigative measure be observed during all construction, not just during the August 15 - November 15 periods, as suggested in the DEIS. Beluga whales can be present within the project area during any time of the year and this mitigation measure for the whole year would act to reduce adverse effects due to exposure by pile driving noise.

A boat survey is suggested once per week to inform personnel of whale group locations. This survey is virtually useless due to the high mobility and rapid movements of belugas. Furthermore, the presence of the survey vessel on the water will unnecessarily disturb belugas, already affected by the bridge construction. NMFS recommends systematic aerial surveys of Knik Arm and/or observers at Cairn Point and Port MacKenzie to look for belugas and identify their distribution. Aerial surveys and land based observations would detect beluga behavioral changes from construction, instead of beluga behavioral changes from small boat harassments.

Pg. 4-253, Impacts on Threatened or Endangered Species.
Currently, NMFS is preparing a Status Review of Cook Inlet belugas to consider whether this population should be listed under the ESA (71 FR 14836, March 24, 2006). A petition to list these whales as an endangered species under the ESA was received in April 2006 (71 FR 44614, August 7, 2006). The Cook Inlet beluga is presently considered a Candidate Species for listing. Should NMFS determine listing under the ESA is warranted, a proposed rule would be published, at which time the status of these whales would change to "Proposed" under the ESA. Certain consultation requirements under the ESA would apply at that time. While consultation under the ESA may now be completed because of the current absence of ESA listed species or critical habitat, re-initiation of consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) take of a listed species occurs, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered, or (4) a new species is listed or critical habitat designated that may be affected by the action.

Pg. 4-310, Cumulative Effects to Marine Mammals.
We found this section deficient in many respects. It fails to describe in detail those activities which were considered in the cumulative analysis, nor does it describe how those past, present, and reasonably foreseeable activities would affect marine mammals, particularly beluga whales. The Cumulative Effects Technical Report, referenced here, is an important document which describes cumulative impacts in greater detail. We question why this two page report was not added to the text appearing in this section of the DEIS. The Technical Report concludes the recommended alternative would contribute significantly to adverse cumulative effects, could

deter passage of whales at the narrow entrance to Knik Arm, would measurably increase in-water noise levels, would have a greater probability to impact fish (prey) behavior, and could increase probabilities for beluga strandings and killer whale predation. Such extraordinary conclusions should appear prominently within the DEIS to allow the reader to make an informed assessment of the Knik Arm Bridge Project.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center
National Marine Mammal Lab
7600 Sand Point Way, NE, Seattle WA 98115
January 23, 2006

MEMORANDUM FOR: Barbara Mahoney, Western Alaska Field Office, AK Region

FROM: Kim Goetz, National Marine Mammal Lab

SUBJECT: Analysis of Beluga Sightings in Knik Arm

In response to your request for an analysis of the distribution of belugas in Knik Arm, I have broken results from NMFS' aerial surveys into a stepwise series of replies:

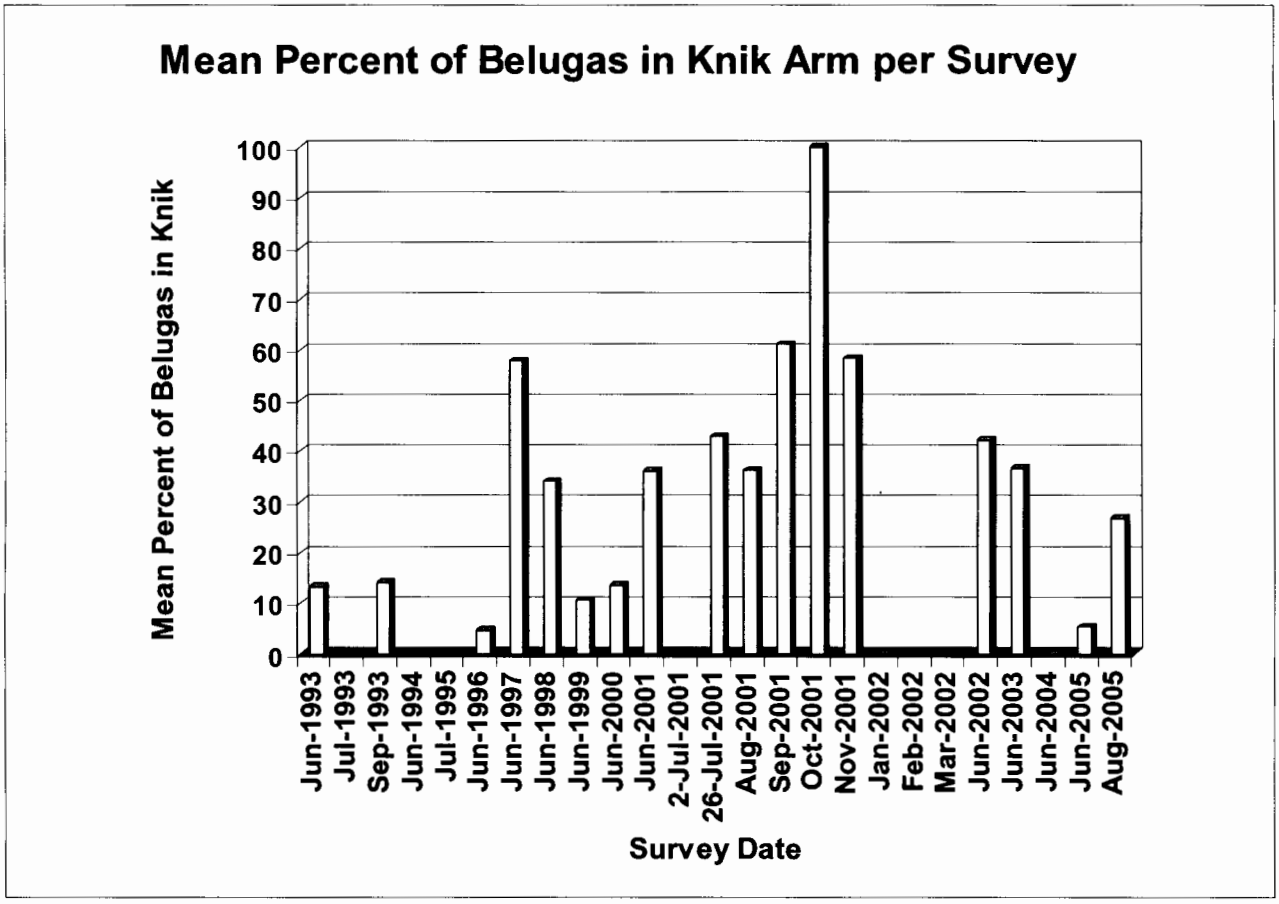
1) Mean percent of belugas in Knik Arm per survey

- How was this Calculated?

All days for the survey were examined and only the days when Knik was searched were included in the analysis. Below is an example for the June 1993 and September 1993 surveys. See spread-sheet for others. For each day Knik was searched, the total number of animals seen in Knik was divided by the seasonal median of belugas and then averaged with the number of Knik days for that survey. Example for 6/2/1993: (80/301.5)*100=26.5%...then (26.5+0)/2=13.27.

Date		Daily Total	Knik Total	Daily % by Seasonal Median	Seasonal Median
2-Jun-93		293	80	26.53	
3-Jun-93	DID NOT SURVEY KNIK	166	NA	NA	
4-Jun-93	DID NOT SURVEY KNIK	173	NA	NA	
5-Jun-93		108	0	0.00	
			80	**13.27**	301.5
3-Sep-93		157	57	36.31	
18-Sep-93		12	0	0.00	
19-Sep-93		50	9	5.73	
			66	**14.01**	157

Result:


Mean Percent of Belugas in Knik Arm per Survey
Mean Percent of Belugas in Knik
100
90
80
70
60
50
40
30
20
10
0
Jun-1993
Jul-1993
Sep-1993
Jun-1994
Jul-1995
Jun-1996
Jun-1997
Jun-1998
Jun-1999
Jun-2000
Jun-2001
2-Jul-2001
26-Jul-2001
Aug-2001
Sep-2001
Oct-2001
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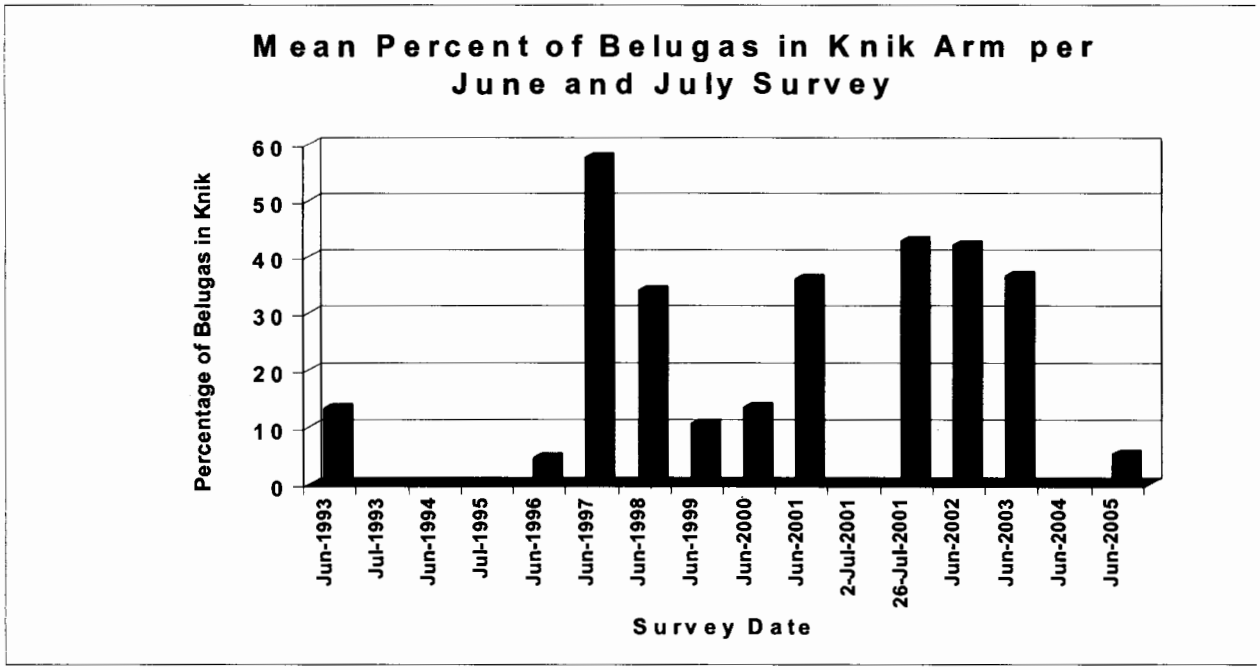
Jan-2002
Feb-2002
Mar-2002
Jun-2002
Jun-2003
Jun-2004
Jun-2005
Aug-2005
Survey Date

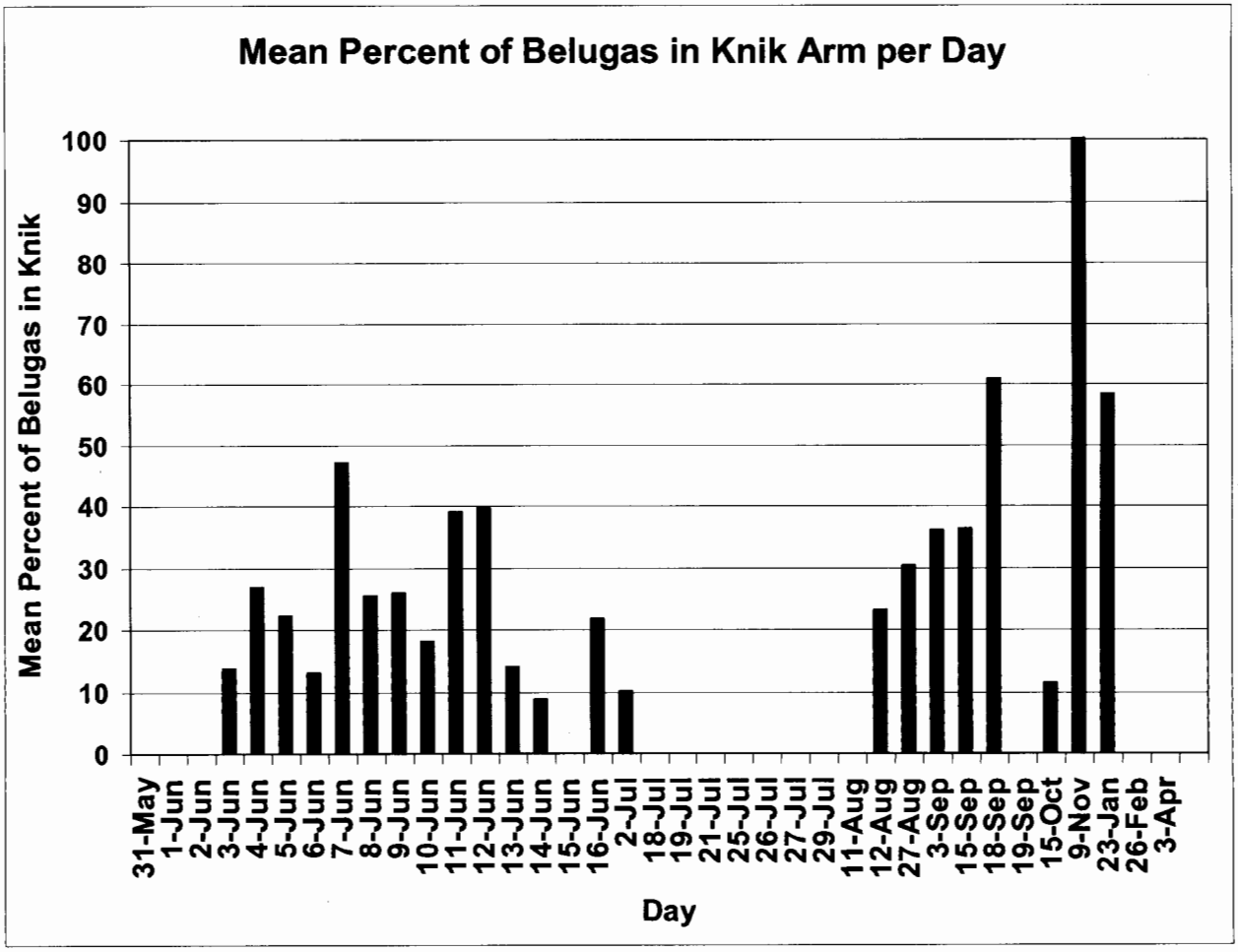

Mean Percent of Belugas in Knik Arm per June and July Survey
Percentage of Belugas in Knik
60
50
40
30
20
10
0
Jun-1993
Jul-1993
Jun-1994
Jul-1995
Jun-1996
Jun-1997
Jun-1998
Jun-1999
Jun-2000
Jun-2001
2-Jul-2001
26-Jul-2001
Jun-2002
Jun-2003
Jun-2004
Jun-2005
Survey Date

2) Mean percent of belugas in Knik Arm per day

- How was this calculated?

Individual survey days were tallied and analyzed. For example, in the table below, you can see that of the 5 times we surveyed on 3-Jun, we only flew into Knik twice (once in 2003 and once in 2004....in 1993, 1994, and 2005, we surveyed CI but not in Knik). The mean % of belugas in Knik per day was calculated by summing the daily percentages across years and dividing by the number of days Knik was surveyed.

Day	Total Survey Days	Knik Days	Mean % Belugas in Knik	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
31-May	1	1	**0.00**													0
1-Jun	2	1	**0.00**		NA											0
2-Jun	4	2	**13.79**	26.5	NA										NA	1.04
3-Jun	5	2	**26.97**	NA	NA									53.9	0	NA
4-Jun	6	2	**22.38**	NA	NA								NA	44.8	0	NA



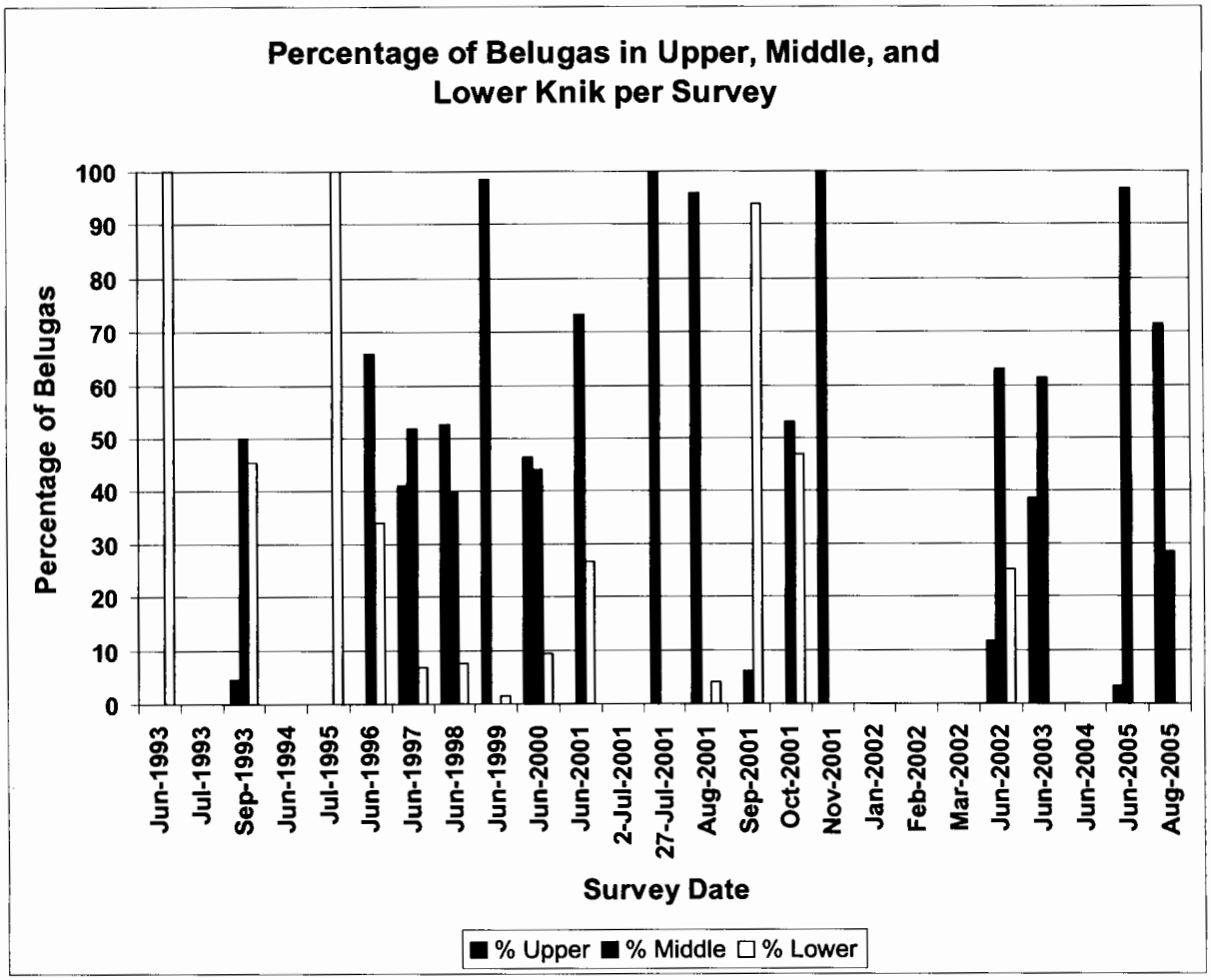
3) Percentage of belugas in upper, middle, and lower Knik Arm per survey

- How was this calculated?

The table below is an example of how the percentage of belugas in upper, middle, and lower Knik Arm were calculated (see spreadsheet for all values). The inlet was divided into 3 regions…(see map) and the median numbers of belugas in each region were summed. A percentage for each region was then calculated.

Survey	Upper	Middle	Lower	Total	% Upper	% Middle	% Lower
Jun-1993	0	0	80	80	0.00	0.00	100.00
Jul-1993	0	0	0	0	0.00	0.00	0.00
Sep-1993	3	33	30	66	4.55	50.00	45.45
Jun-1994	0	0	0	0	0.00	0.00	0.00
Jul-1995	0	0	1	1	0.00	0.00	100.00
Jun-1996	0	35	18	53	0.00	66.04	33.96
Jun-1997	124	156	21	301	41.20	51.83	6.98

Result:



Summary of Belugas in Upper, Middle, and Lower Knik Arm

	Upper	Middle	Lower
Median Totals	843	1456	601
Percentage	29.07	50.21	20.72

4) Percentage of belugas in upper, middle, and lower Knik Arm per day

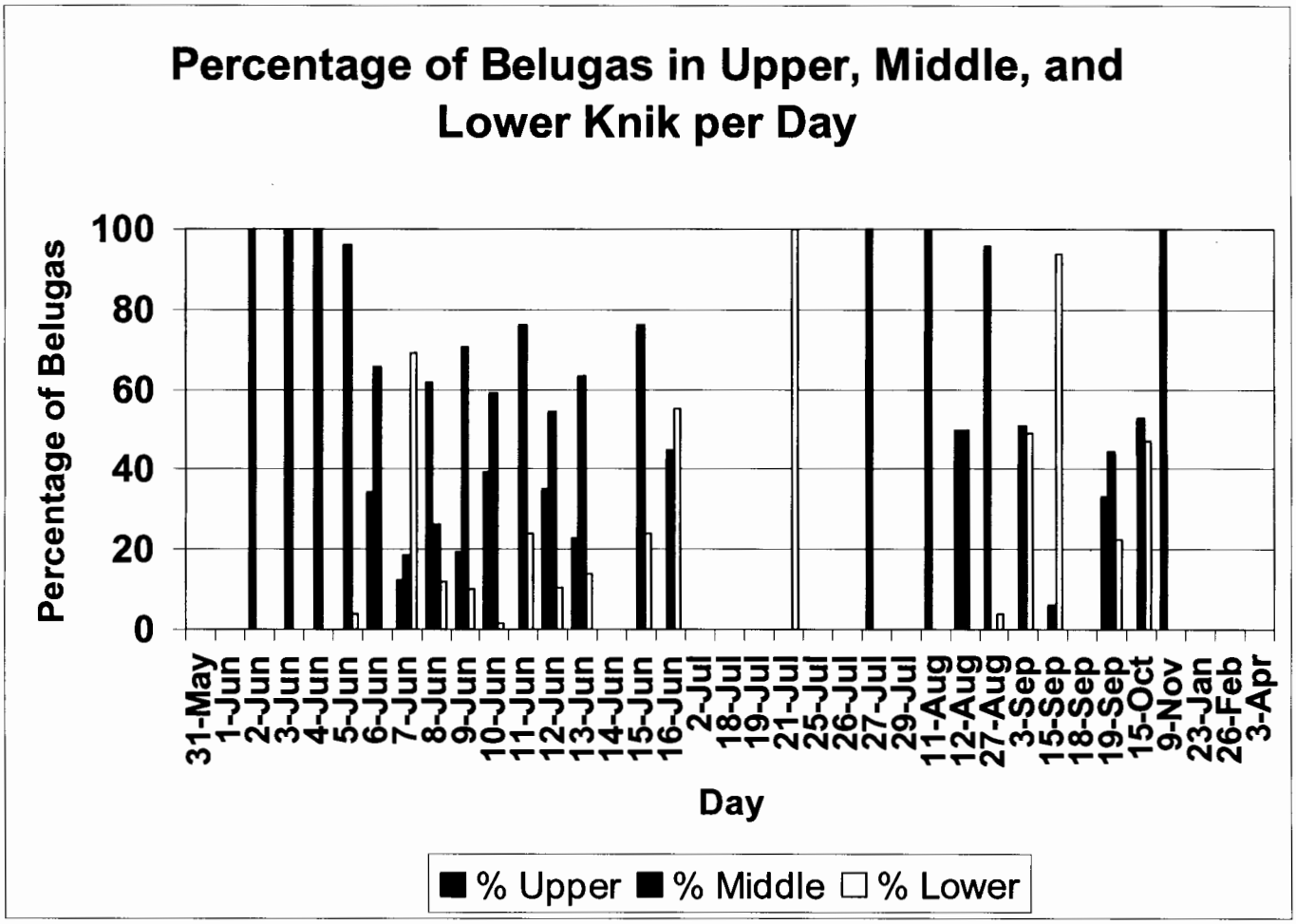
The median numbers of belugas for each region (upper, middle, lower) was summed for each day regardless of year. For example, Knik was surveyed twice on 2-June (once in 1993, and again in 2005). Then, the sum was divided by the total of all belugas in Knik for that day. For example, on 5-Jun, there was total of 130 belugas in the middle inlet and a total of 5 in the upper inlet. Each of these sums was then divided by the total median of belugas in Knik that day.

Date	Knik Days	Region	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
31-May	1	Upper													0	0
		Middle													0	0
		Lower													0	0
1-Jun	1	Upper													0	0
		Middle													0	0
		Lower													0	0
2-Jun	2	Upper	80												2	82
		Middle	0												0	0
		Lower	0												0	0

Summary of table above:

Date	Upper	Middle	Lower	Total	% Upper	% Middle	% Lower
31-May	0	0	0	0	0.00	0.00	0.00
1-Jun	0	0	0	0	0.00	0.00	0.00
2-Jun	82	0	0	82	100.00	0.00	0.00
3-Jun	0	94	0	94	0.00	100.00	0.00
4-Jun	0	78	0	78	0.00	100.00	0.00
5-Jun	0	130	5	135	0.00	96.30	3.70

Result:

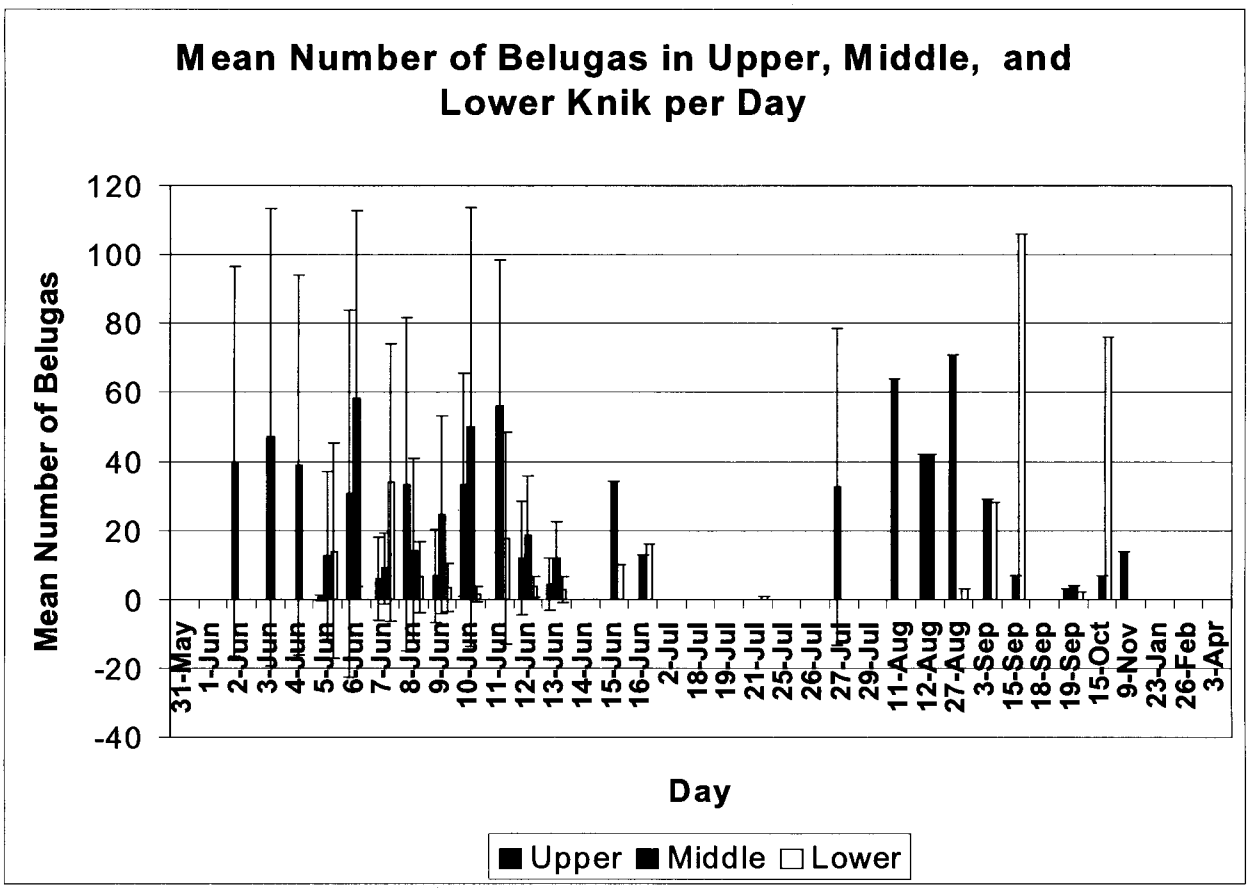


- How was this calculated?

For each day the number of belugas was summed across years and then divided by the number of days surveyed in Knik. The bars on the graph represent standard deviation.

Date	Knik Days	Region	AVG	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
2-Jun	2	Upper	41	80												2
		Middle	0	0												0
		Lower	0	0												0
3-Jun	2	Upper	0											0	0	
		Middle	47											94	0	
		Lower	0											0	0	
4-Jun	2	Upper	0											0	0	
		Middle	39											78	0	

Result:

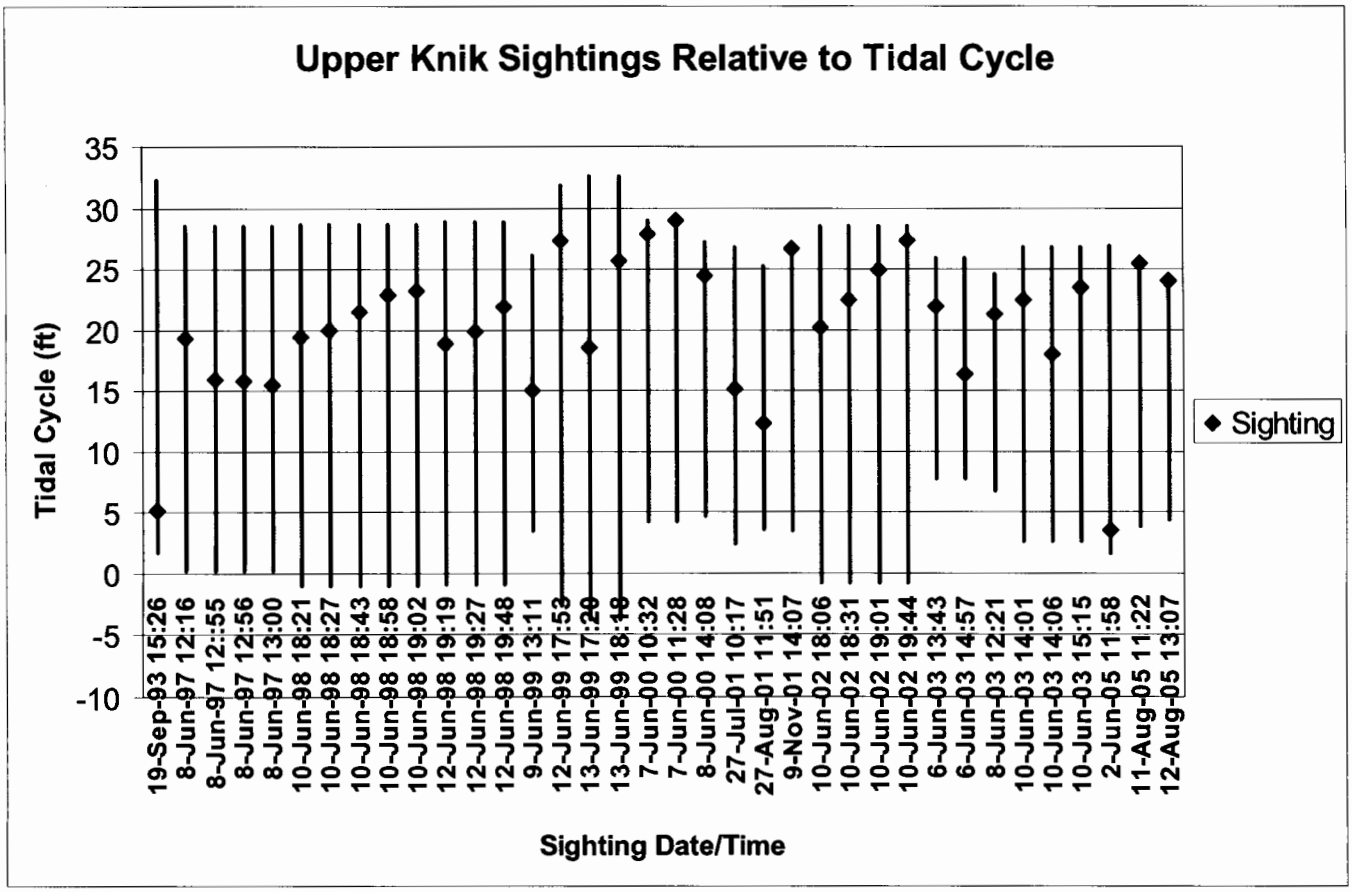

Mean Number of Belugas in Upper, Middle, and Lower Knik per Day
Mean Number of Belugas
120
100
80
60
40
20
0
-20
-40
31-May
1-Jun
2-Jun
3-Jun
4-Jun
5-Jun
6-Jun
7-Jun
8-Jun
9-Jun
10-Jun
11-Jun
12-Jun
13-Jun
14-Jun
15-Jun
16-Jun
2-Jul
18-Jul
19-Jul
21-Jul
25-Jul
26-Jul
27-Jul
29-Jul
11-Aug
12-Aug
27-Aug
3-Sep
15-Sep
18-Sep
19-Sep
15-Oct
9-Nov
23-Jan
26-Feb
3-Apr
Day
Upper
Middle
Lower

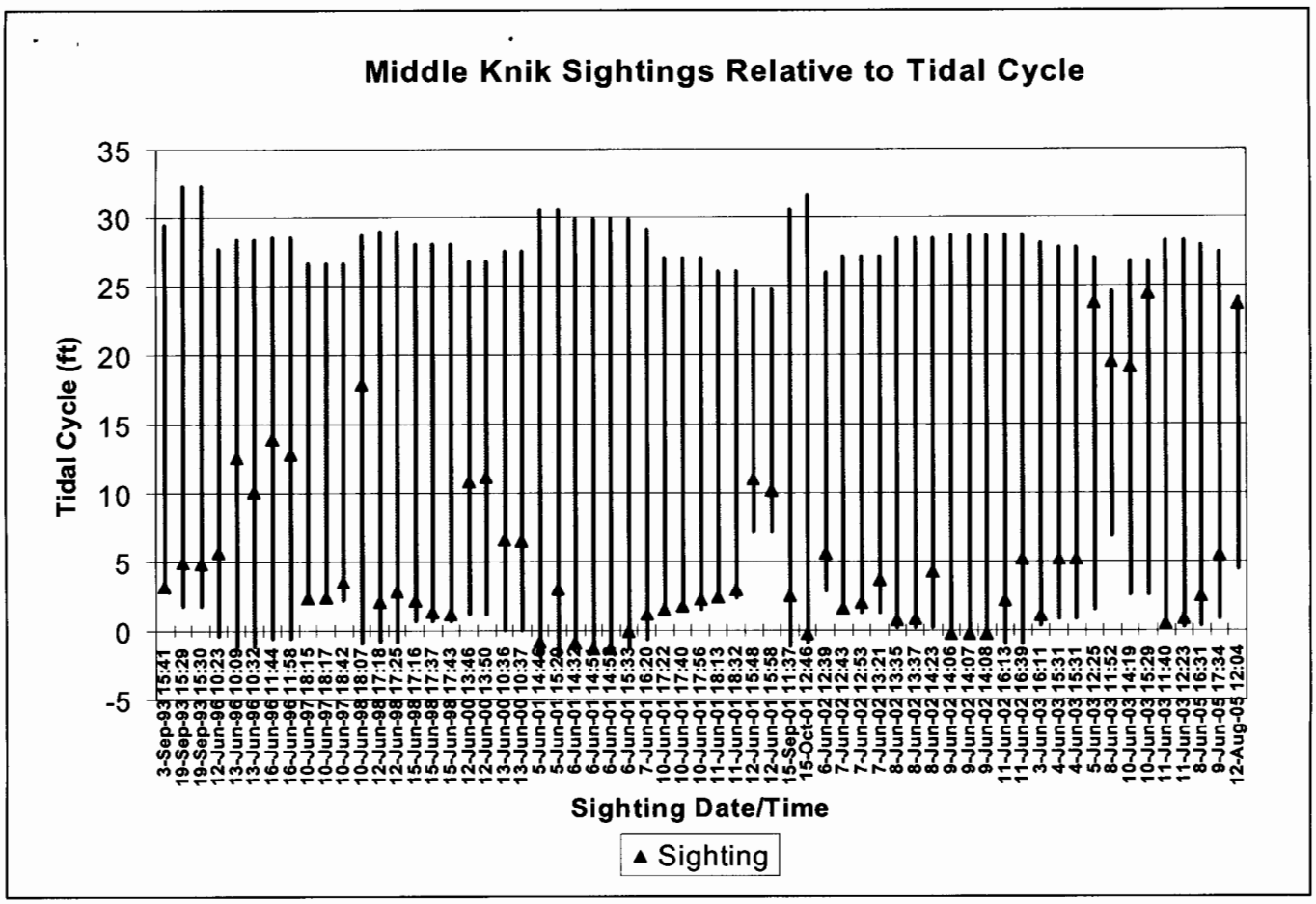
6) Knik sightings relative to tidal cycle

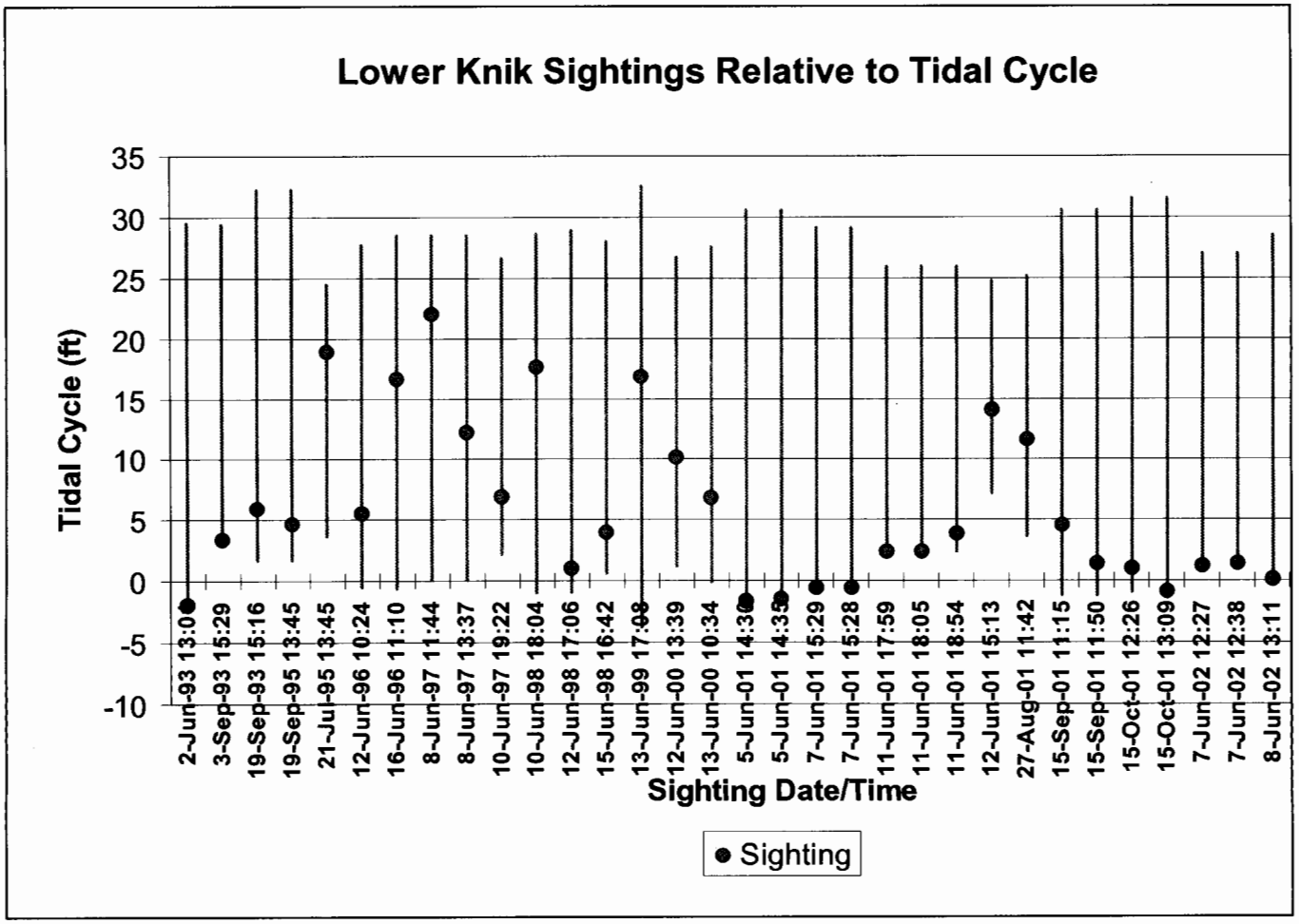
Using data from the Anchorage/Knik Arm buoy, the tidal height for the respective date/time of each sighting was recorded. In addition, the time and tidal height of the low and high tides for all the Knik sighting days was collected. See Example table below. The map included at the end shows the location of the buoy.

Date	Sighting Time	Tide at Sighting (ft)	Low Tide Time	Low Tide (ft)	High Tide Time	High Tide (ft)
9/19/93	15:26:53	5.13	16:39:00	1.73	10:02:00	32.25
6/8/97	12:16:14	19.34	16:42:00	0.16	9:27:00	28.51
6/8/97	12:55:14	15.92	16:42:00	0.16	9:27:00	28.51
6/8/97	12:56:33	15.83	16:42:00	0.16	9:27:00	28.51
6/8/97	13:00:09	15.48	16:42:00	0.16	9:27:00	28.51
6/10/98	18:21:04	19.39	15:03:00	-0.95	7:50:00	28.66
6/10/98	18:27:13	20.00	15:03:00	-0.95	7:50:00	28.66
6/10/98	18:43:47	21.55	15:03:00	-0.95	7:50:00	28.66
6/10/98	18:58:41	22.90	15:03:00	-0.95	7:50:00	28.66
6/10/98	19:02:35	23.24	15:03:00	-0.95	7:50:00	28.66

Results:

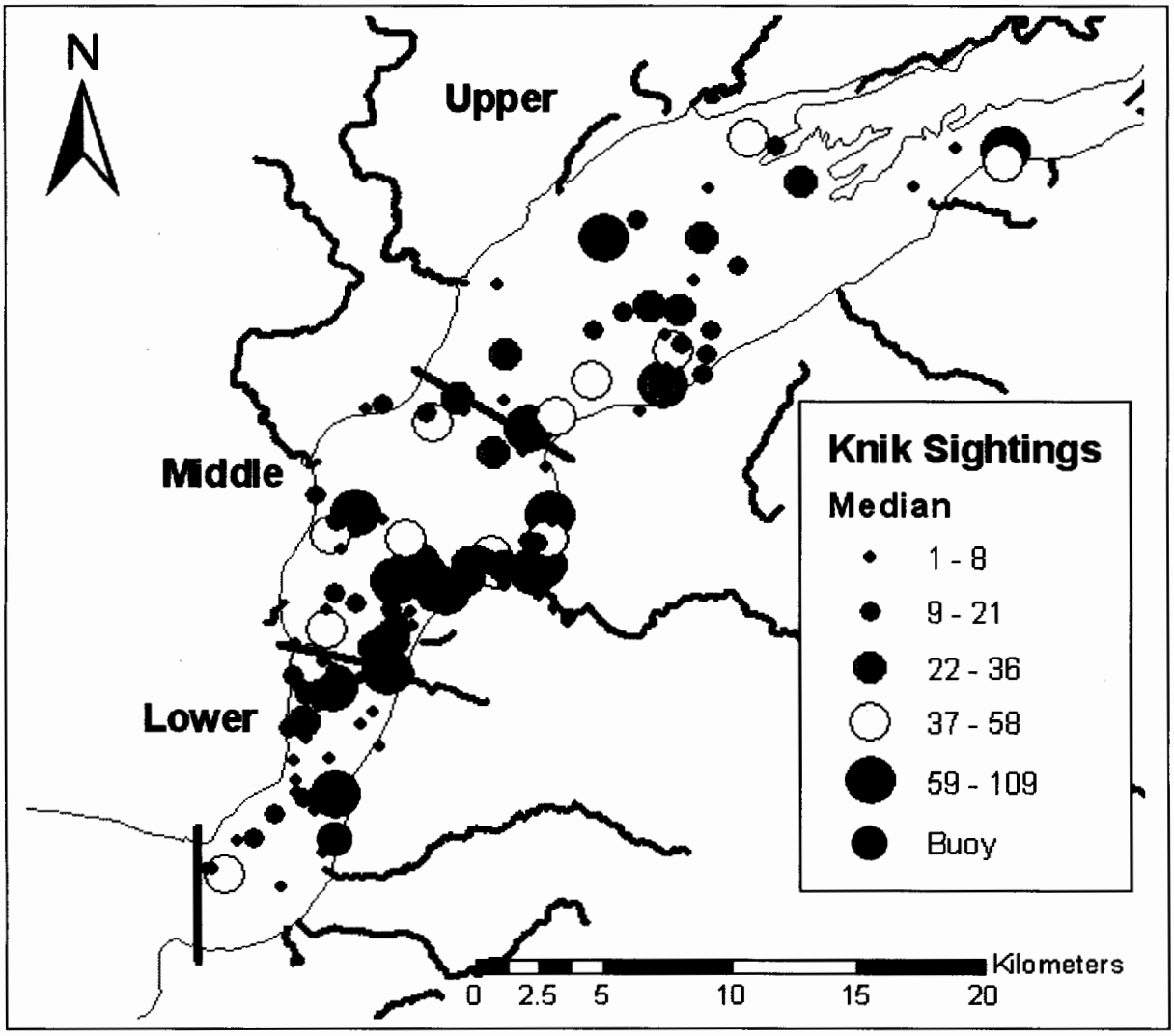



Middle Knik Sightings Relative to Tidal Cycle
Tidal Cycle (ft)
35
30
25
20
15
10
5
0
-5
Sighting Date/Time
▲ Sighting

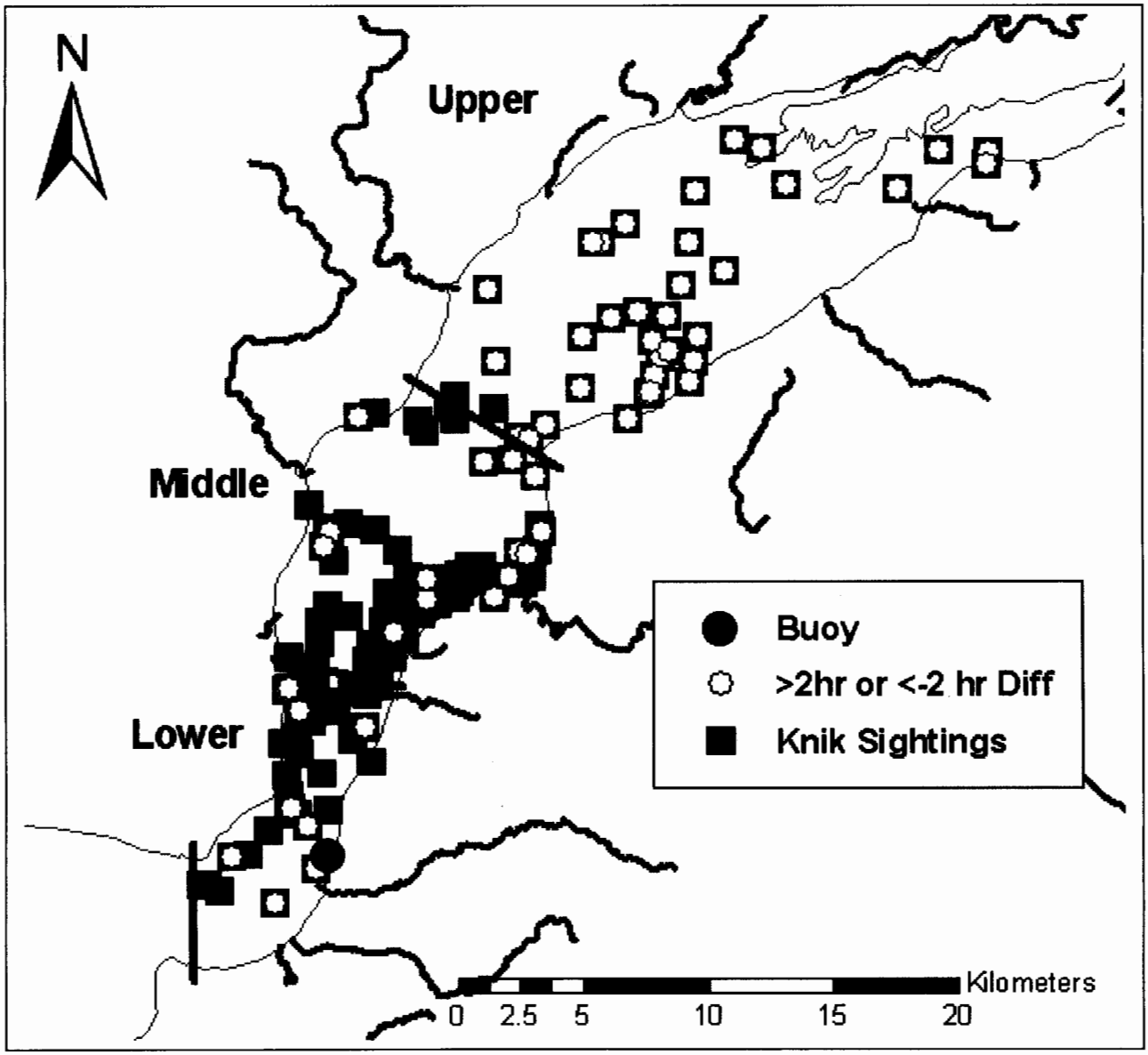

Lower Knik Sightings Relative to Tidal Cycle
Tidal Cycle (ft)
35
30
25
20
15
10
5
0
-5
-10
Sighting Date/Time
● Sighting

7) Maps

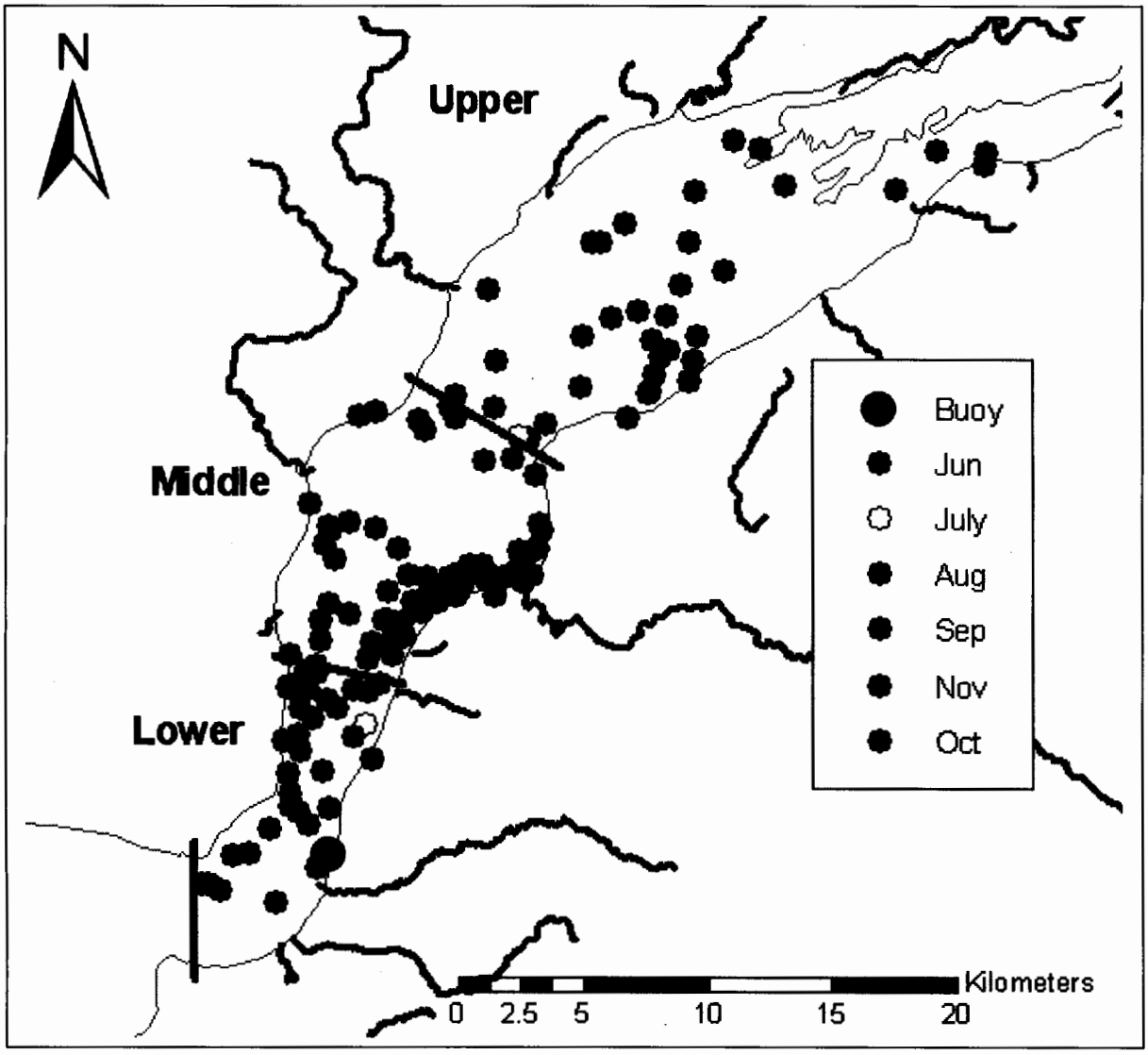
- This map shows all Knik sightings by median group size.



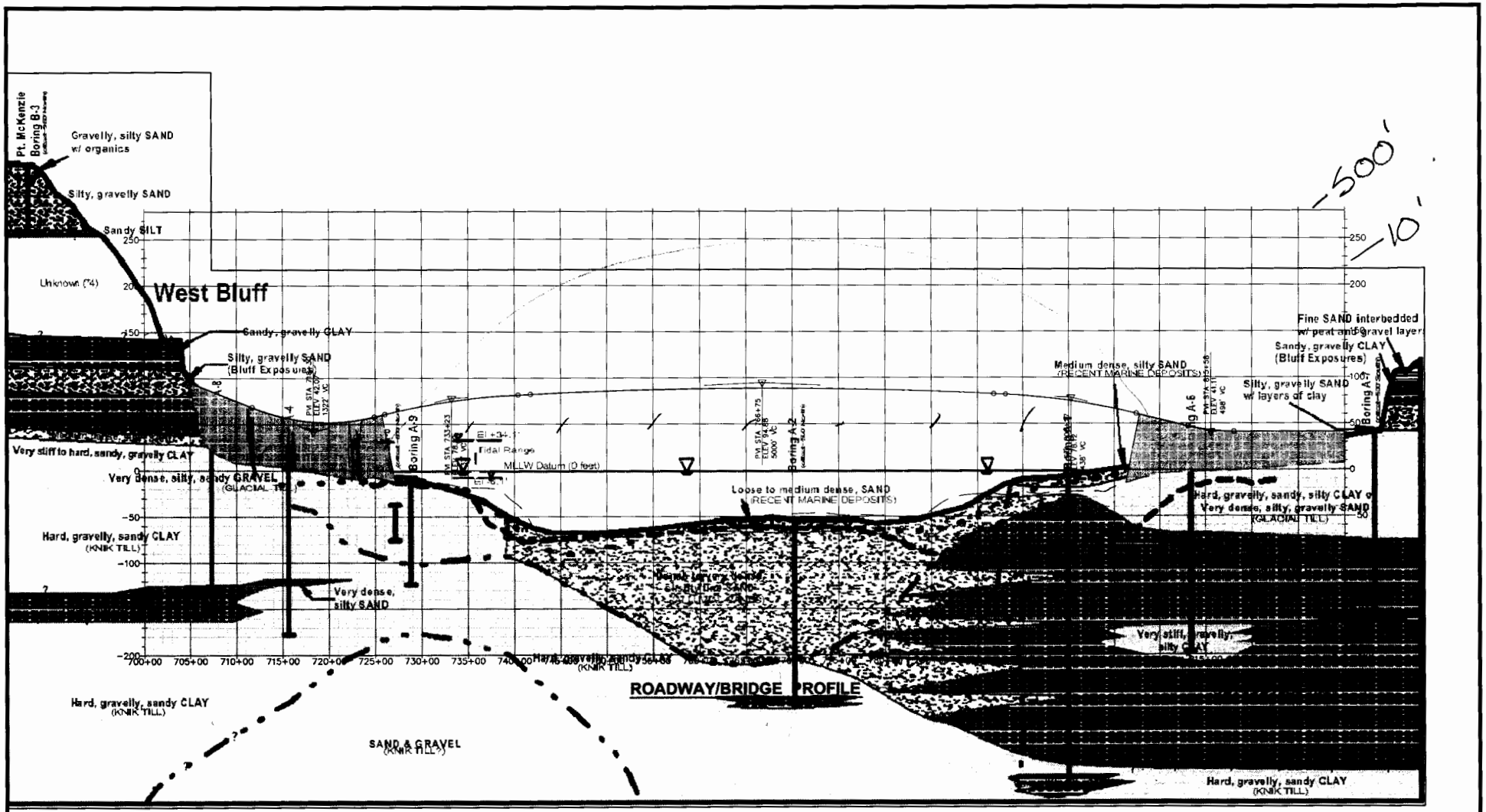
- This map shows all Knik sightings (green squares) with yellow circles indicating the sightings when tide was + or – 2 hours from low tide. This makes sense since most surveys were intentionally conducted at or near low tide in Knik Arm (therefore most of the sightings are within 2 hours of low tide), and almost all upper Knik sightings were taken at high tide because whales must retreat from this area at low tide when it has almost no swimmable water. Keep in mind that all tidal data taken from the one buoy near Anchorage so may not be exact for sightings in the upper inlet.



- This map shows all the sightings in Knik by month.



HEP



-500'
-10'

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P N D ENGINEERS, INC.

PROJECT: **KNIK ARM CROSSING**

TITLE: PROOF OF CONCEPT WORK
GEOLOGICAL SECTION

DESIGNED BY:	XXX	DATE:	11/06/09
CHECKED BY:	XXX	PROJECT NO:	041133

SHEET NO: 1 OF