FOXE BASIN POLAR BEAR PROJECT 2007-2012

Elizabeth Peacock[1]
Anne Orlando[1]
Vicky Sahanatien[2]
Seth Stapleton[3]
Andrew E. Derocher[2]
David L. Garshelis[3]

[1]Wildlife Research Section, Department of Environment,
P.O. Box 209, Igloolik, NU X0A 0L0

[2]Department of Biological Sciences, University of Alberta, Edmonton, AB

[3]Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota

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ᓯᑯᓯᓖᕐᒥᐅᑦ ᑕᕆᐅᖓᑕ 2008-ᒥ ᓇᓄᕐᓄᑦ ᖃᐅᔨᓴᖅᑕᐅᓂᖓ

ᐅᓂᒃᑳᖅᓯᒪᓂᖓ

ᐅᓇ ᐅᓂᒃᑲᐅᓯᖅ ᐅᓂᒃᑲᐅᓯᕐᑲᖅᐳᖅ ᐱᓕᕆᐊᖑᕚᓪᓕᐊᓯᒪᔪᒥᒃ ᓯᑯᓯᓖᕐᒥᐅᑦ ᑕᕆᐅᖓᑕ ᓇᓄᕐᓄᑦ ᖃᐅᔨᓴᖅᑕᐅᓂᕆᓚᐅᖅᑕᖓᓄᑦ ᓄᕙᐱᕆ 2007-ᒥᑦ ᓄᕙᐱᕆ 2008-ᒧᑦ.

ᑐᕌᕆᔭᐅᓪᓗᐊᑕᓚᐅᖅᑐᑦ 2008-ᒥ ᓯᓚᒥ ᐱᓕᕆᔪᕐᑲᖅᑎᓪᓗᒍ ᐃᓕᐅᖅᑲᐃᓇᔾᕐᓂᖅ ᐊᒥᐊᒃᑯᒋᔭᐅᔪᓂᒃ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔫᒃᑯᑦ ᓂᕚᖕᖓᑖᓂᒃ ᐃᓕᕐᖅᑲᕐᓗᒋᓪᓗ ᓇᓄᕐᓄᑦ ᖃᐅᔨᓴᕈᒪᒧᑦ ᓯᕗᓪᓕᖅᐹᕐᒥᒃ ᖃᐅᔨᓴᕐᓂᕆᔭᐅᔪᒥᒃ ᖃᖓᑕᔫᒃᑯᑦ ᖃᐅᔨᓴᕐᓂᐅᓗᓂ. ᐱᓕᕆᔭᐅᔪᒪᖅᑳᖅᑕᐅᓚᐅᖅᑐᑦ ᓯᕗᓪᓕᖅᐹᒥ ᐊᕐᕌᒍᒥ ᓇᓗᓇᐃᒃᑯᑎᖅᓯᕚᓪᓗᓂ-ᐱᒃᑲᓐᓂᖅᐸᒡᓗᒋᓪᓗ ᖃᐅᔨᒪᓕᕈᒪᒧᑦ ᖃᔅᓯᐸᓘᖕᒪᖔᑕ (ᐊᕐᕌᒍᓕᒫᒥ ᐆᒪᓇᓱᒃᐸᕐᓂᕆᓲᖑᑦ, ᐊᖏᓂᖏᑦ, ᖃᓄᐃᓕᓯᒪᓂᕆᓲᖑᓪᓗ) ᓄᖅᑲᖅᑎᑕᐅᓯᒪᑲᐃᓐᓇᓚᐅᖅᐳᑦ ᓄᓇᓕᖕᒥᐅᑦ ᐃᓱᒫᓗᑎᖃᕐᓂᖏᓐᓄᑦ ᓇᓄᐃᑦ ᓯᓂᒃᑎᑕᐅᕙᖕᓂᖏᓐᓄᑦ.

ᓯᓚᒥ ᐱᓕᕆᓂᕆᔭᐅᔪᖅ ᐱᓕᕆᐊᖑᓚᐅᖅᐳᖅ ᐊᐅᒡᒍᓯᑎ 4-ᒥᑦ ᓯᑎᐱᕆ 5-ᒧᑦ 2008-ᒥ, ᑐᖕᖓᕕᖃᖅᖢᑎᒃ ᕿᒥᕈᒥ, ᑮᖕᒐᕐᓂ, ᐃᒡᓗᕋᓖᒥᑦ Bray Island-ᒦᑦᑐᒥ, ᐃᒡᓗᓕᖕᒥ ᓇᐅᔾᔫᓂᓗ. ᓇᓄᐃᑦ ᐱᔪᕐᑲᑦᑕᓚᐅᖅᐳᑦ ᐃᓪᓕᕆᔭᐅᕙᓪᓗᑎᒃ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᕚᖅᓯᐅᑎᓂᒃ ᖁᖓᓯᕈᕐᓂ 23 ᐃᓐᓇᐅᓪᓗᑎᒃ ᐊᕐᓇᓪᓗᖕᓄᑦ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᕚᖅᓯᐅᑎᓂᒡᓗ ᓯᐅᑎᕈᑎᓂᒃ ᓂᕚᖓᔪᓂᒃ ᑎᓴᒪᓄᑦ ᐊᖑᑎᓄᑦ ᐃᓐᓇᕐᓄᑦ. ᑎᒥᖓᓂᖕᖑᖅᑐᓂᒃ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ ᐲᖅᓯᕖᐅᓪᓗᑎᒃ ᐅᒃᑐᕋᖅᑕᐅᓪᓗᑎᒡᓗ ᑕᐃᑕ ᓯᓂᖅᑎᑕᐅᓯᒪᔪᑦ ᑕᐃᒪᐃᓕᐅᖅᑕᐅᓚᐅᖅᑐᑦ. ᓇᒧᖕᒌᑎᖅᑕᐅᓂᖏᑦ 2008-ᒥ ᖁᖓᓯᕈᓯᖅᑕᐅᓚᐅᖅᑐᖅ ᐃᑲᔪᕐᓂᖅᑲᖅᐳᖅ 2007-ᒥ ᓇᒧᖕᖓᖅᑕᐅᓚᐅᕐᓂᖏᓐᓄᑦ, ᑕᐃᒪᐃᓐᓂᖓᓄᓪᓗ ᓄᓇᒥ ᑭᒡᒐᖅᑐᐃᓂᖅᑲᑦᑎᐊᖅᑐᒥ ᑕᑰᔭᑕᐅᔭᓐᓇᖅᑐᑎᒃ ᑐᓴᖅᑕᐅᔪᒃᓴᓂᒃ ᐊᑐᖅᑕᐅᓂᐊᕐᓗᑎᒃ ᖃᔅᓯᐅᓂᖏᑕ ᖃᓄᐃᓕᓯᒪᓂᖏᓐᓄᑦ ᓄᓇᖏᑕ ᖃᐅᔨᓴᖅᑕᐅᓂᖏᓐᓄᑦ ᑐᑭᓯᐅᒪᓕᕈᒪᓂᕐᒧᑦ ᖃᓄᖅ ᐊᒃᑐᖅᑕᐅᑐᐃᓐᓇᓇᐊᖃᒪᖔᑕ ᓯᓚᐅᑉ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖓᓄᑦ ᑐᕙᖅ ᓄᓇᒋᕙᒃᑕᖓᑦ ᓇᓄᐃᓪᓗ ᓇᒧᖕᖓᐅᕙᓪᓕᐊᓂᕙᒃᑕᖏᑦ.

ᐃᓪᓕᕆᓯᓚᐅᕐᒥᔪᒧᑦᑕᐅᖅ 33-ᓂᒃ ᓈᓚᐅᑎᒃᑯᑦ ᑑᓵᔭᐅᔪᓐᓇᖅᑐᓂᒃ ᓇᓗᓇᐃᒃᑯᑦᑕᕐᓂᒃ (RFID-ᖑᓂᕋᖅᑕᐅᒋᓪᓗᑎᒃ) ᓂᕚᖕᖓᑖᓂᒃ ᓯᐅᑎᖏᓐᓄᑦ ᑕᒪᐃᓐᓄᑦ ᐊᑎᖅᑕᓖᖑᖕᒋᑦᑐᓄᑦ ᓇᓄᕐᓄᑦ ᐱᔭᐅᓚᐅᖅᑐᓄᑦ. ᑖᒃᑯᐊ RFID-ᖑᓂᕋᖅᑕᐅᔪᑦ ᓂᕚᖕᖓᑖᑦ ᐊᑐᖅᑕᐅᕐᑲᑦᑕᕐᓂᐊᖅᐳᑦ ᖃᐅᔾᔪᑕᐅᕙᒡᓗᑎᒃ ᓇᓕᐊᖑᖕᒪᖔᑕ ᓇᓄᐃᑦ ᖃᖓᑕᔪᒃᑯᑦ, ᑕᐃᒪᐃᓂᖓᓄᓪᓗ ᒥᑭᓪᓕᒋᐊᖅᑎᑦᑎᓗᓂ ᐱᓇᔪᒃᑕᐅᒃᑲᓐᓂᕆᐊᖃᕐᕙᖏᓐᓂᒃ ᖃᐅᔨᒪᔭᐅᔪᑦ ᓇᓄᐃᑦ ᓯᕗᓂᒃᓴᑦᑎᓐᓂ ᐊᕐᕌᒍᓂ. ᖃᐅᔨᔪᕐᑲᓕᓚᐅᖅᑐᖅ ᓇᐅᑦᑎᖅᓱᕐᓂᖅ ᖃᐅᔨᑎᑦᑎᓚᐅᕐᓂᖓᓂᒃ ᓇᓕᐊᖑᒪᖔᑕ ᓂᕐᔪᑏᑦ RFID-ᓂᒃ ᓂᕚᖕᖓᑖᓕᖅᓯᒪᔪᑦ ᐅᖓᓯᒋᓂᖃᕋᓗᐊᖅᑎᓪᓗᒋᑦ 2 ᑭᓗᒦᑕᓂᒃ. ᖃᖓᑕᕝᕕᒋᓖᖅᑕᕗᑦ ᓯᑯᓯᓖᕐᒥᐅᑦ ᑕᕆᐅᖓᑦ ᐅᐱᕐᖔᖑᓕᖅᐸᑦ 2009-ᒥ ᖃᐅᔭᖅᑐᕐᓗᑕ ᖃᓄᖅ ᐊᖏᑎᒋᔪᒥᒃ ᑕᐅᕙᓃᓐᓂᖃᖅᐸᖕᒪᖔᑕ.

ᐱᔭᕇᖅᓯᓚᐅᕐᒥᔪᑦ ᓯᕗᓪᓕᖅᐹᖅᓯᐅᑎᒥᒃ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᖃᐅᔨᒪᓕᕈᒪᒧᑦ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᓂᒃ ᐊᑐᖅᓗᑕ ᖃᔅᓯᐸᓘᓕᕆᐊᒃᓴᖏᓐᓂᒃ ᖃᖓᑕᔪᒃᑯᑦ ᖃᐅᔨᓴᖅᑕᐅᓪᓗᑎᒃ. ᖃᐅᔨᓴᖅᑐᕐᖃᔪᐊᖅᑎᓪᓗᒍ ᖃᖓᑕᔪᕐᖃᖅᓗᓂ ᓴᓪᓕᕐᒥ, ᖃᖓᑕᕝᕕᒋᓚᐅᖅᑕᕗᑦ ᑕᒪᕐᒥᑦᑎᐊᖅ ᑖᓯᒪ ᕿᕿᖅᑕᐅᑉ ᓯᒡᔭᖓ (ᑕᒪᓇ ᐃᓚᖃᓚᐅᕐᒥᔪᖅ ᐊᒥᓱᐃᓯᖅᑕᐅᓪᓗᑎᒃ ᖃᖓᑕᕝᕕᐅᒃᑲᓐᓂᖅᑐᓂᒃ) ᖃᓯᒃᑲᓪᓚᖕᓂᒡᓗ ᓄᓇᖅᐸᓯᒃᑐᒥ ᖃᖓᑕᓂᕆᔭᐅᔪᓂ ᑕᑯᓚᐅᖅᓗᑕᓗ 264-ᓂᒃ ᓇᓄᕐᓂᒃ, 170-ᐅᓂᖏᓪᓗ ᐃᓐᓇᐅᓪᓗᑎᒃ. ᖃᖓᑕᓪᓗᓂ ᖃᐅᔨᓴᕐᓂᕆᔭᐅᔪᑦ ᐊᓯᖏᓐᓂ ᐃᓂᓂ ᓯᑯᓯᓖᕐᒥᐅᑦ ᑕᕆᐅᖓᒍᑦ ᑕᑯᔪᕐᑲᓚᐅᕐᒥᔪᖅ 114-ᓂᒃ, ᐃᓚᓕᐅᔾᔭᐅᖕᒋᕐᖢᑎᒃ ᓇᓄᐃᑦ ᐱᔭᐅᓯᒪᓚᐅᑲᓚᐅᖅᑐᑦ. ᑕᒪᓐᓇ ᓯᕗᓪᓕᖅᐹᖅ ᖃᐅᔨᓴᕐᓂᕆᔭᕗᑦ ᐃᑲᔫᑎᖃᕐᓂᐊᖅᑐᖅ ᐋᖅᑭᒃᓱᐃᓇᔭᕐᓂᕐᒧᑦ 2009 – 2010-ᖑᓕᖅᐸᑦ ᖃᖓᑕᓗᓂ ᖃᐅᔨᓴᕐᓂᐅᓛᖅᑐᓄᑦ. ᖃᐅᔨᒪᓕᓚᐅᖅᑐᒍᑦ ᑲᑎᑦᑎᓂᖅ ᖃᐅᔨᑲᓪᓚᖕᓂᒃ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᓂᒃ, ᑕᒪᓐᓇ ᐃᓚᖅᑲᖅᖢᓂ ᐅᖓᓯᕆᒐᓗᐊᖅᖢᑎᑦ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᑕᑯᔭᐅᓂᖏᓐᓄᓪᓗ-ᑕᑯᔭᐅᒃᑲᓐᓂᕐᓂᖏᓐᓄᑦ ᐊᑐᖅᑕᐅᔪᓂᒃ (ᐸᒃᓚᓐᑦ, 2001), ᐊᑐᖅᑕᐅᔪᓐᓇᑐᐃᓐᓇᕆᐊᖃᖅᐳᖅ ᐊᑐᕈᓐᓇᑦᑎᐊᓗᓂᓗ ᖃᔅᓯᐸᓘᓕᕆᐊᒃᓴᖏᓐᓄᑦ ᓇᓄᐃᑦ.

ᖃᐅᔨᓴᕐᓂᕆᔭᐅᔪᖅ ᖃᐅᔨᑎᑦᑎᓯᒪᓕᖅᐳᖅ ᐊᖏᔫᒪᕆᖕᒥᒃ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᕆᔪᖓᓂᒃ ᓇᓄᐃᑦ ᑐᕙᕐᒥ ᓄᓇᒋᕙᒃᑕᖓᑦ ᓄᕙᐱᕆᒧᑦ, ᑎᓯᐱᕆᒧᑦ, ᔭᓄᐊᕆᒧᑦ ᒪᐃᒧᓪᓗ 1979-ᒥᑦ 2004-ᒧᑦ (Sahanatien, *in prep*). ᑕᒪᒃᑯᐊ ᓯᕗᓪᓕᖅᐹᖅᓯᐅᑏᑦ ᖃᐅᔨᒪᔭᐅᓕᖅᑐᑦ ᐅᓂᒃᑲᐅᓯᐅᓚᐅᖅᓯᒪᕗᑦ ᑲᑎᒪᕐᔪᐊᖅᑐᖅᑲᖅᑎᓪᓗᒍ ᐅᑯᓂᖓ, ᑲᑐᔾᔨᖅᑲᑎᕌᓂᒃ ᓯᓚᑦᑐᖅᓴᕐᕕᖕᓄᑦ ᓯᓚᑦᑐᖅᓴᕐᕕᒡᔪᐊᓄᓪᓗ ᐅᑭᐅᖅᑕᖅᑐᒧᑦ ᐃᓕᓐᓂᐊᕐᓂᕆᓲᖑᓂ (ᐅᑐᐱᕆ 2007-ᐅᑎᓪᓗᒍ) ᓄᓇᕐᔪᐊᕐᒥᐅᑕᐅᖃᑎᒌᓪᓗ ᑲᑎᒪᕐᔪᐊᕐᓂᕆᔪᖓᑦ ᓇᓄᕐᓂᒃ ᖃᐅᔨᓴᖅᑐᖃᕐᕙᖕᓂᖓᓄᑦ ᐊᐅᓚᑦᑎᕙᖕᓂᕐᒧᓪᓗ (ᓄᕙᐱᕆ 2007-ᖑᑎᓪᓗᒍ). ᑕᒪᓐᓇ ᖃᐅᔨᓴᕐᓂᕆᔭᐅᔪᖅ ᐱᔭᕇᖅᑕᐅᔫᒫᖅᑐᖅ ᐃᓚᓕᐅᔾᔭᔪᖃᕐᓗᓂ 2005-ᒥᑦ-2008-ᒧᑦ ᑎᑎᕋᖅᑕᐅᖃᑦᑕᓚᐅᖅᑐᓂᒃ ᐋᖅᑭᒃᓯᖅᑕᐅᓂᐊᖅᖢᑎᒡᓗ ᑎᑎᕋᖅᓯᒪᓕᖅᑎᑕᐅᓗᑎᒃ 2009-ᖑᓕᖅᐸᑦ.

ᑭᒡᓕᓯᓂᐊᖅᑕᐅᔪᑦ ᐱᔭᕇᖅᑕᐅᓚᐅᖅᐸᑦ ᓇᓄᐃᑦ ᓄᓇᒋᕙᒃᑕᖓᑦ ᖃᓄᖅ ᐊᖏᑎᒋᕙᖕᒪᖔᑕ, ᖃᓄᖅ ᐅᖓᓯᒃᑎᒋᔪᓄᑦ ᓄᒃᑕᖅᐸᖕᒪᖔᑕ ᓇᒧᖕᖓᐅᕙᓪᓕᐊᕙᖕᓂᕆᓲᖑᓪᓗ ᑕᒪᓐᓇᓗ ᑐᖕᖓᕕᖅᑎᑕᐅᓗᓂ 2007-2008-ᒥ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᓄᑦ ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᑦ ᓇᒧᖕᖓᖅᐸᓪᓕᐊᔪᖕᒪᖔᑕ ᑎᑎᕋᖅᑕᐅᓯᒪᔪᓂᒃ.

ᐱᑕᕐᑲᖅᐸᕇᖅᑐᑦ ᑲᑎᑕᐅᓯᒪᔪᑦ (ᐃᒡᓗᓕᖕᒥ ᐅᖃᐅᓯᒃᑯᑦ ᖃᓄᐃᓕᐅᖅᐸᓚᐅᕈᓯᕐᓄᑦ ᐱᓕᕆᐊᖑᔪᓂᑦ, ᒥᕐᖑᐃᖅᓯᕐᕕᓕᕆᓂᕐᒧᑦ ᑲᓇᑕᒧᑦ ᐅᖃᐅᓯᒃᑯᑦ ᖃᓄᐃᓕᐅᖅᐸᓚᐅᕈᓯᕐᓄᑦ ᐱᓕᕆᐊᖑᔪᓂ, ᑕᓯᐅᔭᕐᔪᐊᒥ ᐱᓕᕆᐊᖑᔪᒥ) ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᓐᓄᑦ (IQ-ᖑᓂᕋᖅᑕᐅᕙᒃᑭᓪᓗᓂ) ᕿᒥᕐᕈᐊᖅᑕᐅᒃᑲᓂᓚᐅᖅᐳᑦ 2006-ᒥ 2007-ᒥᓗ ᑭᓯᐊᓂ ᒥᑭᑦᑐᒻᒪᕆᑯᓗᖕᓂᒃ ᑐᓴᖅᑕᐅᔫᒃᓴᓂᒃ ᓇᓄᐃᑦ ᓄᓴᕆᕙᒃᑕᖏᓐᓅᖓᔪᓂᒃ ᐊᑐᖅᐸᒃᑕᖏᓐᓄᑦ ᓇᓅᑉᐸᖕᓂᕆᔭᖏᓐᓄᓪᓗ ᓇᓂᓯᔪᖃᓚᐅᖅᑐᖅ. ᓄᑖᓂᒃ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑯᖃᖏᓐᓂᒃ ᑲᑎᖅᓱᐃᔪᖃᓛᖅᑐᖅ 2008-2009-ᖑᓕᖅᐸᑦ ᐅᓂᒃᑲᐅᓯᐅᖅᑐᖃᕐᓗᓂᓗ 2009-ᖑᓕᖅᐸᑦ. ᑕᒪᓐᓇ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᓐᓄᑦ ᖃᐅᔨᓴᕐᓂᖅ ᑭᖑᕙᓯᒃᑎᑕᐅᓕᓚᐅᖅᓯᒪᕗᑦ 2008-ᖑᑎᓪᓗᒍ ᐋᓐᓂᐊᖅᑐᖃᕐᓂᖓᓄᑦ. ᓇᓕᖅᑲᒥᐅᑕᖅᑎᒍᑦ ᐅᓂᒃᑳᕐᓂᖅᑕᖅᑲᓚᐅᖅᓯᒪᕗᖅ ᐅᓂᒃᑲᐅᓯᖃᕐᓗᑎᒃ ᑕᒪᑐᒥᖓ ᓯᑯᓯᓛᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ ᐱᓕᕆᐊᖑᔪᒥ ᐅᓂᒃᑲᐅᓯᐅᓪᓗᓂ ArcticNet-ᒥ (ᑎᓯᐱᕆ 2006-ᖑᑎᓪᓗᒍ) ACUNS-ᑯᓐᓄᓪᓗ (ᐅᑐᐱᕆ 2007-ᖑᑎᓪᓗᒍ).
ᐊᔾᔨᙳᐊᑦ ᐅᖃᐅᓯᐅᓂᖏᑦ

ᐊᔾᔨᙳᐊᖅ 1. ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᑕ ᓇᓄᐃᑦ ᖃᔅᓯᐅᓂᕆᔭᖏᑦ.

ᐊᔾᔨᙳᐊᖅ 2. ᐊᕐᕌᒍᖏᑦ, ᑭᓲᓂᖏᑦ, ᑐᓵᔾᔪᑕᐅᔪᓐᓇᖅᑐᓪᓗ ᖃᓄᓕᑦᑑᖕᒪᖔᑕ ᓇᓄᕐᓄᑦ ᐱᔭᐅᔪᓄᑦ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂᑦ 2008-ᖑᑎᓪᓗᒍ.

ᐊᔾᔨᙳᐊᖅ 3. ᓇᓂ ᓇᓄᐃᑦ ᑕᑯᔭᐅᓚᐅᕐᓂᕆᔭᖏᑦ ᖃᖓᑕᔪᖅᑲᖅᓱᓂ ᖃᐅᔨᓴᕐᓂᕆᔭᐅᒪᐅᖅᑐᒥ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ 2008-ᖑᑎᓪᓗᒍ.

ᐊᔾᔨᙳᐊᖅ 4. ᐃᓂᒋᔭᐅᓚᐅᖅᑐᑦ ᖃᖓᑕᕝᕕᐅᓪᓗᑎᒃ ᑕᐅᕙᓂ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ ᓇᓄᕐᓂᒃ ᖃᖓᑕᔪᖅᑲᖅᓱᓂ ᖃᐅᔨᓴᖅᑐᖅᑲᖅᑎᓪᓗᒍ ᐱᔭᐅᔪᖅᑲᖅᑲᑦᑕᓚᐅᕐᓂᖓᓗᓂᓗ ᐅᖃᖅᓯᒪᔪᑦ 2008-ᖑᑎᓪᓗᒍ.

ᐊᔾᔨᙳᐊᖅ 5. ᓄᓇᙳᐊᖅ ᓄᓇᒋᔭᐅᕙᒃᑐᑦ ᖃᓄᖅ ᐊᖏᑎᒋᓂᖏᓐᓇᓄᑦ (minimum convex polygon) ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᒧᑦ ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᓄᑦ 2007-ᖑᑎᓪᓗᒍ. ᑕᒪᕐᒥᑦᑎᐊᖅ ᑕᒪᒃᑯᐊ ᖁᖓᓯᕈᓰᑦ ᑲᑕᒃᓯᒪᓕᖅᑐᑦ ᑕᒪᒃᑯᓇᙶᑦ ᓇᓄᕐᓂᑦ ᑕᐃᒪᐃᑦᑐᓕᖅᑕᐅᓚᐅᖅᑐᓂᑦ.

ᐊᔾᔨᙳᐊᖅ 6. ᐃᓃᑦ ᓇᓄᓛᑦ ᐊᖏᑎᒋᕙᖕᓂᖏᑦ (minimum convex polygon) ᐃᓛᒃᑰᖅᓱᑎᒃ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᒧᑦ ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᑦ ᐃᓐᓇᐃᑦ ᐊᕐᓇᓪᓗᐃᑦ ᓇᓄᕆᔭᐅᔪᑦ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ 2007-ᖑᑎᓪᓗᒍ ᐊᔾᔩᙳᕆᑦᑐᓂ ᐊᕐᕋᒍᑉ ᐃᓗᐊᓃᑦᑐᓂᒃ ᐊᕙᑎᓕᕆᓂᕆᔭᐅᔪᒥ.

ᐊᔾᔨᙳᐊᖅ 7. (SD-ᖑᓂᕋᖅᑕᐅᒋᓪᓗᓂ) ᑕᖅᑭᑕᒫᑦ ᑲᑎᑕᐅᓯᒪᔪᓄᑦ ᖃᐅᔮᔾᔪᑕᐅᔪᓄᑦ ᐅᖓᓯᒃᑐᒧᐊᖅᐸᖕᓂᕆᔭᖏᑦ (ᑭᓗᒦᑕᑎᒧᑦ) ᓇᒧᙵᖅᐸᑦᓕᐊᖅᑲᑦᑕᕐᓂᕆᔭᖏᑦ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᓄᑦ-ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᓄᑦ ᐃᓐᓇᕐᓄᑦ ᐊᕐᓇᓪᓗᖕᓄᑦ ᓇᓄᕐᓄᑦ (*n*-ᖑᖅᑎᓯᒪᓪᓗᓂ ᖁᓛᓂ ᑐᑭᓕᐊᖓᔪᒥ) ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ 2007-ᖑᑎᓪᓗᒍ.

ᐊᔾᔨᙳᐊᖅ 8. ᐃᓂᒥ ᐃᓂᒧᑦ ᓄᒃᑕᖅᐸᖕᓂᕆᔭᖏᑦ ᓯᑯᓰᓚᕐᒥᐅᑦ ᓇᓄᕆᔭᖏᑕ ᐊᑐᖅᓱᑎᒃ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᒧᑦ/Argos ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᖅᓯᐅᑏᓂᒃ ᖁᖓᓯᕈᕐᓂᒃ (*n* = 23-ᓄᑦ ᐃᓐᓇᕐᓄᑦ ᐊᕐᓇᓪᓗᕐᓄᑦ) ᓯᐅᑎᕈᑎᓄᓪᓗ (*n* = 4-ᓄᑦ ᐊᖑᑎᓄᑦ) ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᑭᑉᐹᕆᒃᓯᓕᖅᓯᒪᔪᑦ ᐅᖃᐅᓯᐅᓂᖏᑦ

ᑭᑉᐹᕆᒃᓯᓕᖅᓯᒪᔪᖅ 1. ᑎᑎᕋᖅᑕᐅᓯᒪᔪᑦ ᓇᓄᕐᓄᑦ ᐱᔭᐅᓚᐅᖅᑐᓄᑦ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂᑦ 2008-ᖑᑎᓪᓗᒍ.

ᑭᑉᐹᕆᒃᓯᓕᖅᓯᒪᔪᖅ 2. (SE-ᖑᓂᕋᖅᑕᐅᒋᓪᓗᓂ) ᑭᒃᑯᑐᐃᓐᓇᓄᑦ ᐊᑐᖅᑕᐅᕙᒃᑐᓄᑦ ᐆᒃᑐᕋᖅᑕᐅᔪᑦ ᑭᓲᓂᖏᓐᓄᑦ (ᐊᕐᓇᓪᓗᐃᑦ/ᐊᖑᑏᑦ) ᖃᓄᖅ ᐊᕐᕌᒍᖃᖅᑎᒋᖕᒪᖔᑕ ᓇᓄᐃᑦ ᐱᔭᐅᔪᑦ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂᑦ, 2008-ᖑᑎᓪᓗᒍ.

ᑭᑉᐹᕆᒃᓯᓕᖅᓯᒪᔪᖅ 3. ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᓄᑦ ᑐᓵᔭᐅᔪᓐᓇᖅᑐᑦ ᐃᓕᐅᖅᑲᖅᑕᐅᓚᐅᖅᑐᑦ ᓇᓄᕐᓄᑦ ᐱᔭᐅᓚᐅᖅᑐᓄᑦ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ, ᓄᓇᕗᒥ, 2008-ᖑᑎᓪᓗᒍ

ᑭᑉᐹᕆᒃᓯᓕᖅᓯᒪᔪᖅ 4. ᐅᖓᓯᖕᓂᕆᔭᖏᑦ, ᐃᓂᖏᑦ, ᐃᑲᕋᐃᑦ ᖃᖓᑕᓂᕆᔭᐅᓚᐅᖅᑐᑦ, ᓇᓄᐃᓪᓗ ᑕᑯᔭᐅᓚᐅᖅᑐᑦ ᑕᒪᐃᓐᓂ ᐊᑐᓂᑦ ᐱᓇᔪᕝᕕᐅᔪᓂ ᑕᒪᑐᒧᖓ ᓯᑯᓰᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᑕ ᓇᓄᓂᕆᔭᖏᓐᓄᑦ ᖃᖓᑕᔪᖅᑲᖅᓱᓂ ᖃᐅᔨᓴᕐᓂᕆᔭᐅᔪᒥᑦ, 2008-ᖑᑎᓪᓗᒍ.

ᑭᐸᓃᓐᑲᓯᓕᖅᓯᒪᔪᖅ 5. ᓄᓇᒋᕙᒃᑕᖏᓐᓂ (minimum convex polygon) ᐊᖏᓂᖏᑦ (km^2) ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᓄᑦ ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᑦ ᐊᕐᓇᓪᓗᐃᑦ ᓇᓄᐃᑦ, ᓯᑯᓷᙵᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ (2007-2008) ᐊᔾᔨᒌᖏᑦᑐᓂ ᐊᕐᕌᒍᑉ ᐃᓗᐊᓂ: ᐊᐅᔾᒎᓯᑎᒥᑦ – ᐅᑐᐱᕆᒧᑦ ᐃᓱᒪᒋᔭᐅᕙᒃᐳᑦ ᐃᒪᖅ ᓱᓕ ᖁᐊᙱᖏᓐᓂᖓᓄᑦ; ᓄᕕᐱᕆᒥᑦ – ᑎᓯᐱᕆᒧᑦ, ᖁᐊᖅᓯᒪᓕᕐᓂᖓᓂᒃ, ᔭᓄᐊᕆᒥᑦ – ᒫᐳᕈᒧᑦ, ᐅᑭᐅᖑᓂᖓᓂᒃ ᒪᐃᒥᓪᓗ – ᔪᓚᐃᒧᑦ ᑐᕙᖅ ᓯᕐᖁᑦᑎᖅᐸᓪᓚᐊᓕᕐᓂᖓᓂᒃ.

ᑭᐸᓃᓐᑲᓯᓕᖅᓯᒪᔪᖅ 6. ᐊᑐᖅᑕᐅᒐᔫᒃᐸᒃᑐᖅ ᐊᕐᕋᒍᐸ ᖃᖓᒃᑰᕐᓂᖓᓄᑦ ᓄᓇᒋᔭᐅᕙᒃᑐᑦ ᐊᖏᓂᖏᑦ ᐅᖓᓯᖕᓂᖏᓪᓗ ᓄᒃᑖᕐᓂᐅᓚᐅᖅᑐᑦ ᑕᒪᒃᑯᓄᖓ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔫᒃᑯᑦ ᖃᐅᔨᓴᐅᔪᓐᓇᖅᑐᓂᒃ ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᑦ ᐊᕐᓇᓪᓗᐃᑦ ᓇᓄᐃᑦ, ᓯᑯᓷᙵᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ (2007-2008-ᒥ).

ᑭᐸᓃᓐᑲᓯᓕᖅᓯᒪᔪᖅ 7. ᑕᖅᑭᑕᓕᑦ ᐅᖓᓯᒃᑎᒋᓂᖏᑦ (ᑭᓗᒥᑕᑎᑯᑦ) ᓄᒃᑕᕐᓂᕆᕙᒃᑕᖏᑦ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔫᒃᑯᑦ ᖃᐅᔨᓴᐅᔪᓐᓇᖅᑐᓂᒃ ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᑦ ᐊᕐᓇᓪᓗᐃᑦ ᓇᓄᐃᑦ, ᓯᑯᓷᙵᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ (2007-2008)[1].

ᑭᐸᓃᓐᑲᓯᓕᖅᓯᒪᔪᖅ 8. ᐃᑲᕐᕿᑕᓖᑦ ᓄᒃᑕᕐᓂᕆᕙᒃᑕᖏᑦ (ᑭᓗᒥᑕᓂᒃ/ᐃᑲᕐᕿᒧᑦ) ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔫᒃᑯᑦ ᖃᐅᔨᓴᐅᔪᓐᓇᖅᑐᓂᒃ ᖁᖓᓯᕈᓯᖅᑕᐅᓯᒪᔪᑦ ᐊᕐᓇᓪᓗᐃᑦ ᓇᓄᐃᑦ, ᓯᑯᓷᙵᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ (2007-2008).

ᑭᖑᓂᖓᓂ ᐃᓕᓯᒪᔪᑦ ᐊᔾᔨᖑᐊᑦ ᐅᕐᑲᐅᓯᐅᓂᖏᑦ

ᐊᔾᔨᖑᐊᖅ A1.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐊᑕᐅᓯᐅᓪᓗᓂ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓗᖅ ᓇᓅᑉ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᑯᓂ #165.620-ᒥᒃ, ᐊᐅᔾᒎᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A2.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᒪᕐᕉᖕᓂᒃ ᐊᑎᖅᑕᓖᖅᑲᖅᑯᓂ ᑕᒪᑐᒪᓂ ᐊᕐᕌᒍᒥ ᐅᓅᓂᑰᖕᓂᒃ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᑯᓂ #165.540-ᒥᒃ, ᐊᐅᔾᒎᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A3.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᒪᕐᕉᖕᓂᒃ ᐊᑎᖅᑕᓖᖅᑲᖅᑯᓂ ᑕᒪᑐᒪᓂ ᐊᕐᕌᒍᒥ ᐅᓅᓂᑰᖕᓂᒃ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᑯᓂ #165.650-ᒥᒃ, ᐊᐅᔾᒎᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A4.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᒪᕐᕉᖕᓂᒃ ᐊᑎᖅᑕᓖᖅᑲᖅᑯᓂ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᑯᓂ #165.140-ᒥᒃ, ᐊᐅᔾᒎᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A5.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓖᖅᑲᖅᑯᓂ ᐊᕐᕋᓂᓚᕿᕐᒥᒃ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᑯᓂ #165.690-ᒥᒃ, ᐊᐅᔾᒎᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A6.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᒪᕐᕉᖕᓂᒃ ᐊᑎᖅᑕᓖᖅᑲᖅᑯᓂ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᑯᓂ #165.550-ᒥᒃ, ᐊᐅᔾᒎᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A7.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ ᐊᕐᕌᓂᓕᓴᕐᒥᒃ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.680-ᒥᒃ, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A8.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ ᐊᕐᕌᓂᓕᓴᕐᒥᒃ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.750-ᒥᒃ, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A9.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ ᐊᕐᕌᓂᓕᓴᕐᒥᒃ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.700-ᒥᒃ, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A10.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕌᓂᓕᓵᖅᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.630-ᒥᒃ, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A11.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕋᒍᒥ ᐃᓅᓂᑰᖕᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.760-ᒥᒃ, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A12.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕋᒍᒥ ᐃᓅᓂᑰᖕᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.770-ᒥᒃ, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A13.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕋᒍᒥ ᐃᓅᓂᑰᖕᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.590-ᒥᒃ, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A14.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓘᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕋᒍᒥ ᐃᓅᓂᑰᖕᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ,
ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.580, ᐊᐅᒡᒎᓯᑎᒥᑦ ᓄᕙᐱᓕᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᙳᐊᖅ A15.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᖑᑕᐅᓪᓗᓂ ᓇᓅᑉ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #84563-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A16.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᖑᑕᐅᓪᓗᓂ ᓇᓅᑉ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #84564-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A17.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕌᒍᒥ ᐃᓅᓂᑰᖕᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.720-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A18.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕌᓂᓚᓰᖕᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.670-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A19.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᕐᕌᓂᓚᓯᕐᒥᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ ᒪᕐᕉᖕᓂᓪᓘᓐᓃᑦ ᐊᕐᕌᒍᓕᖕᒥᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.190-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A20.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ ᐊᕐᕌᓂᓚᓯᕐᒥᒃ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.250-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A21.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᒪᕐᕉᖕᓂᒃ ᐊᕐᕌᓂᓚᓰᖕᓂᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ , ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.310-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A22.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓅᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓛᖅᑲᖅᓱᓂ ᐊᕐᕌᓂᓚᓯᕐᒥᒃ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #165.330-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A23.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᒃᑕᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᖑᑕᐅᓪᓗᓂ ᓇᓅᑉ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓱᓂ #84561-ᒥᒃ, ᐊᐅᒡᒌᓯᑎᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A24.

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ᐊᔾᔨᖑᐊᖅ A25.

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ᐊᔾᔨᖑᐊᖅ A26.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᓪᓚᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓄᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓖᖅᑲᖅᓗᓂ ᐊᕐᕌᓂᓕᕐᒥᒃ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓗᓂ #165.740-ᒥᒃ, ᓯᑎᐱᕆᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

ᐊᔾᔨᖑᐊᖅ A27.

ᐃᓂᒥᑦ ᐃᓂᒧᑦ ᓄᓪᓚᕐᓂᕆᔭᖓ ᐃᓐᓇᐅᓪᓗᓂ ᐊᕐᓇᓪᓘᓪᓗᓂ ᓇᓄᑉ ᐊᑕᐅᓯᕐᒥᒃ ᐊᑎᖅᑕᓖᖅᑲᖅᓗᓂ ᐊᕐᕌᓂᓕᕐᒥᒃ, ᓈᓚᒃᑕᐅᔪᓐᓇᖅᑐᖅᑲᖅᓗᓂ #165.730-ᒥᒃ, ᓯᑎᐱᕆᒥᑦ ᓄᕕᐱᕆᒧᑦ, 2008-ᒥ.

Foxe Basin Polar Bear Project 2007 - 2012

Interim Report - 2008
Project Number - 2-07-16

PROJECT PERSONNEL

Dr. Elizabeth Peacock, Wildlife Research Section, Department of Environment, Government of Nunavut
Dr. Anne Orlando, Wildlife Research Section, Department of Environment, Government of Nunavut
Vicki Sahanatien, Department of Biological Sciences, University of Alberta
Seth Stapleton, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota
Dr. Andrew E. Derocher, Department of Biological Sciences, University of Alberta
Dr. David L. Garshelis, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota

SUMMARY

This report summarizes progress on the Foxe Basin Polar Bear Project from November 2007 to November 2008.

The main objectives of the 2008 field season were to deploy remaining satellite tags on polar bears and to conduct a pilot study on aerial survey methods. Initial plans to start the first year of mark-recapture for estimation of population parameters (annual survival, size and status) were postponed because of community concerns over immobilization of polar bears.

Field work was conducted from 4 August to 5 September 2008, based out of Kimmirut, Cape Dorset, a cabin at Bray Island, Igloolik and Repulse Bay. Polar bears were captured to deploy satellite collars on 23 adult females and satellite ear tags on 4 adult males. Biological samples and measurements were collected from all immobilized polar bears. The distribution of 2008 collars complements the 2007 distribution, resulting in a geographically representative sample of information to be used for population delineation and habitat analyses to understand the potential effects of climate change on sea ice habitat and polar bear movements.

We also affixed 33 Radio Frequency Identification (RFID) tags to ears of all non-cub polar bears that were captured. The RFID tags will be used identify bears from the air, reducing the need to recapture known bears in future years. Initial observations showed that we could identify animals

with RFID tags up to 2 km away. We will fly the Foxe Basin area in spring 2009 to observe levels of retention.

We completed pilot research to evaluate sample designs for estimating populations via aerial surveys. During intensive aerial surveys on Southampton Island, we flew the entire coastline (including many duplicate transects) and several inland transects and sighted 264 polar bears, including 170 adults. Aerials surveys across other portions of Foxe Basin yielded 114 sightings, excluding individuals that were physically captured. Our preliminary research will help to structure the 2009 – 2010 aerial surveys. We concluded that combining multiple techniques, including distance sampling and sight-resight methods (Buckland, 2001), has the potential to provide an effective means to estimate polar bear population size.

Analysis has shown significant changes in polar bear sea ice habitat for November, December, January and May for the time period 1979-2004 (Sahanatien, *in prep*). These preliminary results were presented at the conferences of the Association of Colleges and Universities Northern Studies (October 2007) and International Conference on Bear Research and Management (November 2007). This analysis will be completed by including 2005-2008 data and prepared for publication in 2009.

Summary statistics were completed of polar bear home range, distances moved and movement rates based on the 2007-2008 satellite collar movement data.

Existing collections (Igloolik Oral History Project, Parks Canada Oral History Project, Hudson Bay Program) of *Inuit Qaujimajaiugangit* (IQ) were reviewed in 2006 and 2007 but little information about polar bear habitat use and distribution was found. New IQ will be collected in 2008-2009 and a summary report prepared in 2009. The IQ research was delayed in 2008 due to illness. Poster presentations describing this aspect of the Foxe Basin project were presented at ArcticNet (December 2006) and ACUNS (October 2007).

INTRODUCTION

The Government of Nunavut (GN) is responsible for the management and conservation of polar bear (*Ursus maritimus*) populations within its jurisdiction. This responsibility is outlined in the Nunavut Land Claims Agreement (NLCA). Further, the federal government entrusts Nunavut and other polar bear jurisdictions within Canada with the fulfillment of the Articles of the International Agreement of the protection of polar bears and their habitat, ratified in 1978. This task involves periodic population inventories which are comprised of geographic delineation and estimation of demographic parameters including birth and death rates, population size and status. With this information, the GN recommends the Total Allowable Harvest (TAH) for the population to the Nunavut Wildlife Management Board (NWMB). In addition, under the NLCA, the GN is required to manage wildlife under the *principles of conservation*; climate change and its consequences for polar bears has been highlighted as a conservation concern.

The Foxe Basin polar bear population (Foxe Basin) has received relatively little recent research attention (Lunn et al., 1987, Taylor et al., 1990). No population boundary delineation using satellite telemetry (TaylorAkeeagok et al., 2001) has occurred and demographic rates have not been estimated. The mean population size for polar bears in Foxe Basin from 1989 to 1994 was estimated to be 2197 ± 260 SE (Taylor et al., 2006). In recent years, IQ has indicated increases in polar bear numbers, resulting in an increase in the 2005 TAH from 97 to 106 polar bears, which was considered sustainable with a population estimated at 2,300 bears.

The Foxe Basin polar bear population is comprised of Foxe Basin, northern Hudson Bay and the western most extent of Hudson Strait (Figure 1). Chesterfield Inlet (8), Coral Harbour (40), Repulse Bay (12), Hall Beach (8), Igloolik (10), Cape Dorset (10), Kimmirut (10), Qikiqtalluk Wildlife Board (4) and Kivalliq Wildlife Board (4) harvest from Foxe Basin (TAH in parentheses). The Foxe Basin population is also harvested by Quebec communities (average of 0-7 polar bears per year from 1997-2005) however the harvest is not regulated.

Population Inventory

The Foxe Basin Polar Bear Project includes several components to address our management mandate in the Foxe Basin subpopulation of polar bears. A population inventory (boundary delineation and estimation of population parameters) will result in a recommendation for harvest management. Geographic delineation will be achieved using movements recorded from satellite tags of both adult females and males. Hitherto, boundary delineation of polar bear populations has used satellite information collected from adult females, because the circumference of necks of adult males is too large to wear collars. Advancements in technology shows promise (E. Born, personal communication) for a satellite ear tag (Mikkel Vellum Jensen, Denmark and Wildlife Computers Inc., USA) to collect data on male polar bear movement. Our data from these four male polar bears will be used in addition to the data on female movement for delineation and habitat analyses.

We will use physical mark-recapture to estimate population size. We will use physical mark-recapture to also estimate individual annual survival to be used in Population Viability Analysis (PVA; RISKMAN (Taylor et al., 2001) to evaluate population growth and sustainable harvest. This phase of the project will begin in 2009.

There is broad support in Nunavut, within our Department of Environment (DOE), NWMB and within communities for wildlife research that does not involve chemical immobilization of wildlife. In deference to *Inuit Societal Values* (Pinasuaqtavut 2004), we are developing and will implement a less-invasive aerial survey method for population estimation of polar bears. In 2008 we conducted a pilot study to outline the methods (Buckland, 2001, McDonald et al., 1999) needed for the aerial surveys which will occur in 2009 and 2010.

We will conduct this aerial survey research in concert with our mark-recapture population inventory from 2009 – 2010. We will provide a rigorous and quantitative comparative assessment of the results (population size) from these two methods: mark-recapture and aerial surveys.

Inuit Qaujimajaiugangit

We are also addressing the relationships of polar bear movement to sea ice conditions using both IQ and science. Sea ice habitat conditions experienced by polar bears will change with climate warming, potentially negatively affecting population status and Inuit harvest. A new approach for incorporating Inuit knowledge in research will be explored by using IQ to inform, create and compare 3rd order habitat selection models. The Foxe Basin and Hudson Bay oral history collection and reports of Inuit knowledge of polar bears were reviewed and little information related to sea ice habitat, habitat use, and movements were found. Thus, it is necessary to collect new information. Inuit polar bear hunters and elders of Foxe Basin communities will be asked to provide information on seasonal polar bear movements, sea ice habitat use and the dominant processes affecting sea ice condition. Laidler and Ikkummaq's (Laidler and Ikummaq, 2008) Inuit sea ice classification will be used in the discussions with Inuit on polar bear habitat use. Two standard data collection methods will be used: semi-directed interviews with individuals and focus groups (Grenier, 1998, Huntington, 2000). Inuktitut-English translators will be used to facilitate the discussions. Each interview will be audio-taped and if permission is granted video recorded. Annotated maps will be created during each session and later digitized for use in GIS. Polar bear habitat themes will be extracted from each interview using content analysis or hermeneutic analysis (Patterson and Williams, 2002). We will use the Inuit identified sea ice habitat categories as input into seasonal resource selection function habitat models.

Habitat Ecology

The GN must manage polar bears in the context and uncertainty of climate change. The effects of climate change have been manifested in decreased survival and birth rates, increased mortality and lower body weights of polar bears in Western Hudson Bay (Derocher et al., 2004, Obbard et al., 2007, Stirling et al., 1999, Stirling et al., 2004) and the Beaufort Sea (Monnett and Gleason, 2006, Regehr et al., 2006). These changes in demographic rates in WH have resulted in a decrease from 1200 to 950 bears over the last 20 years. The decrease in population size is most often attributed to changing ice conditions (Stirling and Parkinson, 2006). Polar bears and their prey are dependent on the sea ice and thus are vulnerable to climate change. The potential effects of reductions in sea ice on polar bears are many: survival, reproductive success and movement and distribution. Using the field effort associated with population delineation we propose to address seasonal movement and ice habitat selection of polar bears.

Sea ice extent, thickness and duration have been declining throughout the Canadian Arctic (IPCC, 2007, Parkinson and Cavalieri, 2008, Serreze and Rigor, 2006). The effects of changing habitat availability, increasing habitat fragmentation, timing of freeze-up and breakup, proportions of annual and multi-year sea ice on ice dependent species are of increasing concern (Blum and Gradinger, 2007, Laidre et al., 2008). Hudson Bay and Foxe Basin sea ice extent and duration of ice season have declined and the declines are attributed to climate change (Gagnon and Gough, 2005, Gough et al., 2004, Stirling and Parkinson, 2006, Moore, 2006). Future climate change effects on polar bear habitat, distribution and populations are projected to be most pronounced in regions of seasonal sea ice (Baffin Bay, Davis Strait, Foxe Basin, Hudson Bay) (Amstrup et al., 2007, Derocher et al., 2004).

In 2008, progress was made on several components of the project: 1) we completed the physical collaring phase of the project for population delineation and habitat modeling; 2) we completed a pilot study to determine sampling techniques for the aerial survey; 3) we initiated a study on the efficacy of RFID tags to reduce the need to recapture polar bears; 4) we made progress on habitat analyses; and 5) we garnered additional funding to expand the *Inuit Qaujimajaiugangit* study to the Qikiqtalluq region of Foxe Basin, through the Environment Canada Species-at-Risk program.

PROJECT OBJECTIVES

I. **Population Delineation.** To geographically delineate the Foxe Basin polar bear population (2007 - 2010).

II. **Population Inventory.** (2009 – 2011) note 1 year delay in the commencement of this component:
   a. estimate population size using physical mark-recapture and aerial survey
   b. develop an effective aerial survey method for population estimation
   c. provide quantitative comparative assessment of the two methods for population estimation
   d. estimate survival and recruitment
   e. estimate population status (trend)
   f. determine Total Allowable Harvest (TAH)

III. **Habitat Selection and movement.** To investigate movement and habitat selection of Foxe Basin polar bears as related to ice conditions (2007 – 2011).

IV. **Inuit Qaujimajaiugangit.** To collect and include IQ in the development of the study and interpretation of the results (2007 – 2009).

METHODS AND RESULTS

I./II. Population Inventory

Helicopter fuel was cached under contracts from March – July 2008. A cabin at Bray Island (69.233, -77.258) was retrofitted for use by field crews.

Satellite collar deployment

Polar bears were captured and immobilized for deployment of satellite collars and satellite ear tags. Bears were immobilized with a pneu-dart gun from a Bell 206L helicopter using Telozol (tiletamine hydrochloride and zolazepam hydrochloride), at a concentration of 250 mg/ml and administered at approximately 5mg/kg. The following data and samples were collected: axillary girth; zygomatic breadth; straight-line length; a vestigal premolar tooth (aging); ear puncture (DNA); hair samples (heavy metals); claw tip (stable isotopes); and a fat sample (fatty acid analysis). Other information collected included sex, an approximate field age, and body condition. We marked captured bears with ear tags and lip tattoos.

In total, 78 bears were immobilized (Table 1 and 2, Figure 2). Bears were primarily immobilized to affix satellite tags. However, bears were also immobilized if they were 1) dependent young of adult females (n = 40); 2) were in close proximity to immobilized adult females and therefore posed a threat (n = 4); 3) were close to the field camp on Bray Island (n = 3); or 4) were evaluated for the fitting of a collar, but ultimately not fitted (n = 2). Telonics Gen IV GPS/ARGOS satellite collars were fitted on 23 adult female polar bears (Table 3). Two collars slipped off two adult females within 1 week; these collars were fitted on other adult females. Four satellite ear tags (Mikkel Vellum) were fitted on the right ear of adult male polar bears.

All independent (i.e., non-cub) bears that were immobilized were fitted with a radio-frequency identification (RFID) ear tag in the right ear (n = 33; Table 3). We determined that bears with RFID tags could be identified from 2km at 1,000 ft in above ground level, and 1 km at 400 ft above ground level. RFID tags were retained on all polar bears that were subsequently opportunistically observed after immobilization (up to 3 weeks post deployment).

All physical marks placed on polar bears in 2007 and 2008 will ultimately be used in mark-recapture-recovery modeling to estimate polar bear population size and survival in Foxe Basin. The initial plan was to start a large-scale mark deployment in Foxe Basin in 2008, however this segment of the project was postponed and will commence in 2009 and finish in 2011.

Delineation using cluster-analysis (Taylor et al. 2001) will incorporate all Foxe Basin satellite data (collected by 2010), and satellite data from polar bears captured in the neighbouring Gulf of Boothia (Taylor et al. in review), southern Hudson Bay (provided by M. Obbard, Ontario Ministry of Natural Resources) and western Hudson Bay (provided by A. Derocher, University of Alberta).

Aerial survey pilot study

During a total of 141 search hours and 17,655 km flown in Foxe Basin during the field season, 487 bears were observed. A mean of 0.028 bears were observed per km searched, and 3.5 bears per hour searched (Table 4, Figure 4). These data and the associated effort data can be used as an index for comparison to efforts in the future. It is important to note that while the bears observed per unit effort can be used for comparative purposes, the total number of bears seen (487) includes bears that were seen on duplicate transects. It is also important to note that these bears were observed from 3 August – 5 September, while a lot of rotten ice was still in the northern parts of Foxe Basin. Many more bears were seen on land in September and October in aerial surveys performed by industry consultants (T. Elliot, LGL Limited, pers. Communication).

We also completed a pilot study to assess aerial survey sampling designs for estimation of Foxe Basin polar bear population size in 2009 and 2010. We conducted intensive trials of survey techniques, including sight-resight (McDonald et al., 1999) and distance sampling (Evans et al., 2003), on Southampton Island from 29 August to 3 September, 2008. During our intensive trials, we flew inland contours (i.e., parallel to the coastline) at a distance of approximately 500 m from the coast in low topography regions. Coastal transects were shifted towards the coastline in higher topography areas to ensure that polar bears along the coastline were adequately detected. We also flew contours further inland, about 1.5 and 2.5 km from the coast, across portions of Southampton Island and completed random inland transects to assess bear distribution and density gradient from the coastline. We generally maintained an above ground level (AGL) altitude of approximately 120 m and an average airspeed of about 160 km/hour. We documented sex and age class, noted our relative confidence in these estimates, and qualitatively ranked topography and weather (i.e., visibility) conditions.

During our intensive Southampton Island surveys, we sighted a total of 264 bears, including 170 adults and subadults and 94 cubs-of-the-year and yearlings (Figure 4). Note that several transects were flown multiple times to assess daily variation in detection; thus, some bears and groups were presumably sighted and recorded multiple times. Despite flying intensive inland survey transects, only 0.577 bears per search hour, and 0.004 bears per search km were observed on these transects.

Polar bear distribution was non-random (i.e., highly clumped) across Southampton Island (Figure 3) and throughout the remainder of Foxe Basin.

These initial results suggest that a combination of sight-resight and distance sampling methods will provide effective coverage and have the potential to provide a population estimate for polar bears Foxe Basin. As such, the 2009-2010 study designs will implement both methodologies and permit a rigorous comparative assessment of the two aerial survey techniques as well as an evaluation of the efficacy of aerial surveys relative to mark-recapture techniques. The pilot study airspeed and AGL altitude proved efficient for identifying bears; we estimate that our minimum sighting distance in low topography areas was typically about 500 m. Additionally, our pilot study has confirmed that we are confident in our ability to identify sex and age class from the air, and we will use a topographic ranking system to control for variation in detection due to terrain.

2008 Field Team

- Leader: Dr. Elizabeth Peacock, Government of Nunavut
- Jay McConnell, GIS technician, Government of Nunavut
- Dr. Anne Orlando, polar bear technician, Government of Nunavut
- Dr. Malik Ghulam Awan, carnivore technician, Government of Nunavut
- Hillary Robison, Ecosystem biologist, Government of Nunavut
- Tiivi Qiatuk, Cape Dorset conservation officer, Government of Nunavut
- Andrew Nakashuk, Cape Dorset conservation officer, Government of Nunavut

- Vicki Sahanatien, Ph.D. student, University of Alberta
- Seth Stapleton, Ph.D. student, University of Minnesota
- Dr. David L. Garshelis, University of Minnesota
- Chairman Michel Akkuardjuk , Repulse Bay HTO
- Jason Hudson, Parks Canada, Repulse Bay

III. Movements and Habitat Selection

Satellite Collar Data Collection

Each satellite telemetry collar attempts to collect a GPS location every 3 hours, totalling 8 location attempts per day. The GPS location data are transmitted from the collars to the ARGOS satellite system, received by CLS America (http://www.clsamerica.com), and emailed to our office every four days. Complete GPS location for each bear is stored in each collar. Any locations not successfully transmitted through the ARGOS system can be downloaded from the collar after automatic drop-off (apprx. two years from date of deployment) and retrieval. All location information is plotted on maps using ArcGIS 9.3 (ESRI, Redlands, CA, USA).

Foxe Basin Polar Bear Seasonal and Annual Movements (2007-2008)

This section describes preliminary results. Further analyses will be completed in 2008 and the movement data from 2008-2010 will be incorporated. A publication will be prepared on the movement data of polar bears in Foxe Basin. These analyses will be included in V. Sahanatien's Ph.D dissertation.

Home Range

Annual and seasonal home ranges were calculated using the Hawth's Tool minimum convex polygon method in ArcMap 9.2©. Annual home ranges for Foxe Basin bears with at least three seasons of data ranged from 108,348 – 339,681 km^2 (Table 5, Figure 5). The annual home range sizes of Foxe Basin polar bears are larger than those reported for the northern Beaufort Sea and similar to those of the southern Beaufort Sea and western Hudson Bay (Amstrup et al. 2000, Parks et al. 2006). Mean seasonal Foxe Basin home range size during open-water (August-October) and freeze-up (November-December) were larger than western Hudson Bay. During the winter (January-April) season, Foxe Basin and western Hudson Bay home range was similar in size. All Foxe Basin seasonal home range sizes increased from open-water to freeze-up, then most decreased in size during the winter season (Figure 6). Only one satellite collar remained active for the entire break-up season (77012) and her home range area increased in size during this season.

Movement

Annual, seasonal and monthly distances moved were calculated using the Hawth's Tool movement parameters method in ArcMap 9.2©. The total annual distance moved for bears with at least three seasons of data ranged from 3,254 to 7,064 km. The Foxe Basin mean annual distance and mean seasonal distances (Table 6) moved are greater than that reported from western Hudson Bay (Parks et al., 2006). The monthly distances travelled increased abruptly in November with sea ice habitat availability, then tended to decrease as sea ice consolidated and thickened (Figure 7). The distances moved by adult females in Foxe Basin monthly varied among individual bears (Table 7) and mean monthly distances moved are generally larger than those reported for southern and northern Beaufort populations (Amstrup et al., 2000).

Seasonal movement rates were calculated by dividing the distance (km) moved by the intervening time (hr) between locations. Mean movement rate during freeze-up was greatest, followed by rates during the winter and the open-water seasons (Table 8). These rates are comparable to those reported for the western Hudson Bay mid-term (>8hr and <100 hr) movement rates (km/hr) (Parks et al. 2006).

The first three months (August – November) of movements of 23 adult female and 4 adult male polar bear, collared in Foxe Basin in 2008 is shown in Figure 8. The Appendix contains maps of the first three months of movement data for individual bears.

Habitat Selection

We will investigate seasonal habitat selection using a combination of sea ice maps and polar bear location information to develop spatial, predictive Resource Selection Models (RSM). The analyses will build on the understanding and approaches to modeling polar bear habitat selection developed by Ferguson et al. (Ferguson et al., 2000)and Durner *et al*. (Durner et al., 2007). At this time the parameters of the RSM are unknown but are likely to include: ice cover; ice thickness; floe size; water depth, and distance to ice edge.

Polar bear habitat selection will be studied using a hierarchical approach: landscape scale or 2nd order and at the feature scale or 3rd order (Johnson, 1980). Habitat selection will be studied using the use: availability approach and individual RSMs will be estimated (Manley et al., 2000). Habitat selection of family group type, gender, and age will be compared by sea ice year, month and season. Seasonal definitions are to be determined and will be based on the timing of the Foxe Basin sea ice cycle and prey (ringed seal, *Phoca hispida*) life history.

Second order habitat selection analyses will follow the approach develop for environments in which habitat availability changes (Arthur et al., 1996). Polar bear locations will be mapped onto daily[1] or weekly sea ice charts (Canadian Ice Service) and same day ice concentration maps (National Snow and Ice Data Center). The grid cell size of both products is approximately 25 x 25 km. Sea ice characteristics at the locations will be used for developing individual resource selection functions of 2nd order habitat selection.

3rd order habitat selection will be evaluated using the resource selection function approach but the habitat units are yet to be determined. Sea ice features are not detectable on sea ice charts and concentration maps due to image resolution and technological limitations. Satellite imagery

[1] Daily ice charts are available for the Foxe Basin from late July – October only.

(e.g., EnviSat, AVHRR, AMSAR-E) will be evaluated to select imagery that best identifies sea ice features, is manageable in terms of data volume, and cost effective.

It has been hypothesized that open water sea ice features (polynyas, leads and landfast ice edge) are important habitat for polar bears (Stirling, 1997, Stirling et al., 1993) but the actual use of and significance of these habitat features has not been well studied. Polynyas, unless >650km², and leads are not detectable on sea ice charts and concentration maps. Using alternative satellite imagery as determined above, adjacency and distance metrics will be calculated in GIS to understand the spatial relationship of selected sea ice habitat (2nd and 3rd order) to open water features.

The habitat selection analyses of the 2007-2008 movement data will be completed early in 2009 and a progress report prepared. The 3rd order habitat selection methods and results will be prepared for publication late in 2009. The data from 2008-2010 will be included as it becomes available and progress reports will be prepared. All results will be included in V. Sahanatien's Ph.D. thesis.

Habitat Fragmentation

We completed analyses of sea ice concentration and available polar bear habitat in the Foxe Basin polar bear population area for the time period 1979 – 2004. Available polar bear sea ice habitat in Foxe Basin, Nunavut Territory was studied using trend and landscape fragmentation analyses for the period 1979-2004. Monthly (October – June) sea ice concentration maps, derived from satellite images, were reclassified to four polar bear habitat classes using ArcGIS 9.1: sea ice class 1 (0-30% or open water), sea ice class 2 (30-60% or very open ice), sea ice class 3 (60-85% or open ice) and sea ice class 4 (85-100% or closed ice). The area of each sea ice habitat class was calculated by month and year.

Over time, least squares regression analysis showed significant decreases in the total area of available habitat of sea ice classes 3 and 4 in November, December, May and June. Mean monthly air temperature was significantly correlated with amount of available sea ice habitat in October, November and December.

Landscape metrics were calculated using FRAGSTATS (McGarigal et al., 2002) to assess fragmentation of polar bear sea ice habitat. During the study period, the number of patches of all sea ice habitat classes increased and the mean patch size of sea ice classes 3 and 4 decreased in November, December, January, May and June. Overall, available polar bear habitat (sea ice classes 3 and 4) in Foxe Basin during fall and spring is decreasing and becoming increasingly fragmented.

The habitat fragmentation analysis will be updated to include 2005-2008 sea ice data and prepared for publication in 2009. These results will be included in V. Sahanatien's Ph.D. thesis.

IV. Inuit Quajimajatuqangit

IQ collections (Igloolik Oral History Project, Parks Canada Oral History) archived at the Nunavut Research Institute (Igloolik, NU) and by Parks Canada (Iqaluit, NU) were reviewed. Reports and published literature of Inuit knowledge of polar bears were reviewed: (Dowdsley 2005, McDonald et al. 1997, Keith 2006, Tyrrell, 2007).

Unfortunately in 2007 it was not possible to conduct interviews to collect new IQ about polar bears due to the serious illness of one of the researchers. Interviews will proceed in late 2008 and in 2009. New funding from the Environment Canada Species-at-Risk program was obtained that will allows the *Inuit Qaujimajaiugangit* study to expand to the Qikiqtalluq region of Foxe Basin.

Application of Results

The primary results include delineation of the Foxe Basin polar bear population boundaries, population enumeration, assessment of natural birth and date rates and determination of status (increasing, decreasing or stable). The final results of the population inventory in 2012 will allow NWMB and the GN to establish revised TAH for the Foxe Basin polar bear population.

Satellite telemetry data will be used to assess the impact of sea ice on the movement and habitat selection of polar bears. These data will be used to predict changes in habitat use, and possibly population status, when sea ice habitat changes.

Interim data and results have or will be presented:

Poster Presentations

- December 2006 – ArcticNet, Victoria, BC
- October 2007 – Association of Colleges and Universities Northern Studies (ACUNS), Saskatoon, SK
- December 2008 – ArcticNet, Quebec City, QC

Conference Presentations

- October 2007: Association of Colleges and Universities Northern Studies (ACUNS), Saskatoon, SK
- November 2007: Sixteenth International Bear Research and Management Conference, Monterrey, Mexico

Future Presentations

- January – February, 2009: Polar Bear Technical Committee Meeting, Whitehorse, YT
- October, 2009: The 18th Biennial Conference of the Society for Marine Mammalogy, Qúebec City, QC

REPORTING TO COMMUNITIES/RESOURCE USERS

Community consultation efforts were shared between the University of Alberta and the Government of Nunavut.

Maps of polar bear movements have been and will be provided to Foxe Basin HTOs quarterly.

Completed

- Repulse Bay, Coral Harbour, Chesterfield Inlet (February 2007)
  - Hunters and Trappers Organizations
  - Grades 9-12 in each community
- Rankin Inlet
  - Hunter and Trappers Organization (February 2007)
  - Kivalliq Inuit Association – Lands (February 2007)
  - Nunavut Tunngavik Incorporated – Wildlife (February 2007)
  - Sila Lodge Co-Owners (July 2007)
- Igloolik, Hall Beach, Cape Dorset, Kimmirut (April-May 2007)
  - Hunter and Trappers Organizations
- Coral Harbour
  - Hunter and Trapper Organization – (July 2007) follow-up meeting
  - HTO, February 2008
- Ukkusiksalik Park Management Committee (February 2007, January 2008)
- Coral Harbour, Chesterfield Inlet, Repulse Bay, Rankin Inlet and Baker Lake (winter and Spring, 2008)
  - Included HTOs, Elders' Societies, Kivalliq Inuit Association, Sila Lodge Co-owners as per Ukkusiksalik National Park IIBA
- Foxe Basin Polar Bear Study Poster created, printed and distributed to Foxe Basin HTOs (April 2008)
- Progress Report to HTOs (July 2008)

Planned

- Wildlife Research Techniques Symposium, January 2009, Iqaluit
- Foxe Basin research updates:
  - November 2008, Qikiqtalluq Wildlife Board
  - November 2008, Igloolik HTO
  - January 2009, Kimmirut HTO
  - February – March 2009, HTOs in Coral Harbour, Cape Dorset, Hall Beach, Repulse Bay, Chesterfield Inlet and Baker Lake.

Table 1. Summary data of polar bears captured in the Foxe Basin in 2008.

Total	**Adult**		**Subadult**		**Yearling**		**COY**		**Mean litter size**	
	M	F	M	F	M	F	M	F	COY	Yearling
78	9	28	0	1	9	5	14	12	1.63 (±0.50)	1.56 (±0.53)

M = male, F = female, COY = cub of year

Table 2. Mean standard measurements for sex and age classes of polar bears captured in Foxe Basin, Nunavut, 2008.

	Adult		Subadult		Yearling		Cub of Year	
	M(9)	F(28)	M(0)	F(1)	M(7)	F(5)	M(14)	F(12)
Axial girth	175.2 ±27.5	132.0 ±14.4	NA	111.5	110.2 ±11.7	98.8 ±17.8	82.2 ±8.3	80.0 ±6.2
Straight line length	229.3 ±9.5	190.7 ±14.0	NA	166.0	160.4 ±23.4	154.1 ±14.4	120.8 ±8.2	119.7 ±4.9
Zygomatic arch	25.8 ±2.3	21.1 ±2.0	NA	16.7	17.9 ±1.4	27.4 ±1.5	13.9 ±0.6	13.6 ±0.5
Body condition index	3.4 ±0.9	3.1 ±0.6	NA	3.0	3.0 ±0.0	2.8	3.0 ±0.0	3.0 ±0.3
Tooth wear	1.4 ±0.4	1.4 ±0.6	NA	1.0	1.0 ±0.0	1.0 ±0.0	1.0 ±0.0	1.0 ±0.0

M = male, F = Female, COY = cub of year. Sample size (n) in parentheses.
Body condition: 1 to 5, 1 = very poor, 5 = very fat; Tooth wear: 1 = light, 2 = moderate, 3 = heavy.

Table 3. Transmitters deployed on polar bears captured in Foxe Basin, Nunavut, 2008

	Total	**GPS Argos collar**	**Satellite ear tag**	**RFID ear tag**
Adult male	9	0	4	5
Adult female	28	23	0	27
Subadult female	1	0	0	1

Table 4. Distances, locations, hours flown, and bears observed per unit effort for Foxe Basin polar bear aerial survey, 2008.

	Km searched	**Hours searched**	**Bears observed**	**Bears/km searched**	**Bears/search hours**
Inland	3,705	26.0	14	0.004	0.523
Coastal	13,950	115.2	473	.034	4.106
Total	17,655	141.2	487	0.028	3.449

Table 5. Home range (minimum convex polygon) sizes (km^2) of satellite collared female polar bears, Foxe Basin (2007-2008) during different seasons: August – October are considered Open-water; November – December, Freeze- up, January – April, Winter and May – July are Break-up.

Bear ID	Annual	Open-water	Freeze-up	Winter	Break-up
34045	69,858	599	65,871		
34046	221,765	7,024	59,568	47,241	
34047	99,696	8,799	82,802	7,097[1]	
34048	1,058	1,058			
34049	108,348	1,677	44,364	24,561[2]	
34051	213,727	7,132	43,341	103,053	
34054	49,029	1,533	47,042		
34056	131,686	913	95,472	54,198	1,824[3]
34057	155,578	1,979	106,518	27,255[2]	
34058	155,925	3,433	57,937	28,840	648[4]
67778	65,782	86	56,666	10,480[1]	
77011	1,443	1,443			
77012	399,681	559	109,694	115,110	166,358
Mean (SE)		2,787 (809); *n* = 13	69,934 (2426); *n* = 11	57,179 (14,038); *n* = 7	

[1] January only; [2] January – March only; [3] May – June only; [4] May only

Table 6. Mean seasonal home range sizes and distances moved of satellite collared female polar bears, Foxe Basin (2007-2008).

Season	Mean (km^2) ± SE	n	Mean(km) ± SE	n
Open water	2787 ± 809	13	406 ± 32	13
Freeze-up	69934 ± 7426	11	1384 ± 85	11
Winter	57179 ± 14083	7	1930 ± 271	7
Annual			4221 ± 579	6

Table 7. Monthly distances (km) moved by satellite collared female polar bears, Foxe Basin (2007-2008)[1].

ArgosID	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June
34045	230	163	708							
34046	162	300	777	762	839	356	367	274		
34047	79	419	740	474	478					
34048	198									
34049	271	136	704	783	705	401	305			
34051	95	335	665	745	815	582	618	547		
34054	192	276	734	292						
34056	76	329	884	877	436	380	432	304	216	
34057	41	230	986	787	717	438				
34058	70	379	534	824	361	540	458	362		
67778	144	78	515	657						
77011	144									
77012	33	185	751	824	780	772	856	822	746	954
Mean (SE)	133 ± 21	257 ± 32	726 ± 41	702 ± 58	641 ± 66	495 ± 56	506 ± 82	461 ± 102	480 ± 265	

[1] Months with incomplete data are excluded.

Table 8. Hourly movement rates (km/hr) of satellite collared female polar bears, Foxe Basin (2007-2008).

Season	Mean ± SE (km/hr)	n
Open-water	0.24 ± 0.02	13
Freeze-up	1.04 ± 0.05	11
Winter	0.79 ± 0.08	7

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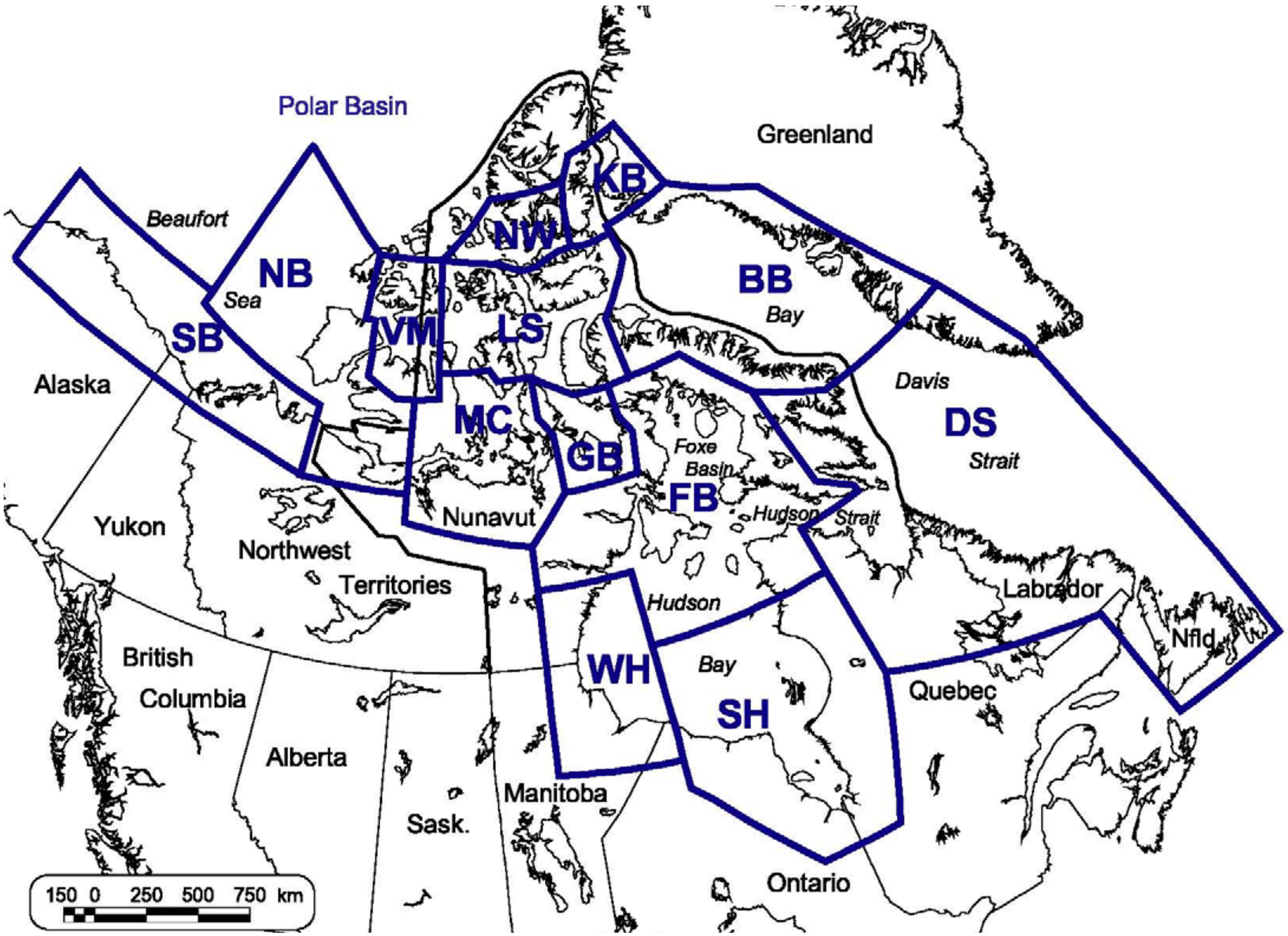

Figure 1. The polar bear populations of Canada, including our study population, Foxe Basin (FB).

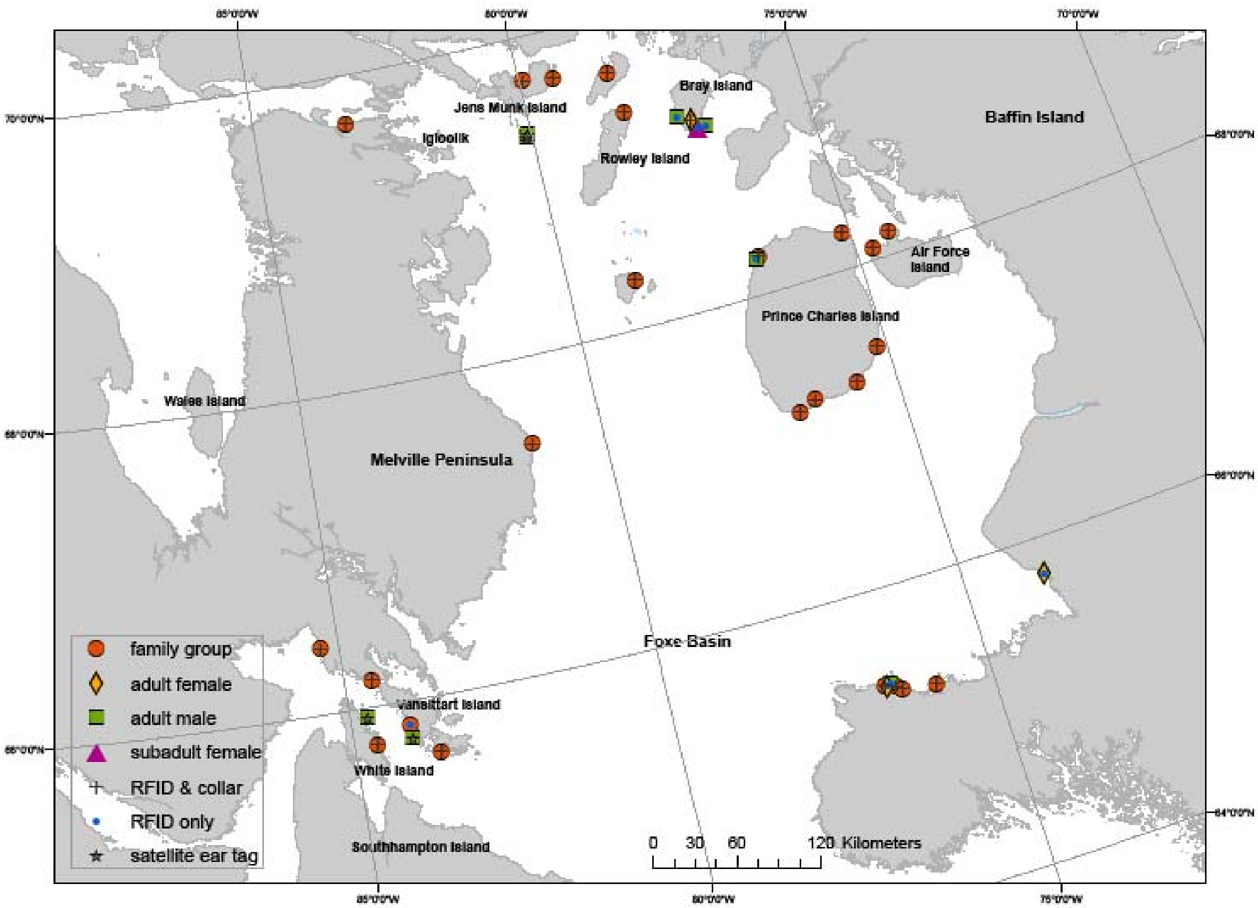

Figure 2. Age, sex, and transmitter type for polar bears captured in Foxe Basin in 2008.

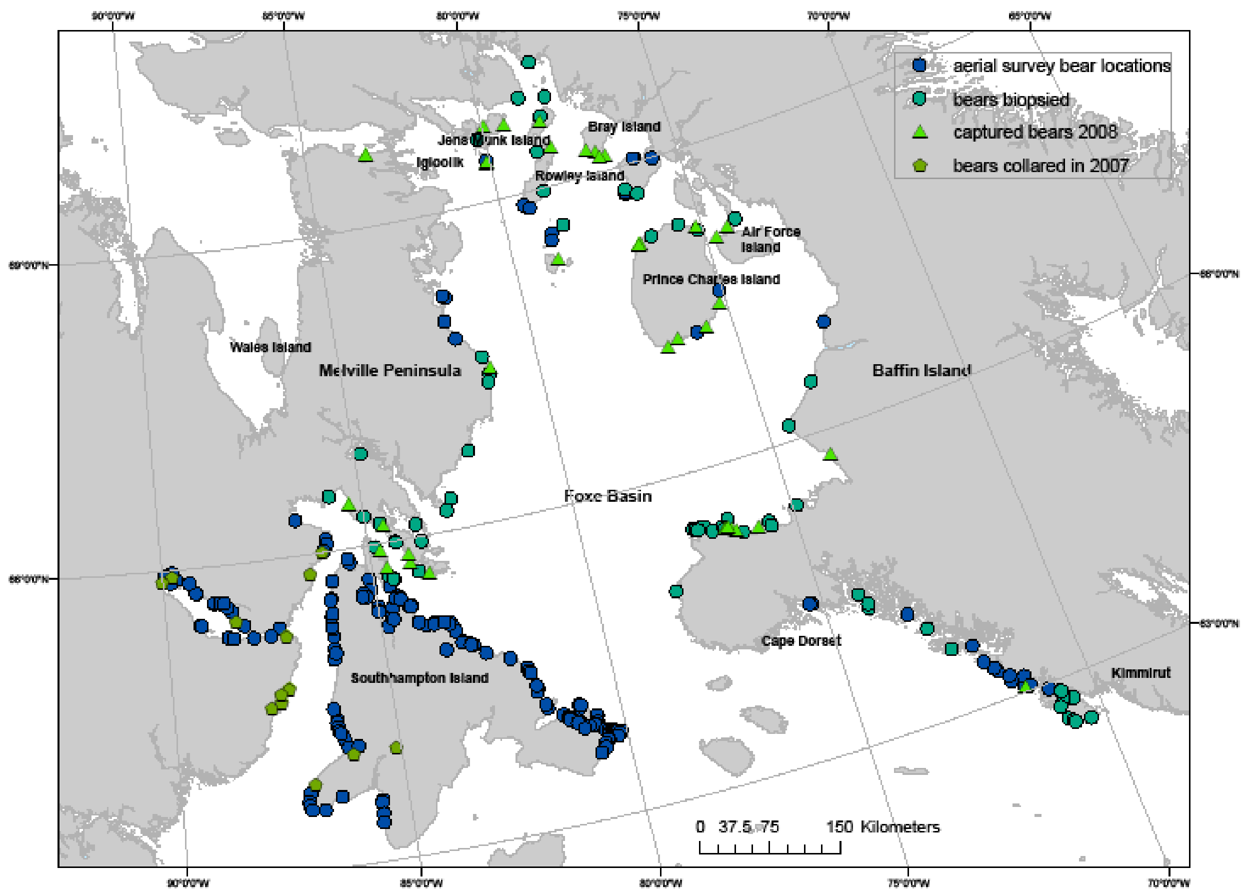

Figure 3. Locations of polar bears observed during aerial surveys, in addition to those captured, collared in Foxe Basin in 2008.

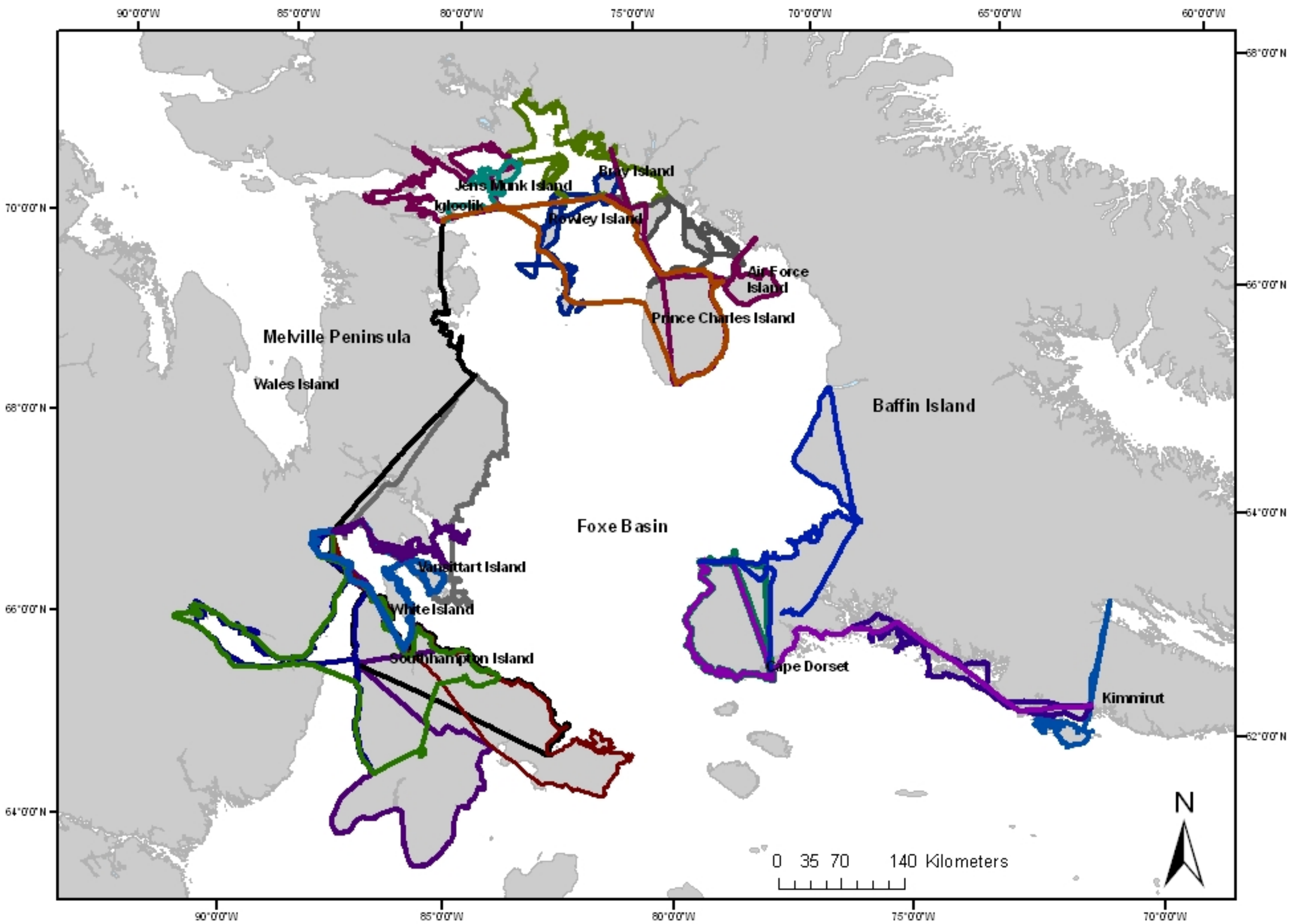

Figure 4. Tracks flown during Foxe Basin polar bear research in 2008. Each color represents a different day of survey.

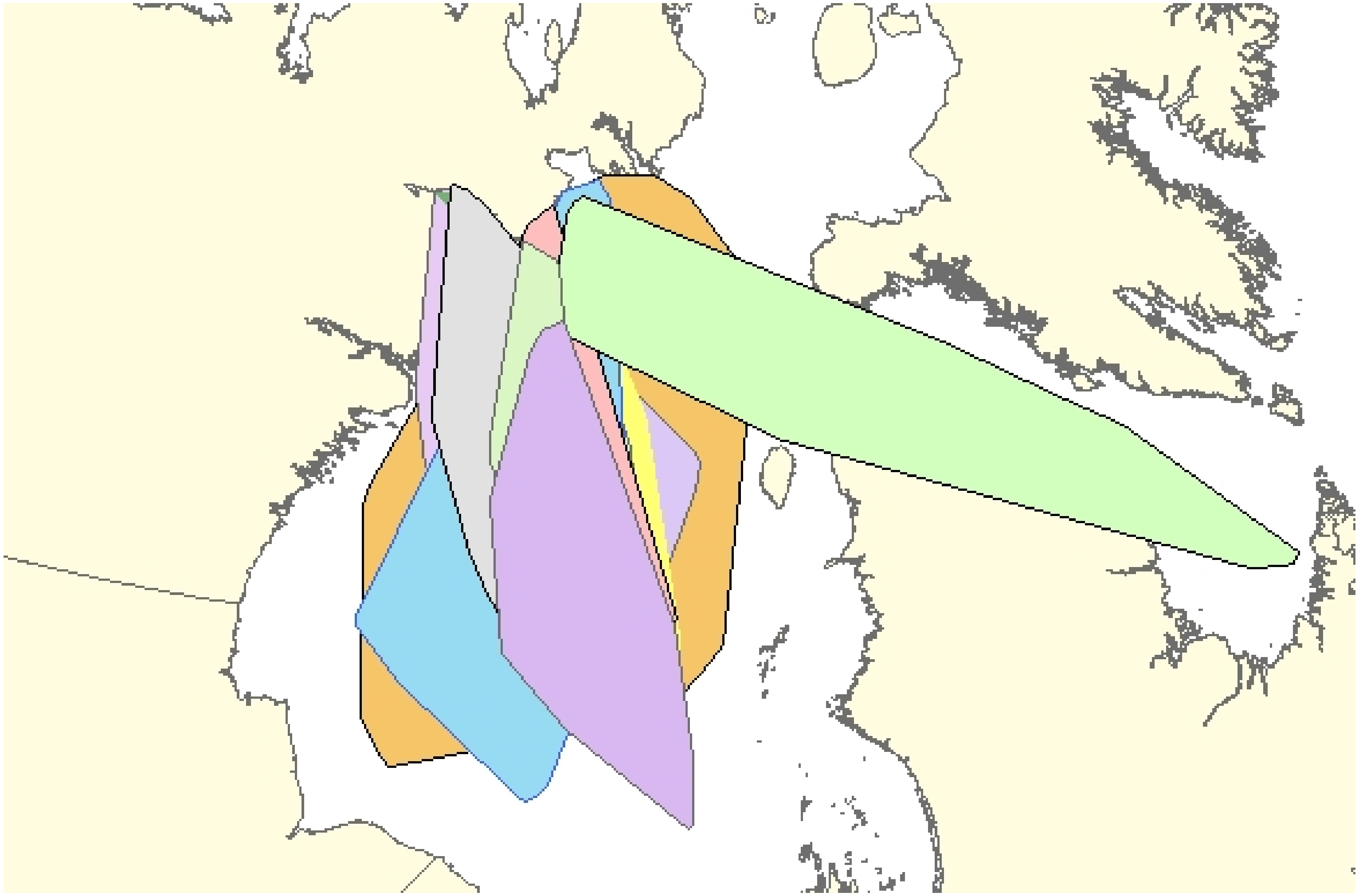

Figure 5. Map of home ranges (minimum convex polygon) of satellite collared female polar bears in 2007. All of these collars have now dropped off the polar bears.

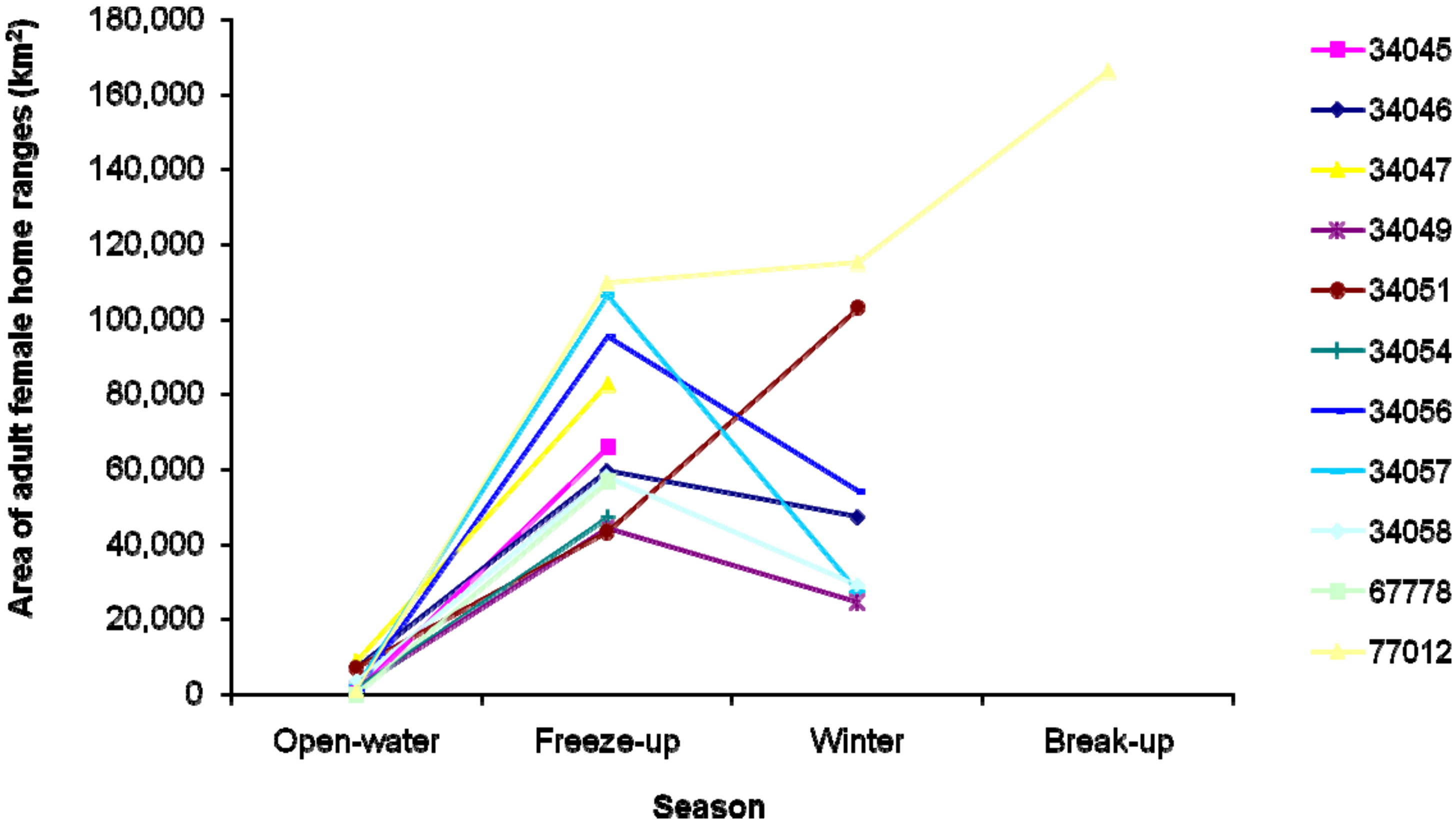

Figure 6. Areas of home ranges (minimum convex polygon) of individual satellite collared adult female polar bears in Foxe Basin in 2007 in different ecological seasons.

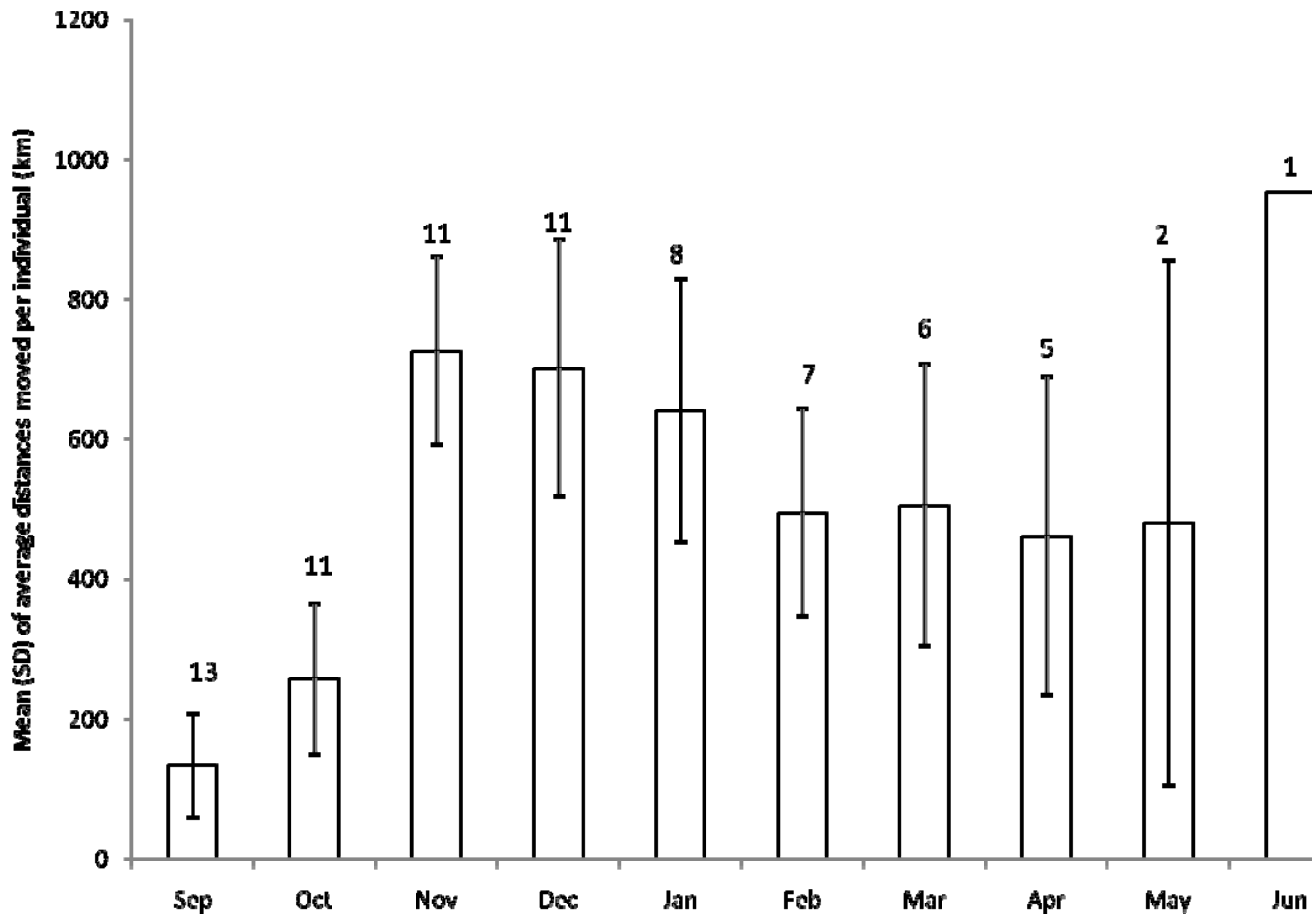

Figure 7. Mean (SD) of average monthly distances (km) moved by satellite-collared adult female polar bears (*n* above bar) in Foxe Basin in 2007.

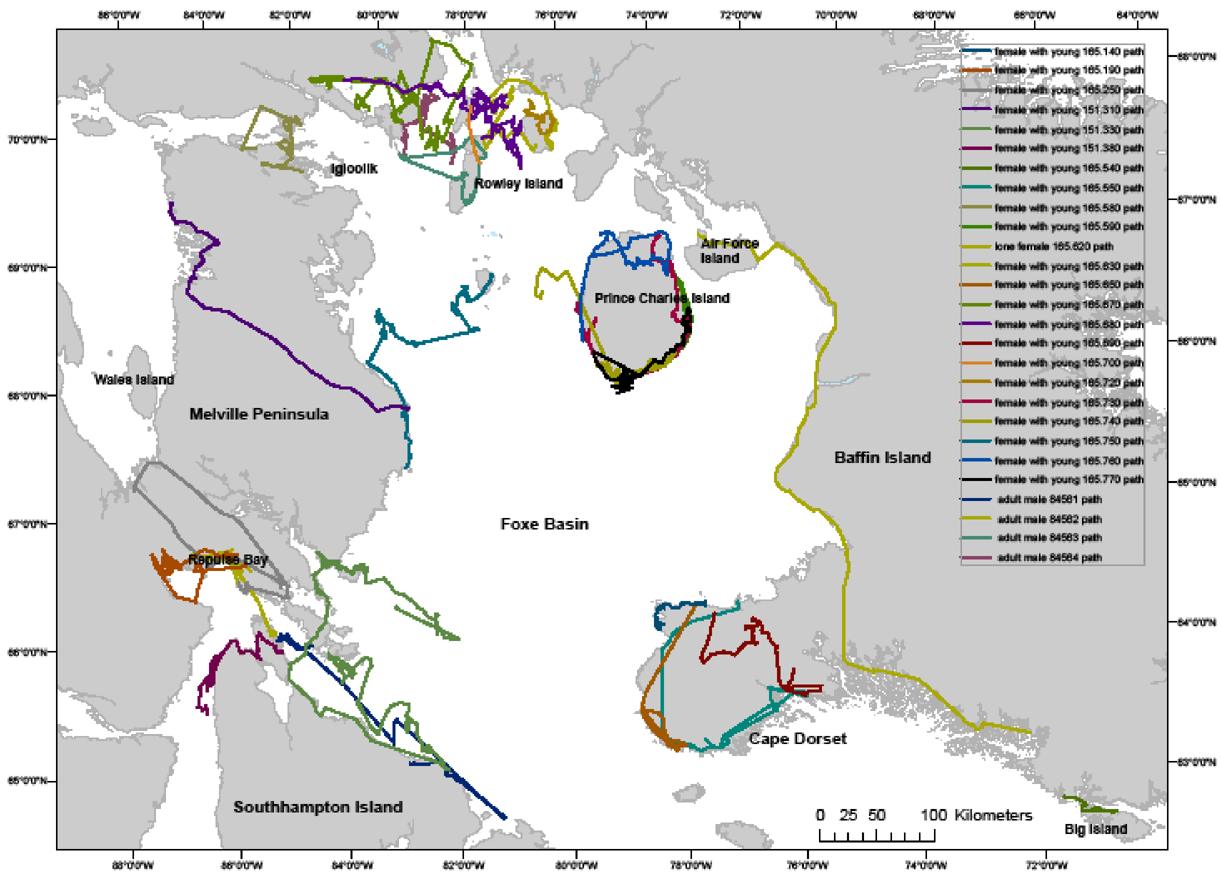

Figure 8. Point to point movements of Foxe Basin polar bears wearing GPS/Argos satellite collars (*n* = 23 adult females) and ear tags (*n* = 4 males) from August to November, 2008. Maps of movements of individual bears are in the Appendix.

Appendix: Movements of polar bears collared in 2008

Figure A1. Point to point movements of lone adult female polar bear, transmitter #165.620, August to November, 2008.

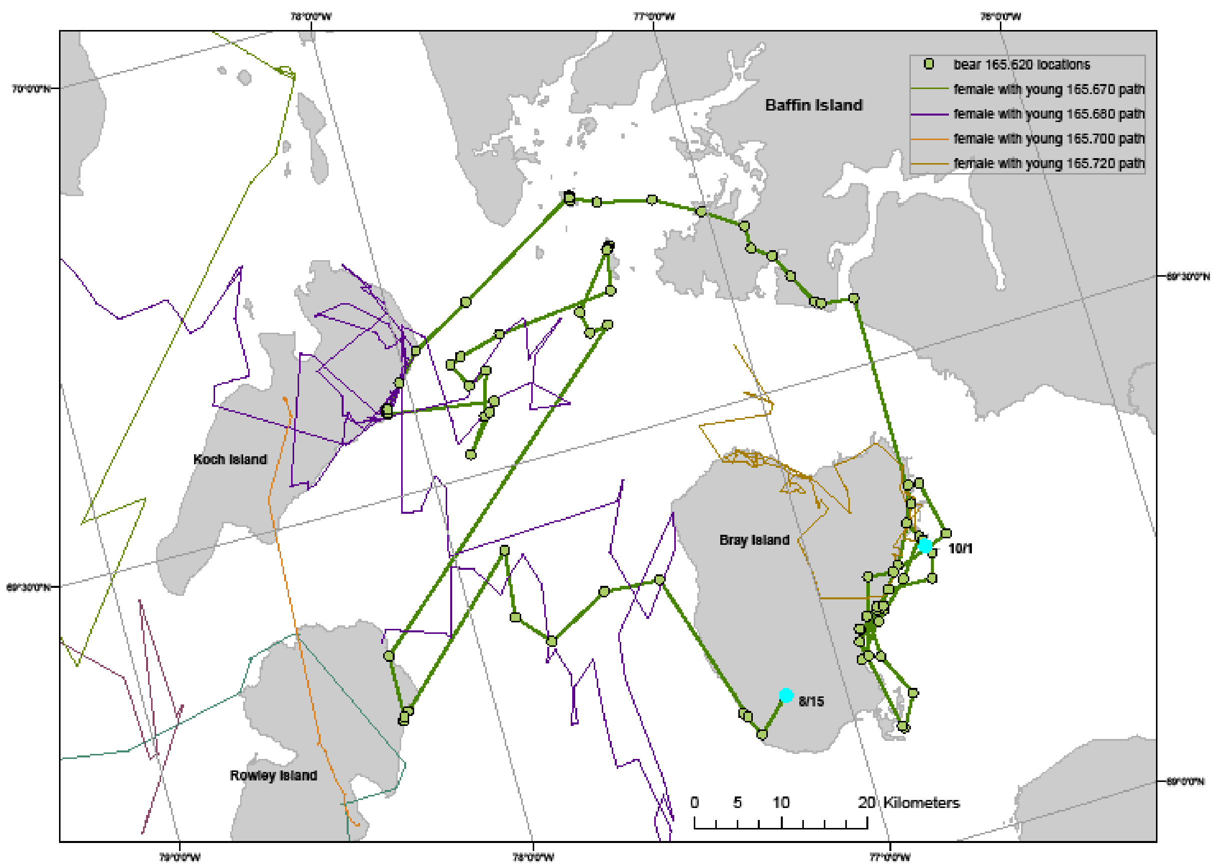

Figure A2. Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.540, August to November, 2008.

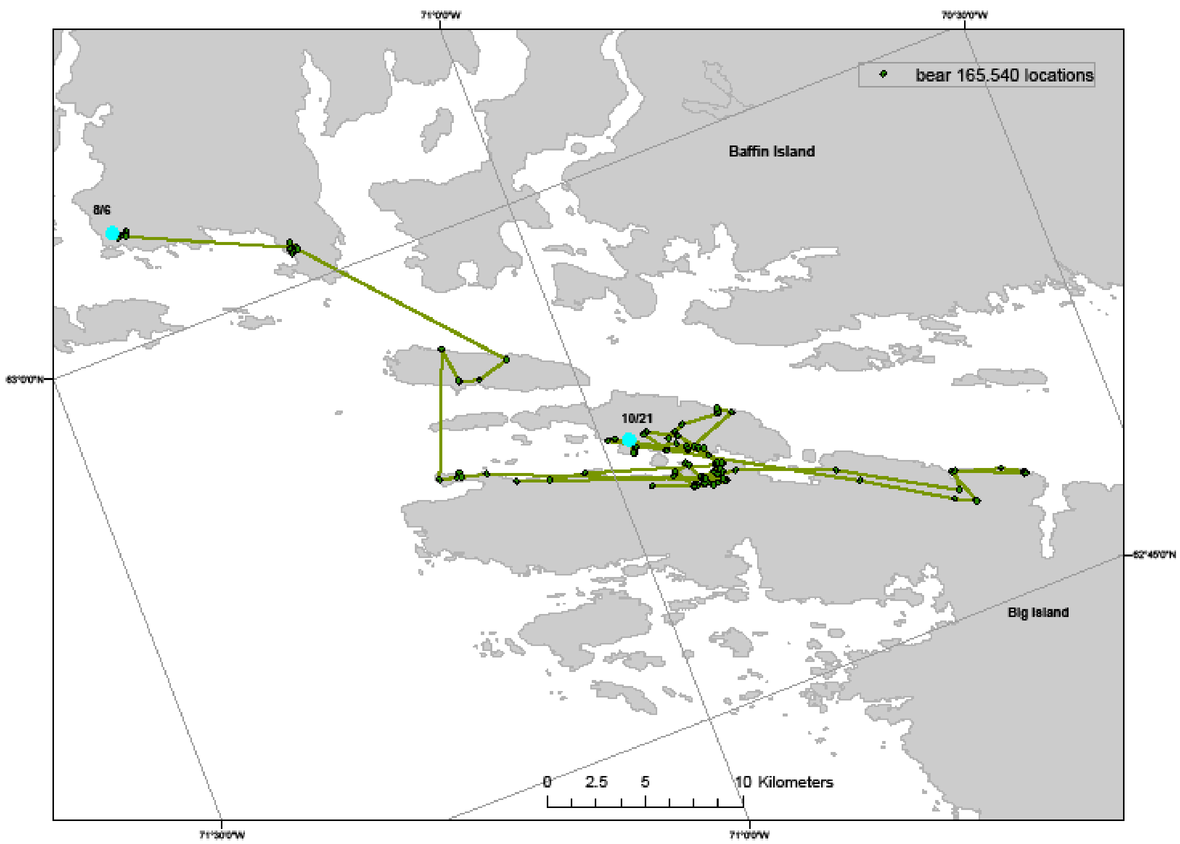

Figure A3. Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.650, August to November, 2008.

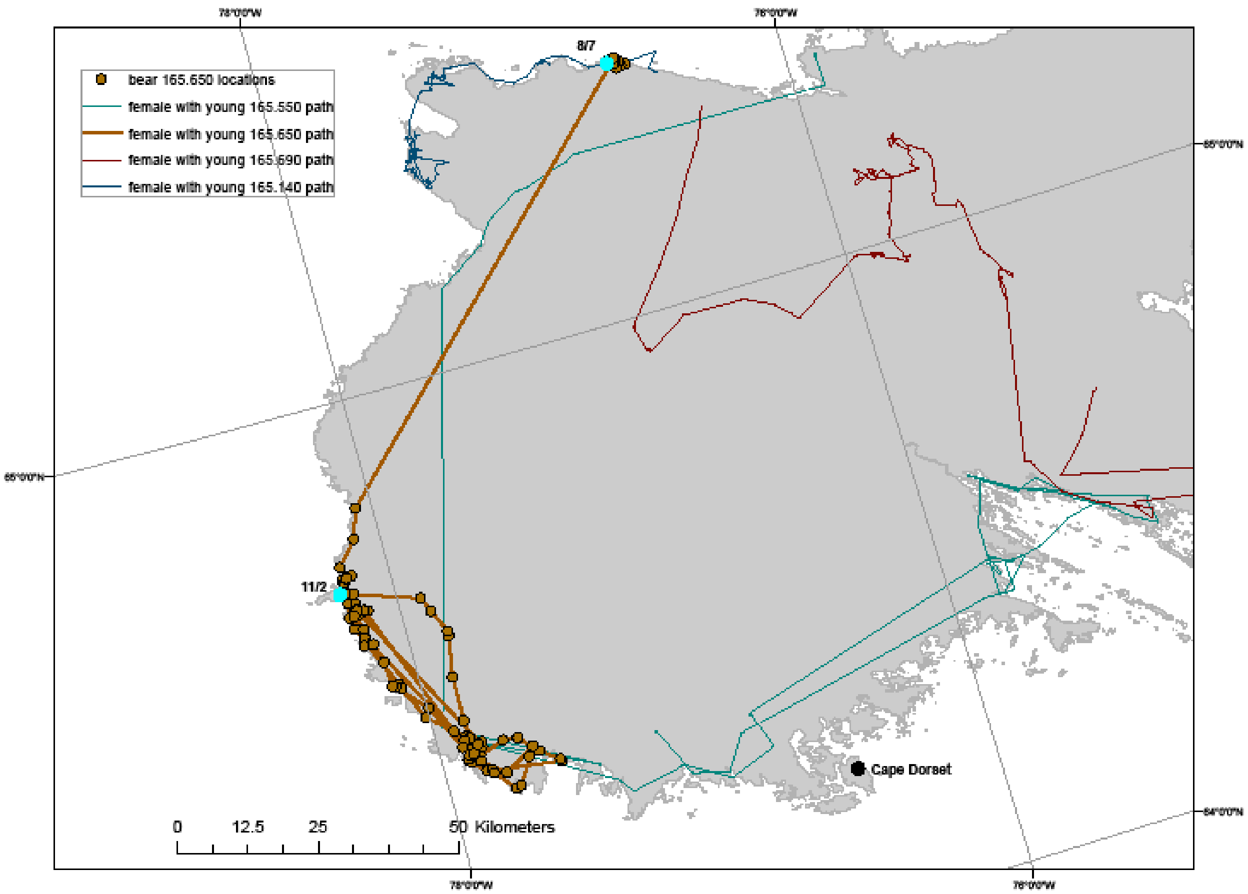

Figure A4. Point to point movements of adult female polar bear with 2 yearling cubs, transmitter #165.140, August to November, 2008.

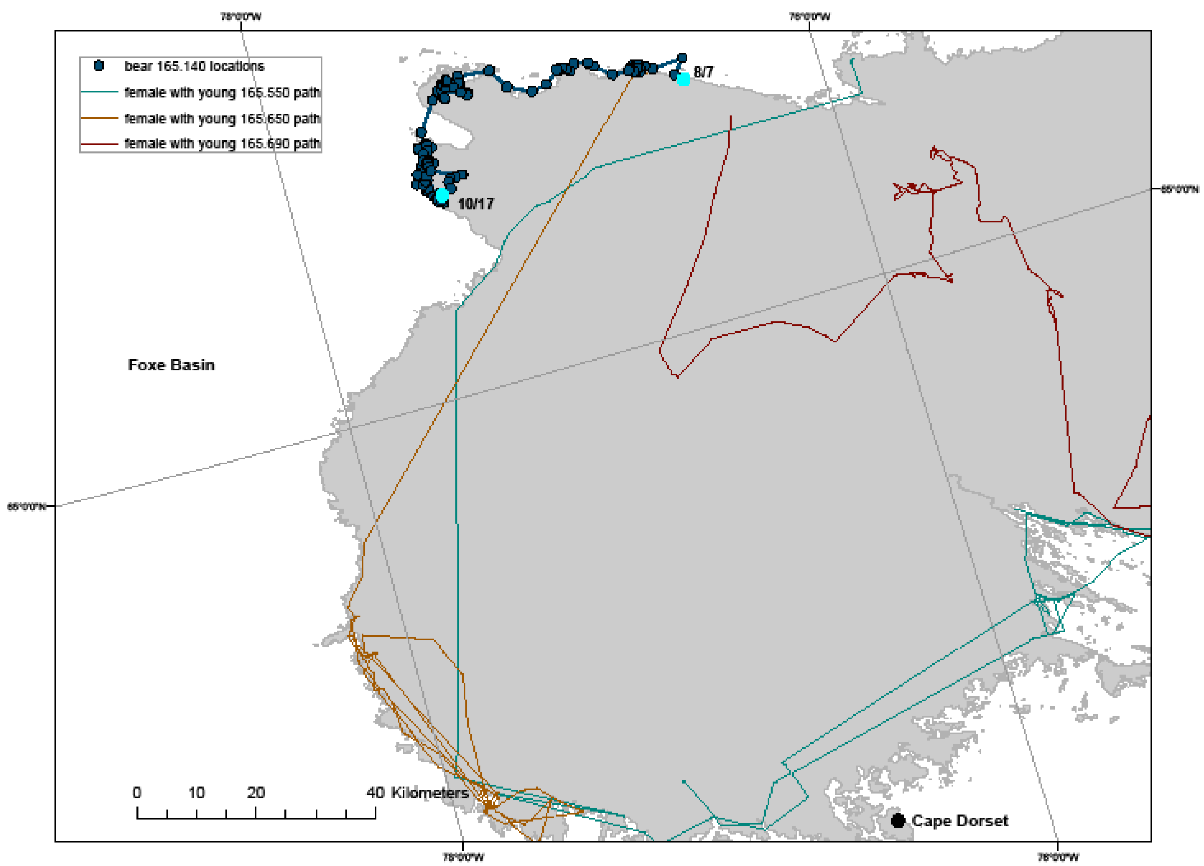

Figure A5. Point to point movements of adult female polar bear with 1 yearling cub, transmitter #165.690, August to November, 2008.

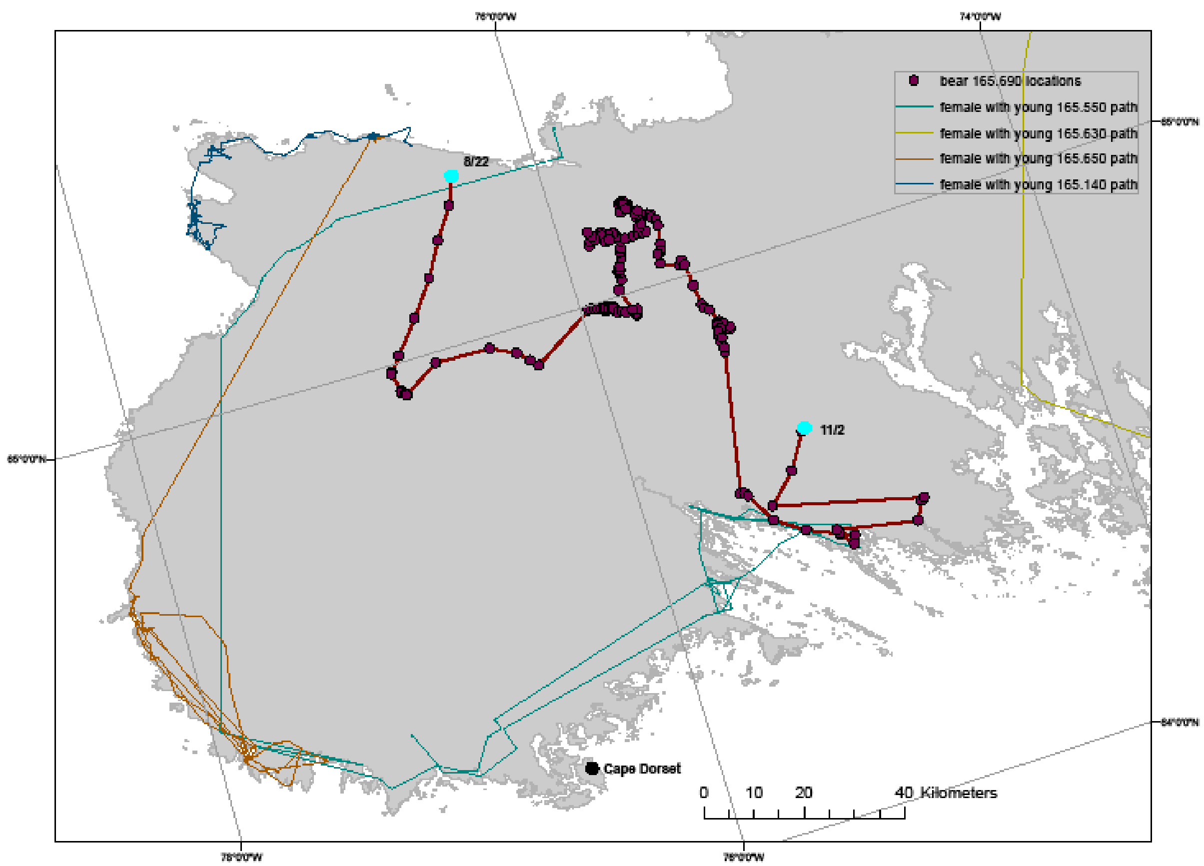

Figure A6. Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.550, August to November, 2008.

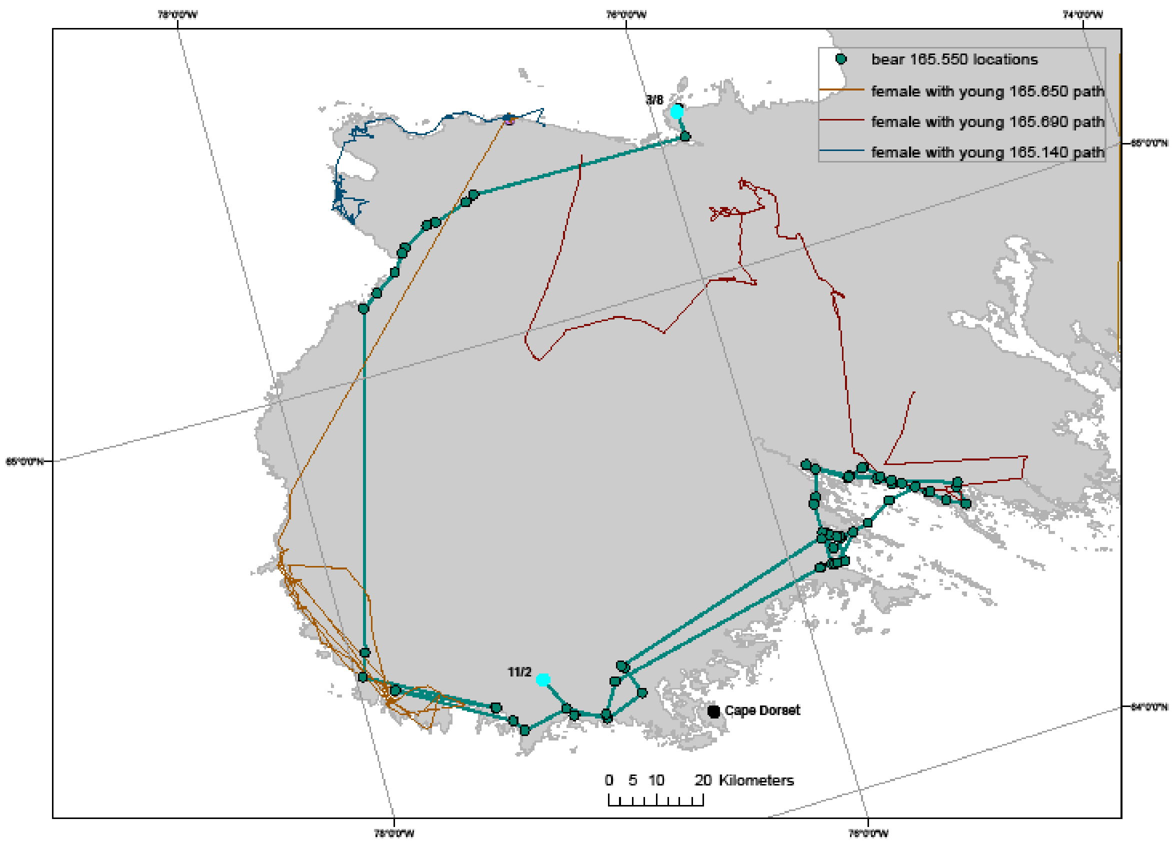

Figure A7. Point to point movements of adult female polar bear with one yearling cub, transmitter #165.680, August to November, 2008.

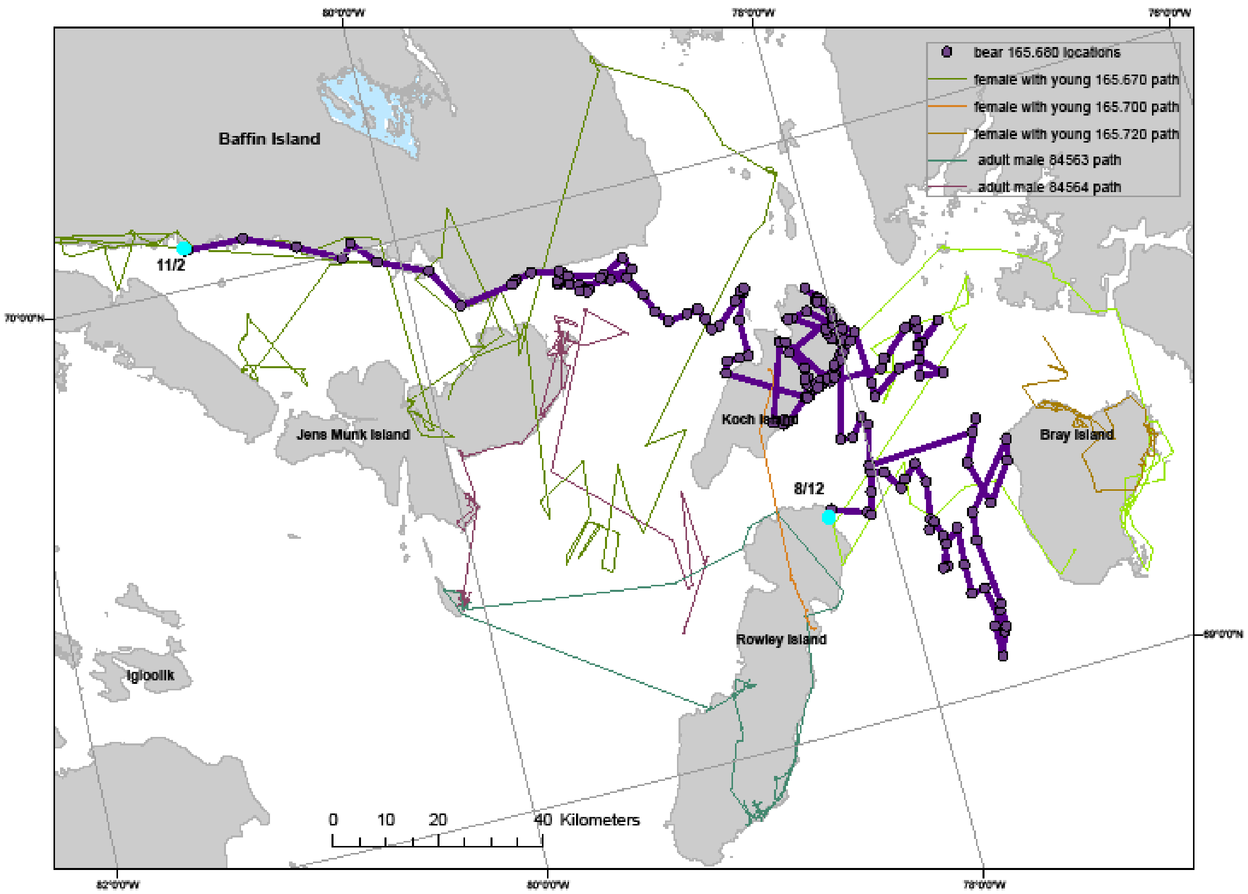

Figure A8.Point to point movements of adult female polar bear with 1 cub of the year, transmitter #165.750, August to November, 2008.

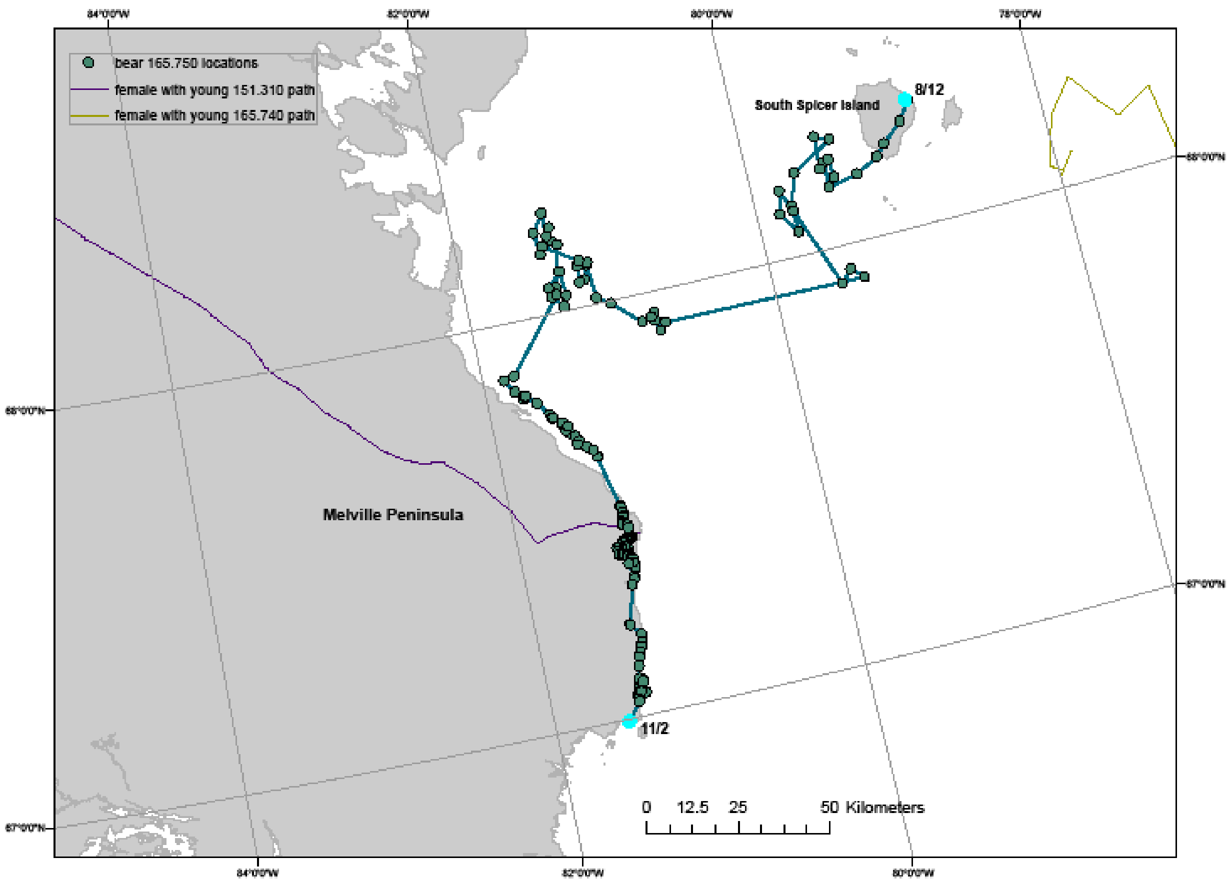

Figure A9. Point to point movements of adult female polar bear with 1 cub of the year, transmitter #165.700, August to November, 2008.

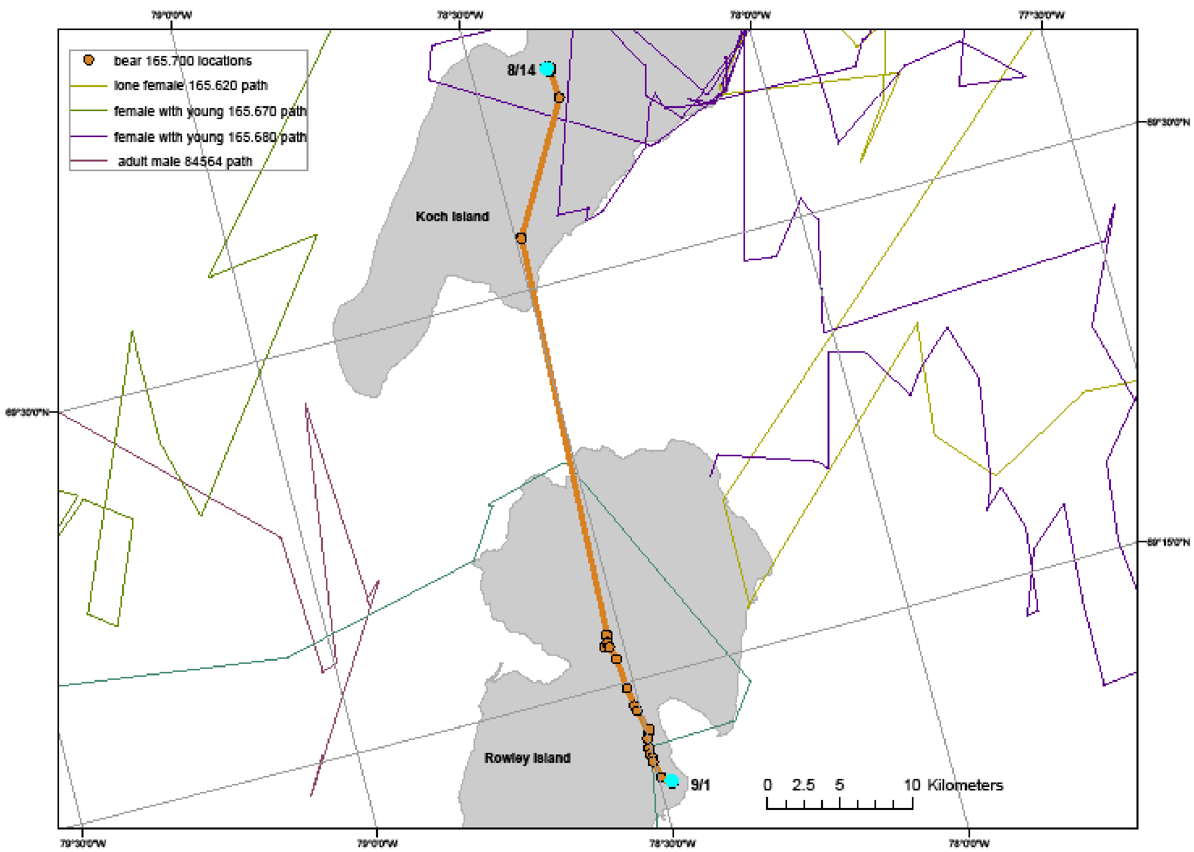

Figure A10. Point to point movements of adult female polar bear with 2 yearling cubs, transmitter #165.630, August to November, 2008.

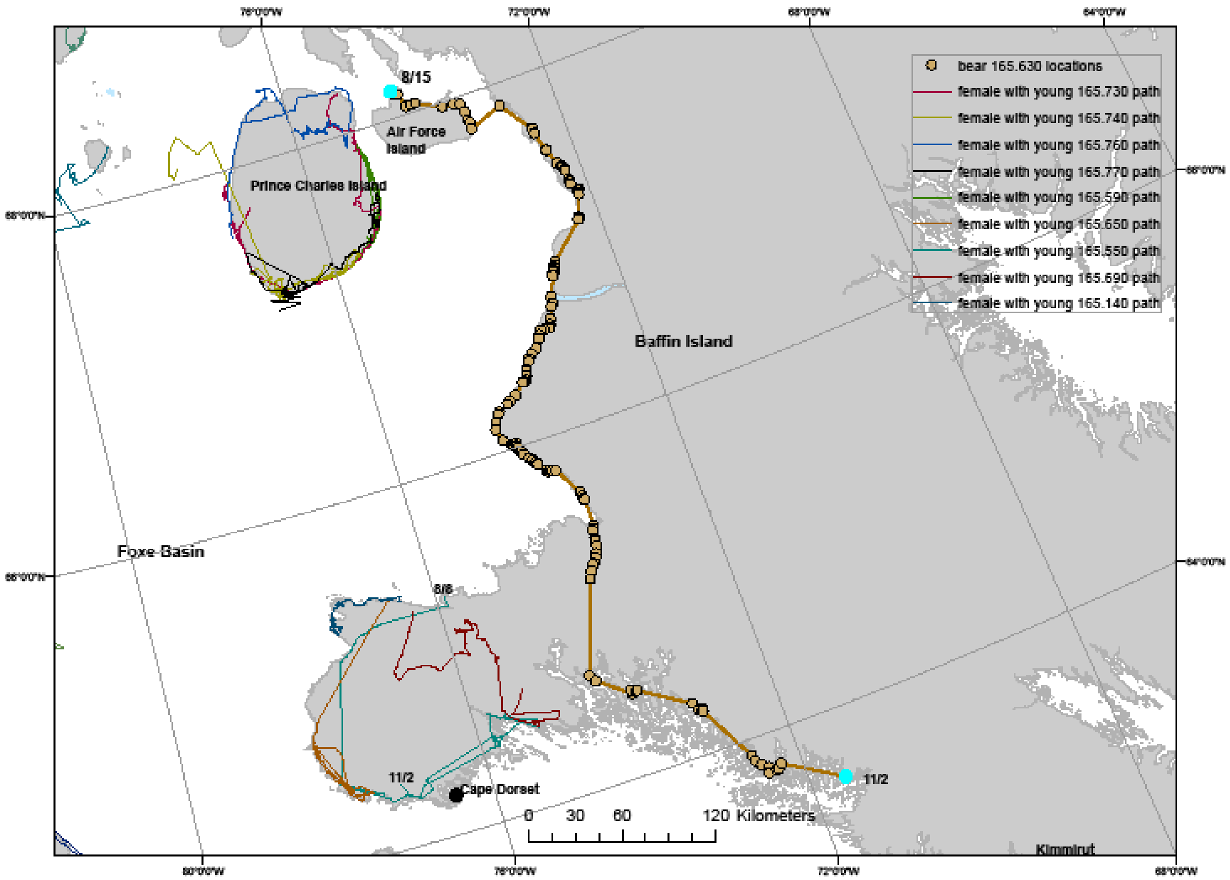

Figure A11. Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.760, August to November, 2008.

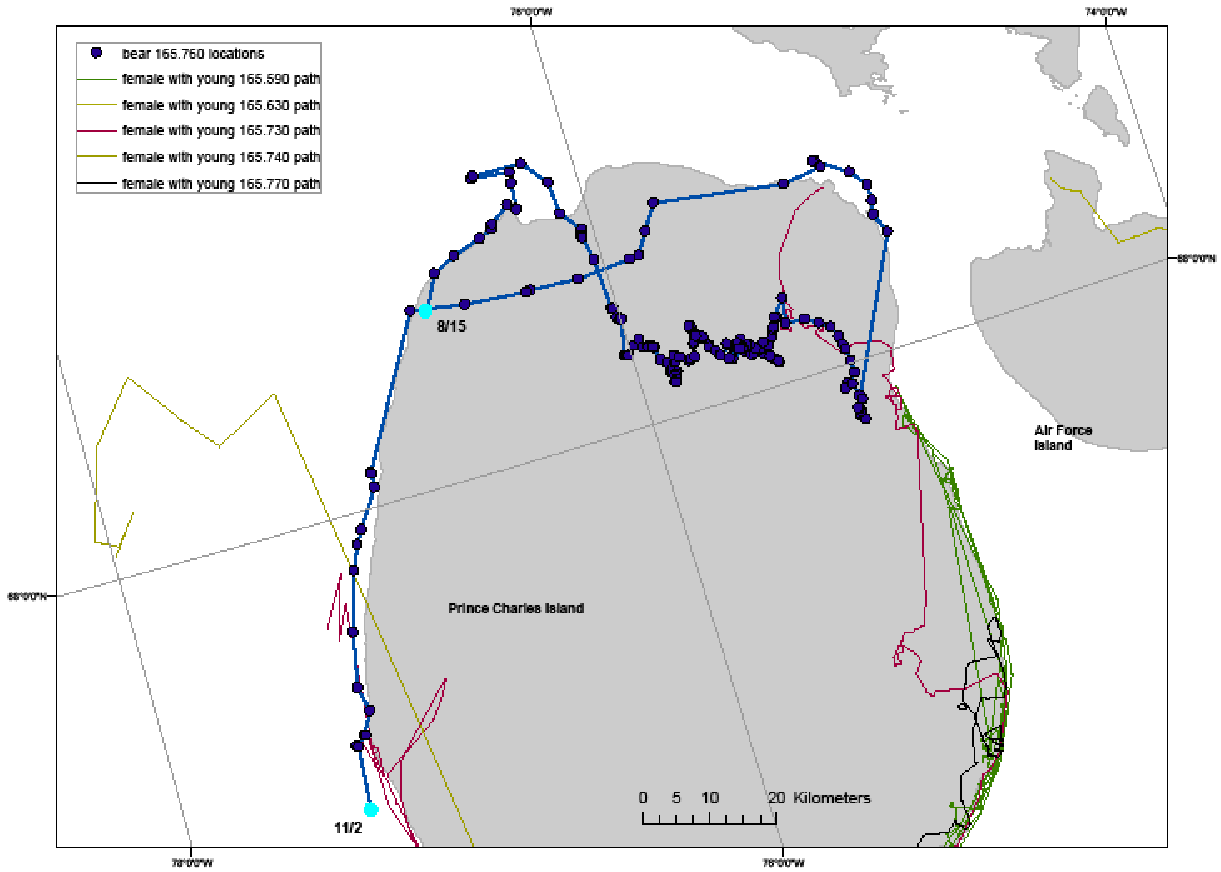

Figure A12. Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.770, August to November, 2008.

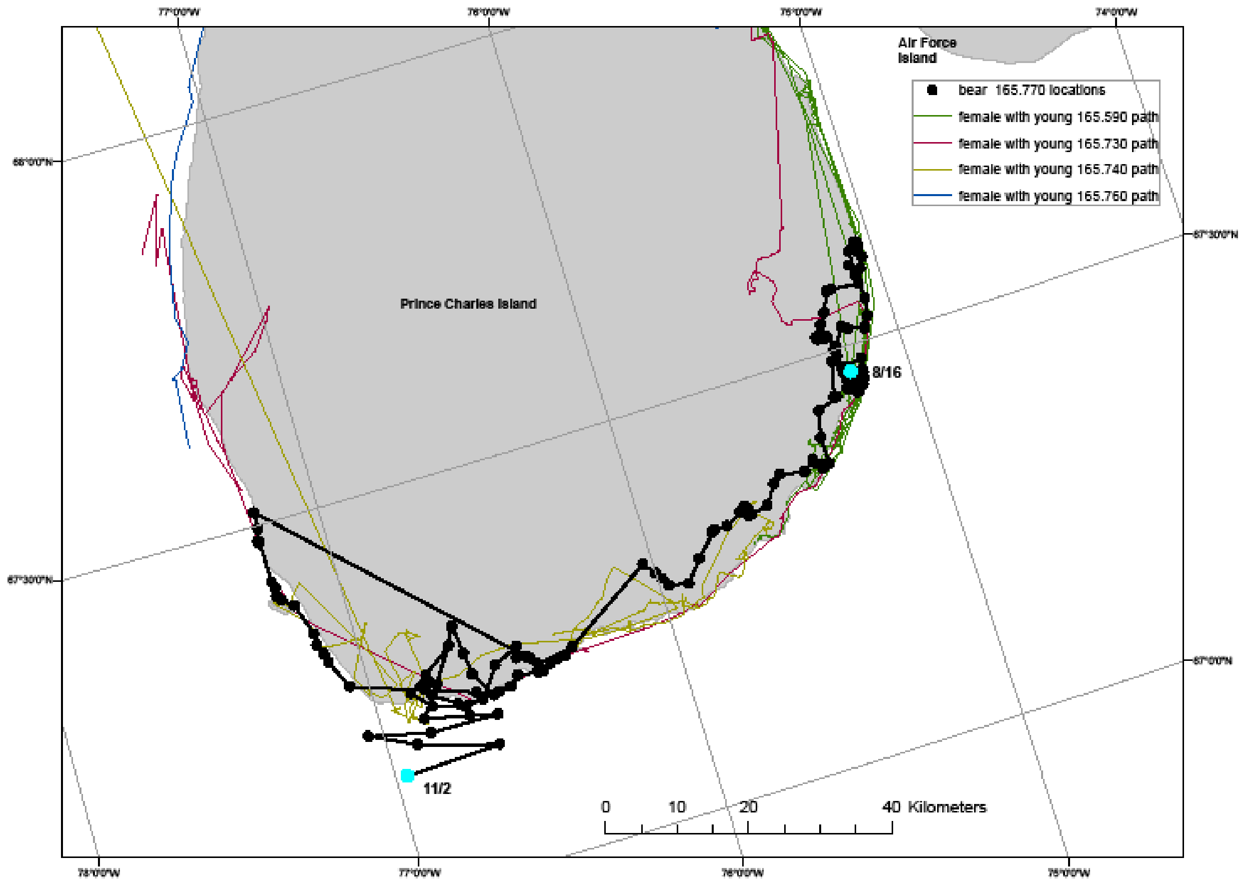

Figure A13. Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.590, August to November, 2008.

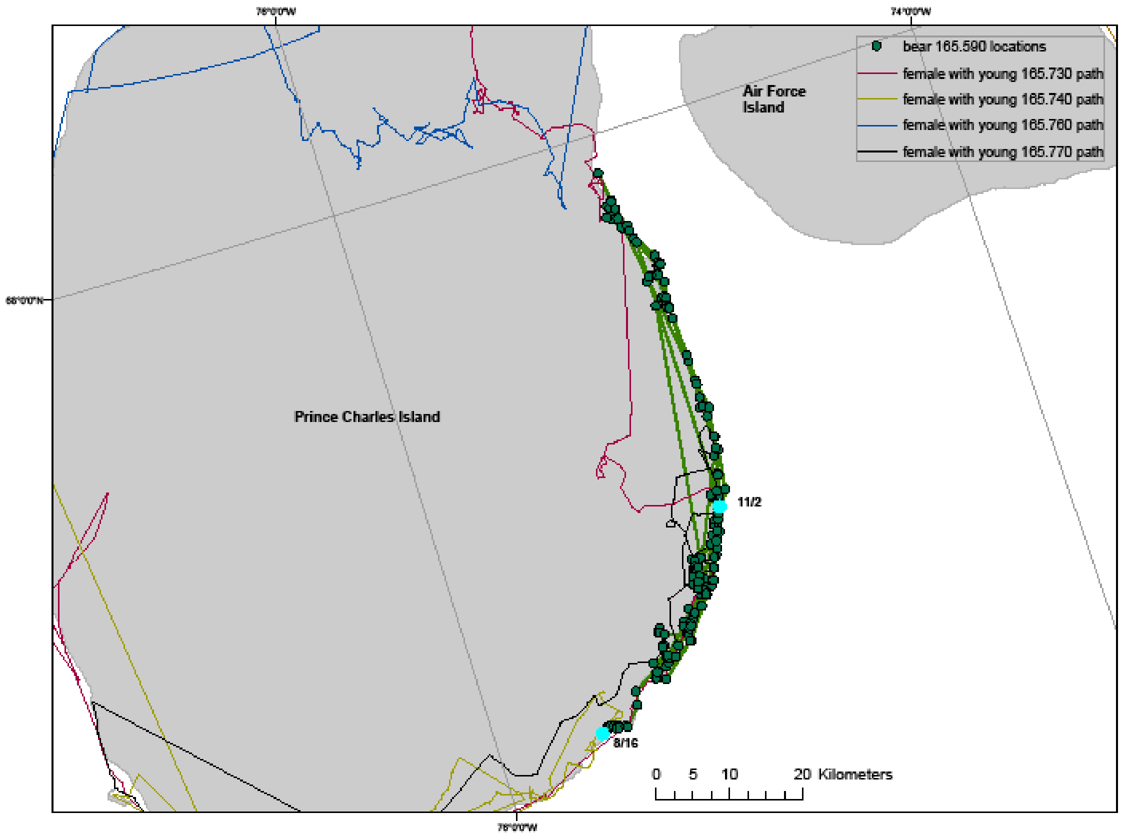

Figure A14.Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.580, August to November, 2008.

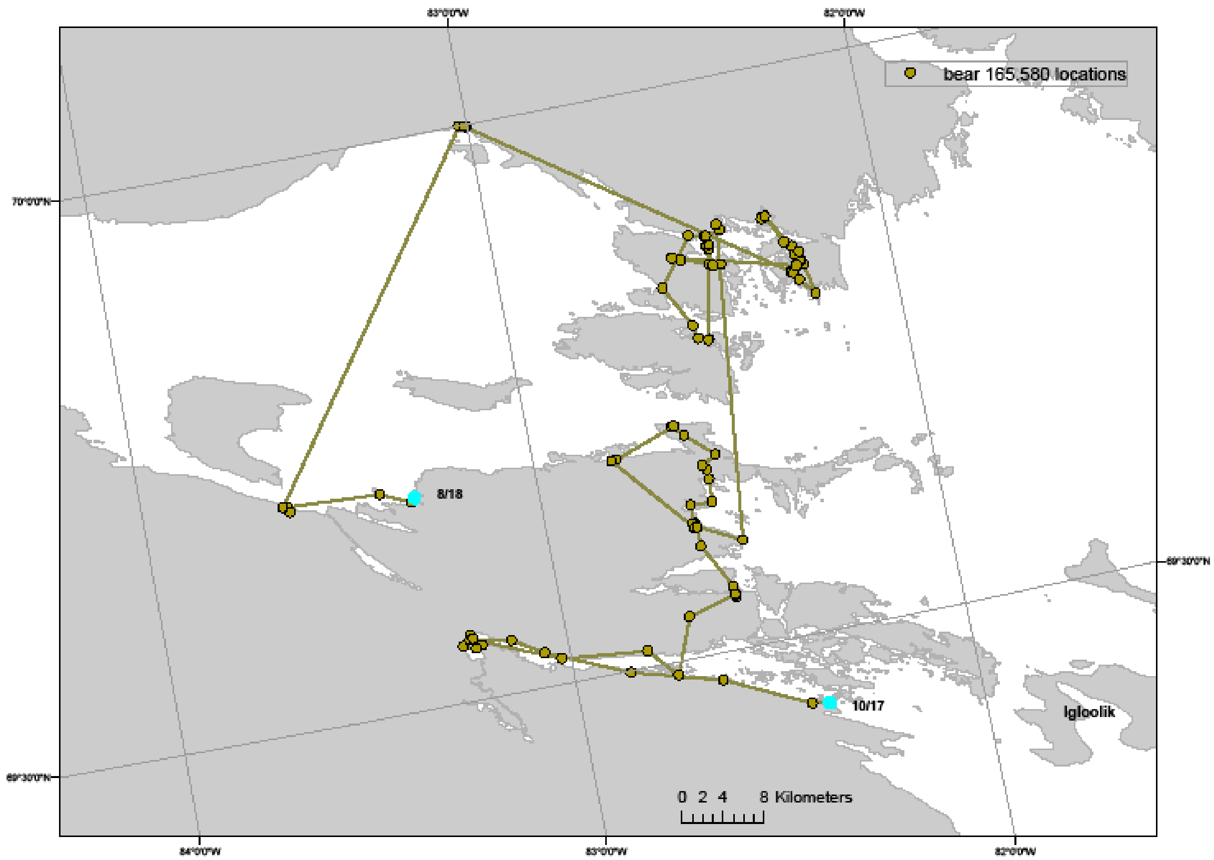

Figure A15. Point to point movements of adult male polar bear, transmitter #84563, August to November, 2008.

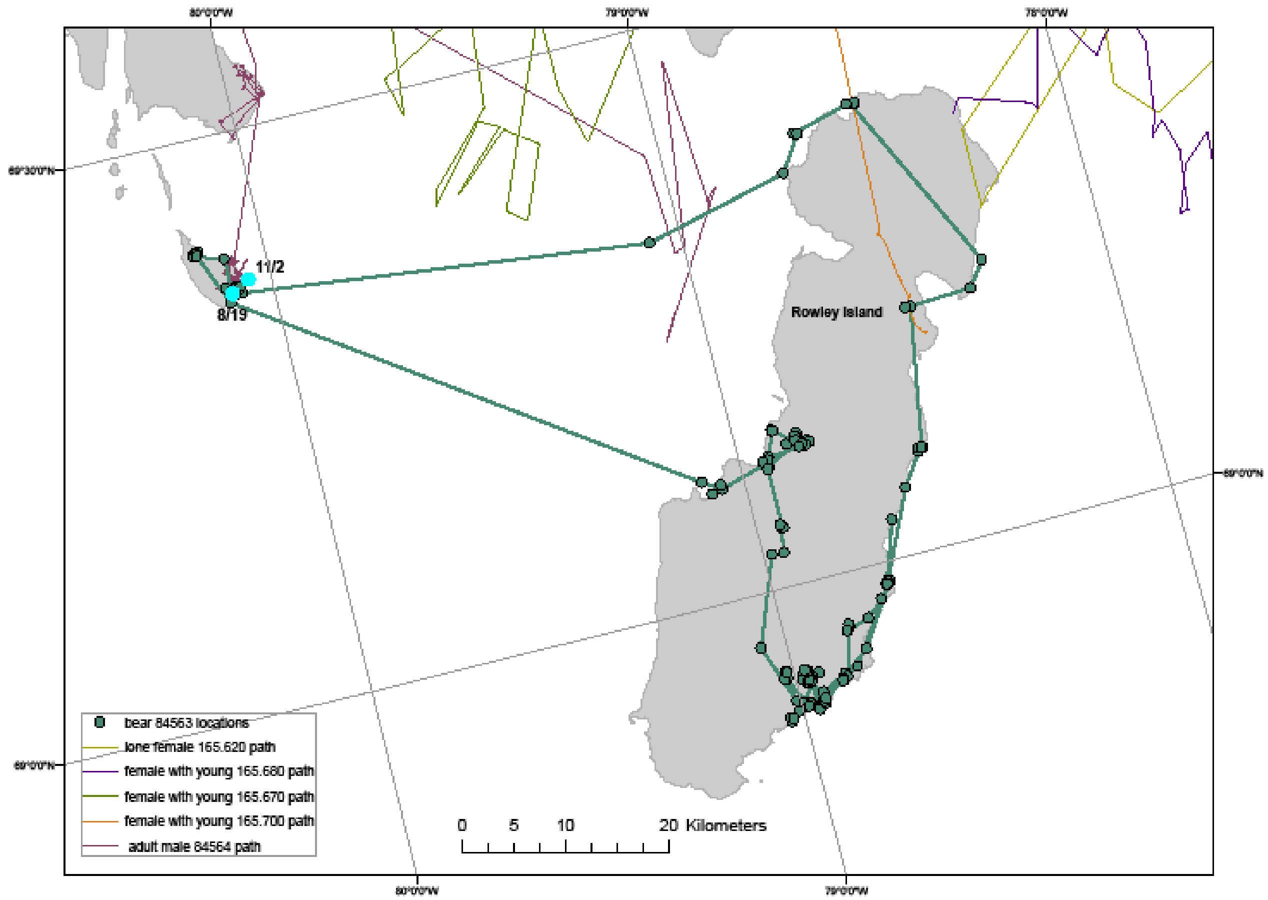

Figure A16. Point to point movements of adult male polar bear, transmitter #84564, August to November, 2008.

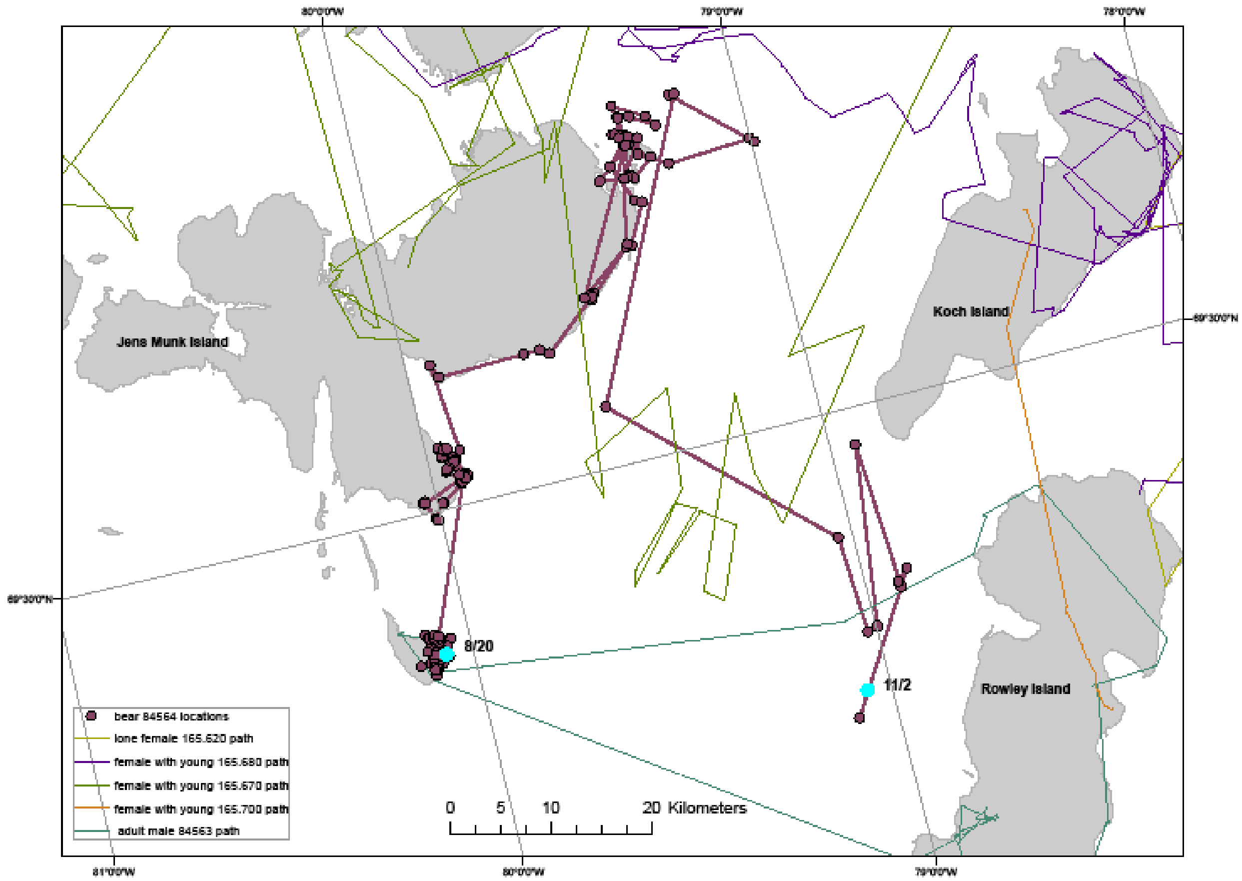

Figure A17. Point to point movements of adult female polar bear with 2 cubs of the year, transmitter #165.720, August to November, 2008.

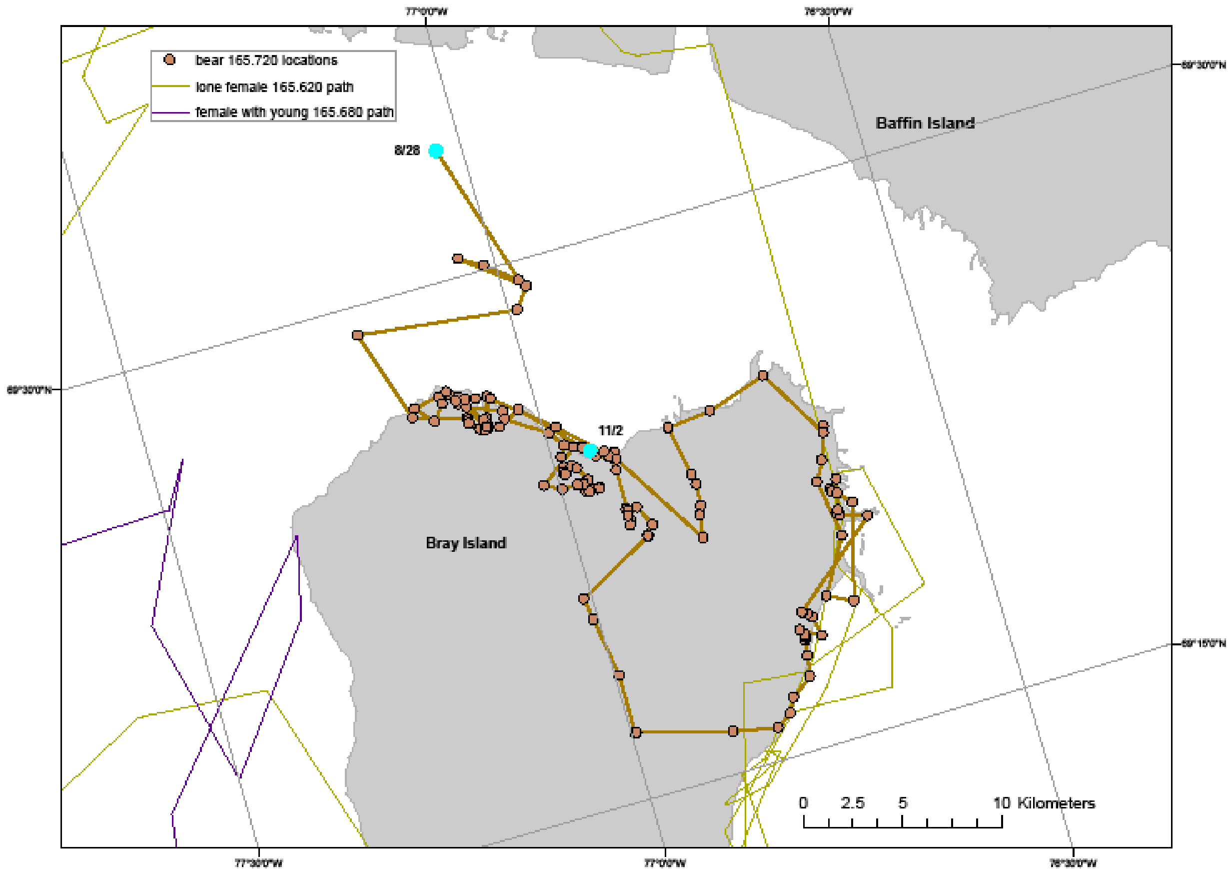

Figure A18. Point to point movements of adult female polar bear with 2 yearling cubs, transmitter #165.670, August to November, 2008.

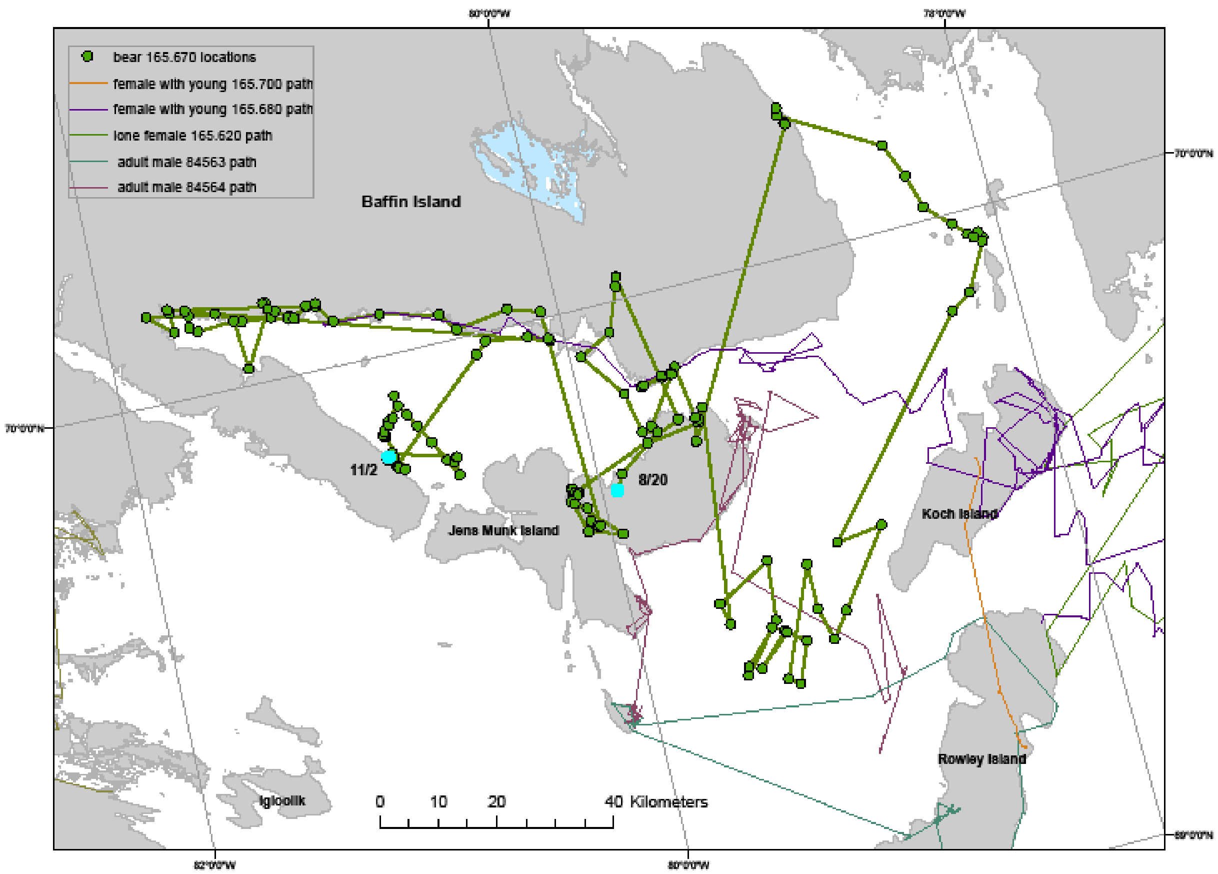

Figure A19. Point to point movements of adult female polar bear with 1 yearling or 2-year-old cub, transmitter #165.190, August to November, 2008.

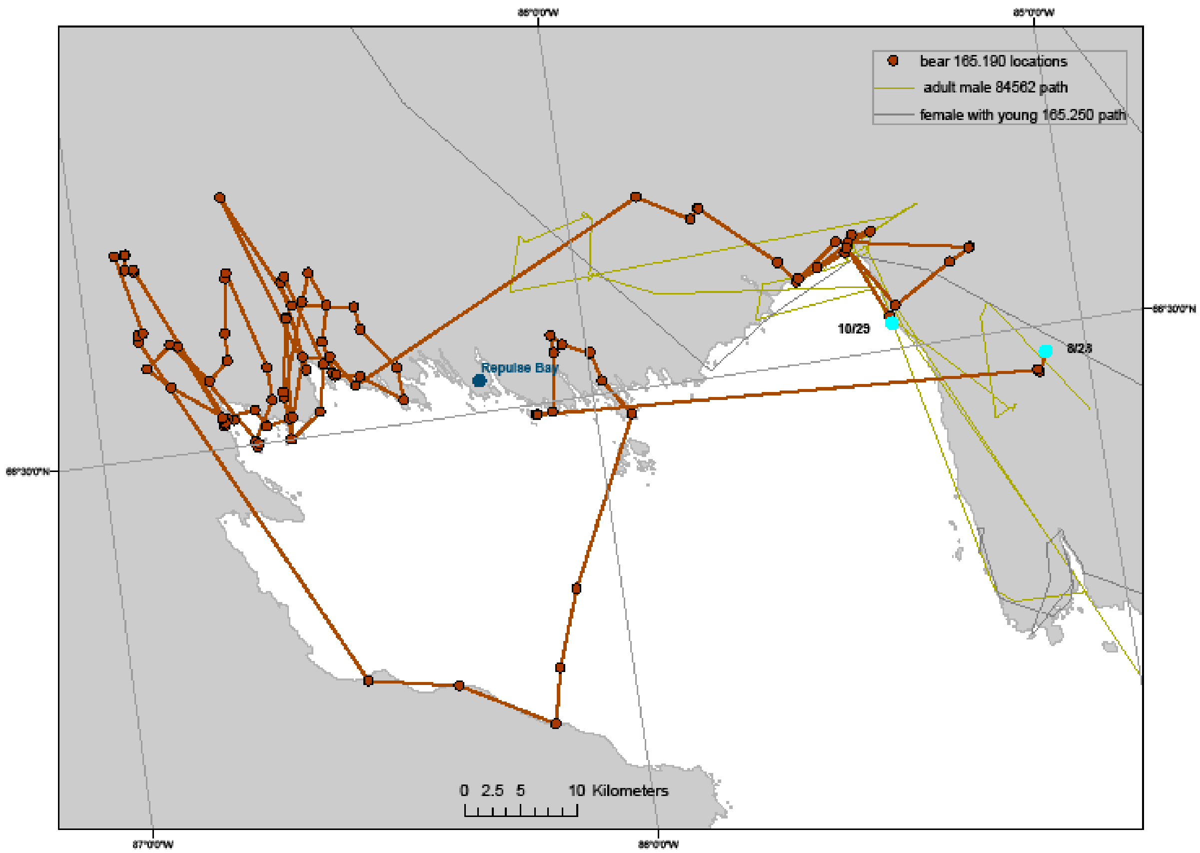

Figure A20. Point to point movements of adult female polar bear with 1 cub of the year, transmitter #165.250, August to November, 2008.

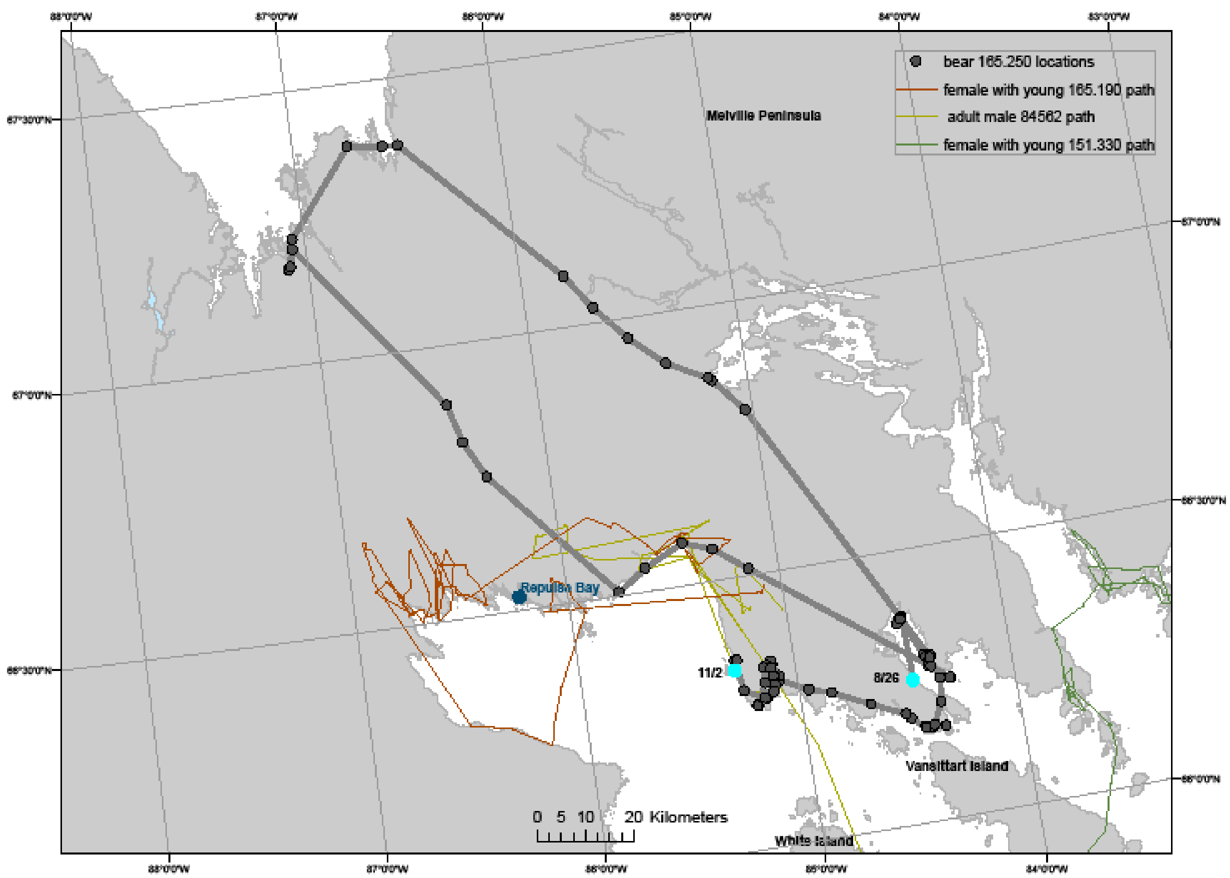

Figure A21. Point to point movements of adult female polar bear with 2 yearling cubs, transmitter #165.310, August to November, 2008.

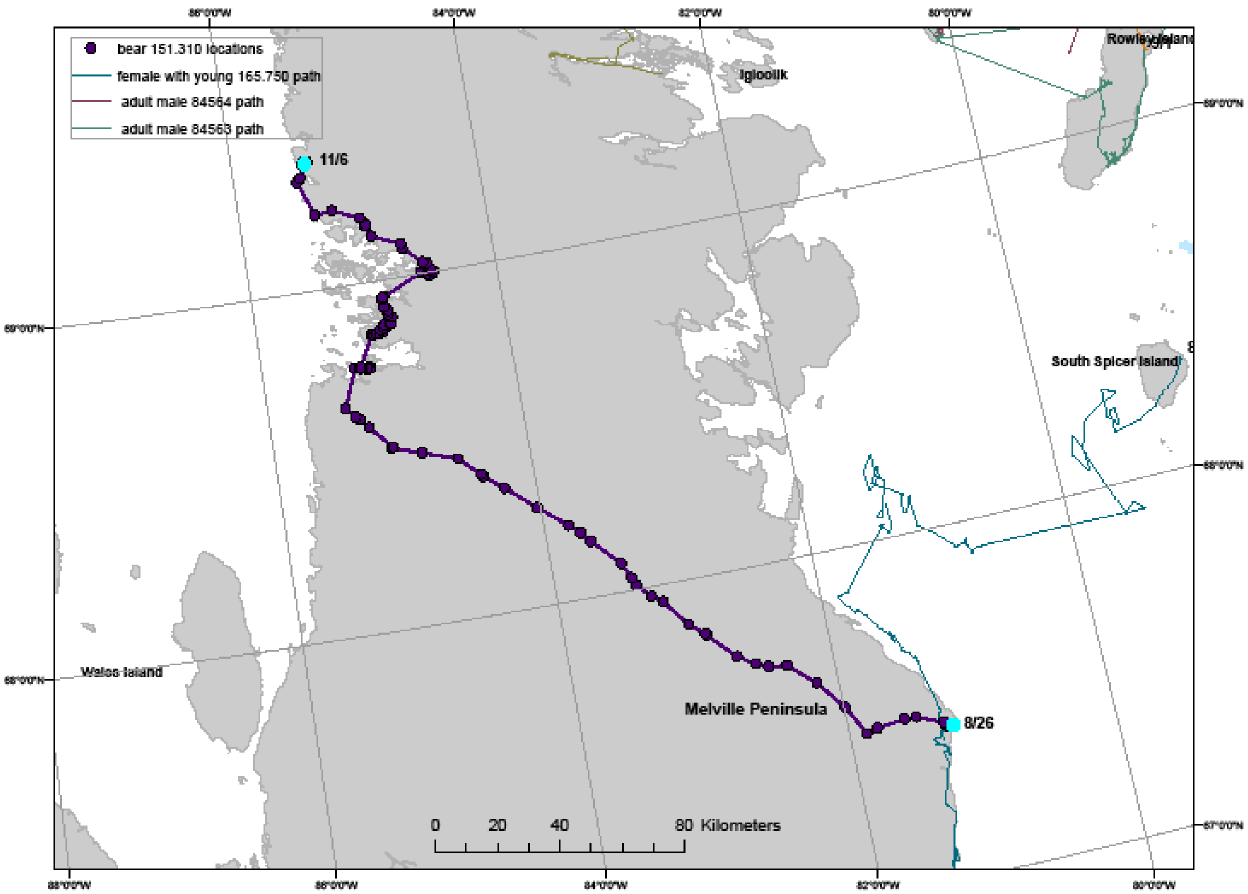

Figure A22. Point to point movements of adult female polar bear with 1 cub of the year, transmitter #165.330, August to November, 2008.

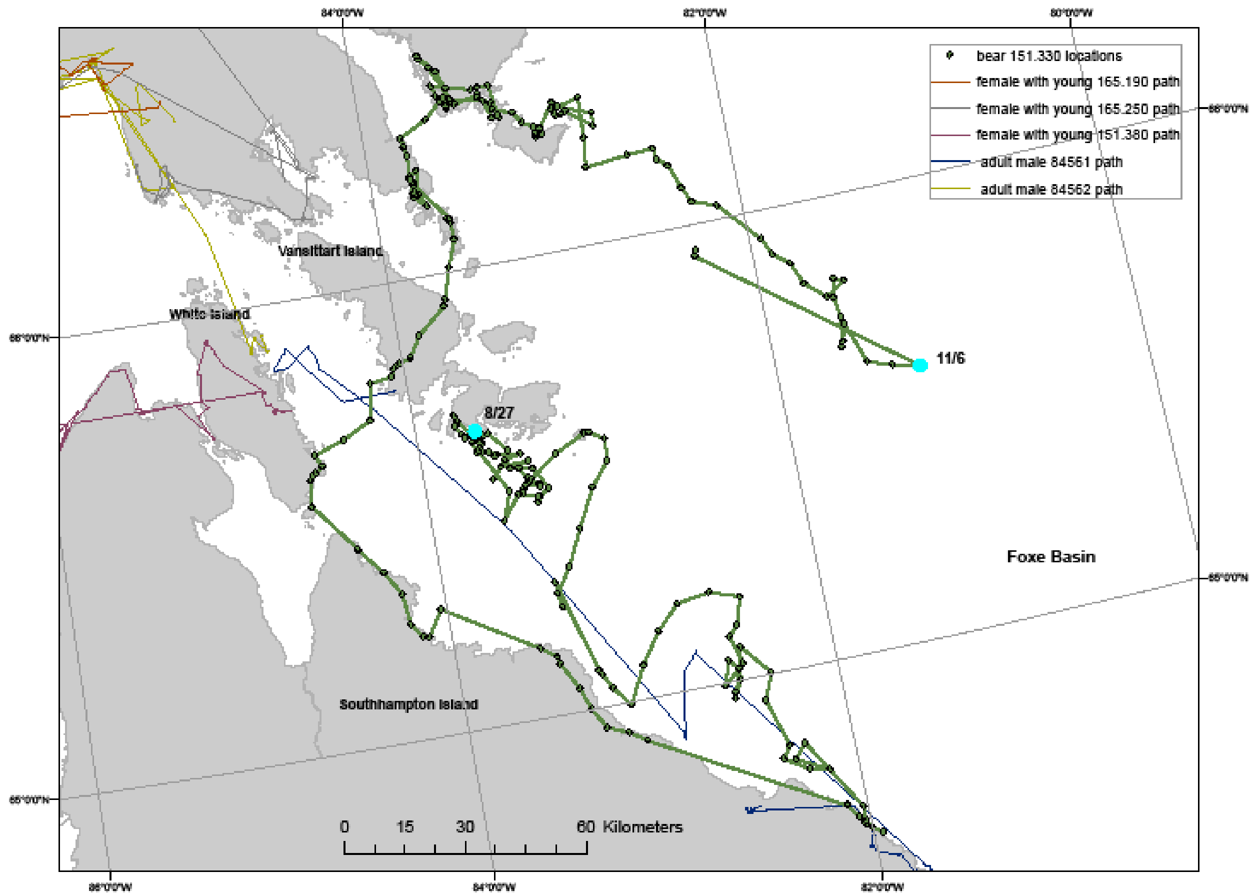

Figure A23. Point to point movements of adult male polar bear, transmitter #84561, August to November, 2008.

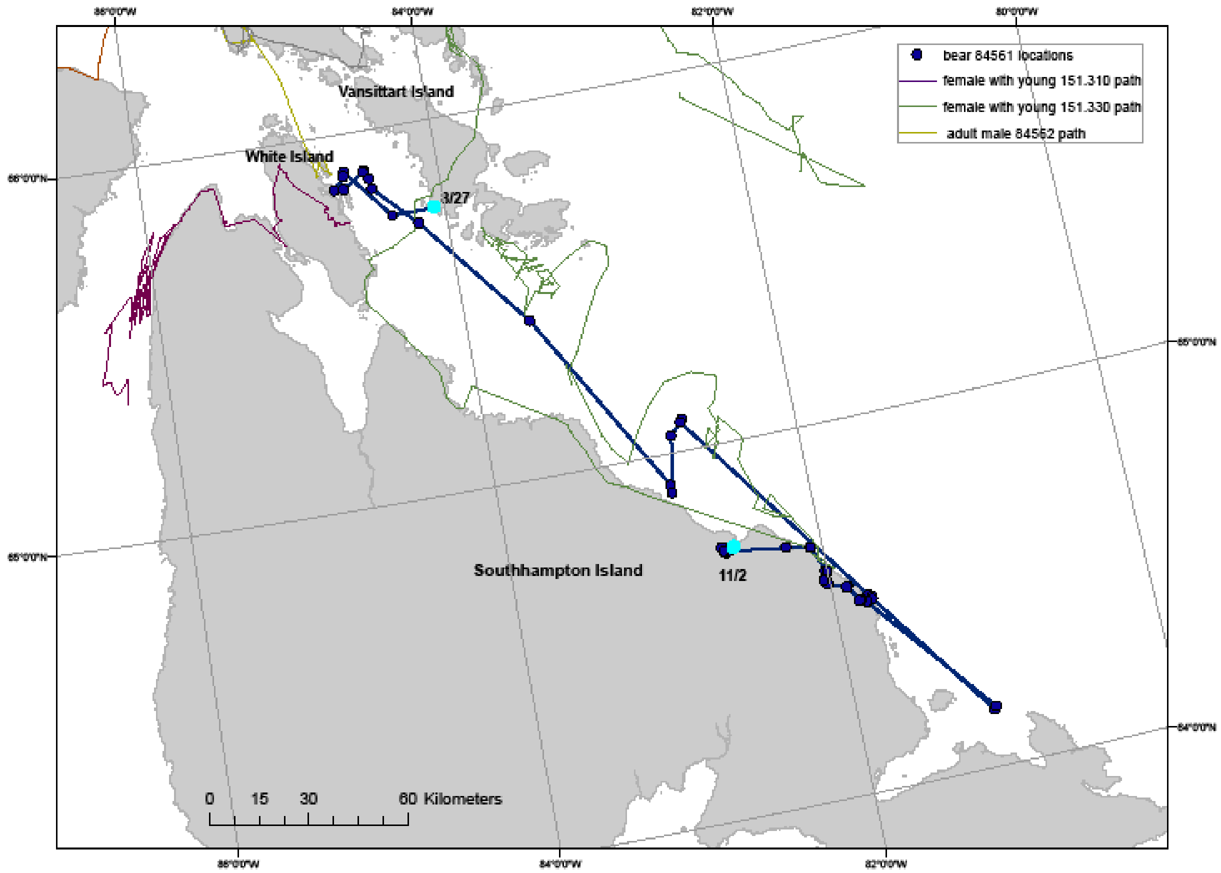

Figure A24. Point to point movements of adult male polar bear, transmitter #84562, August to November, 2008.

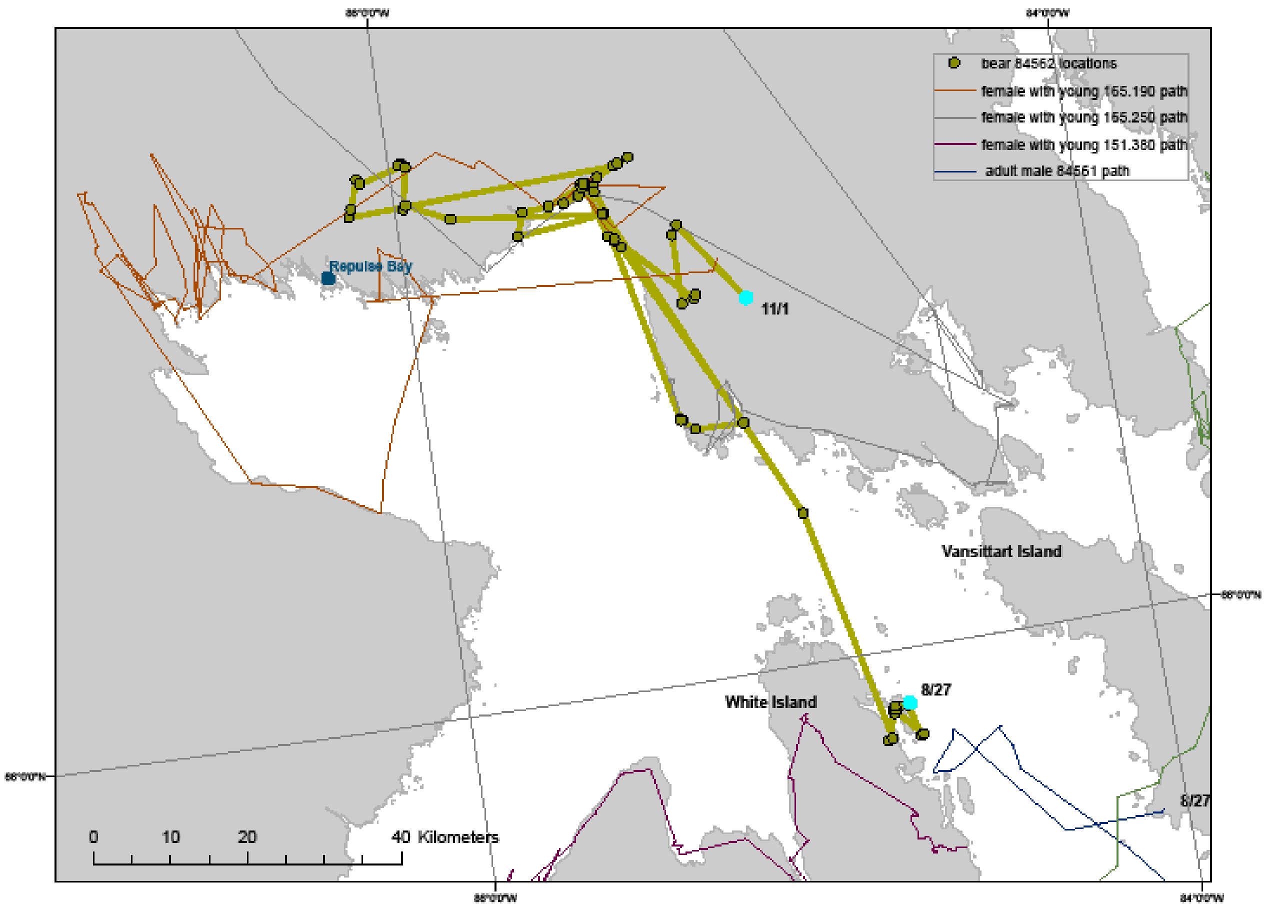

Figure A25. Point to point movements of adult female polar bear with 2 yearling cubs, transmitter #151.380, August to November, 2008.

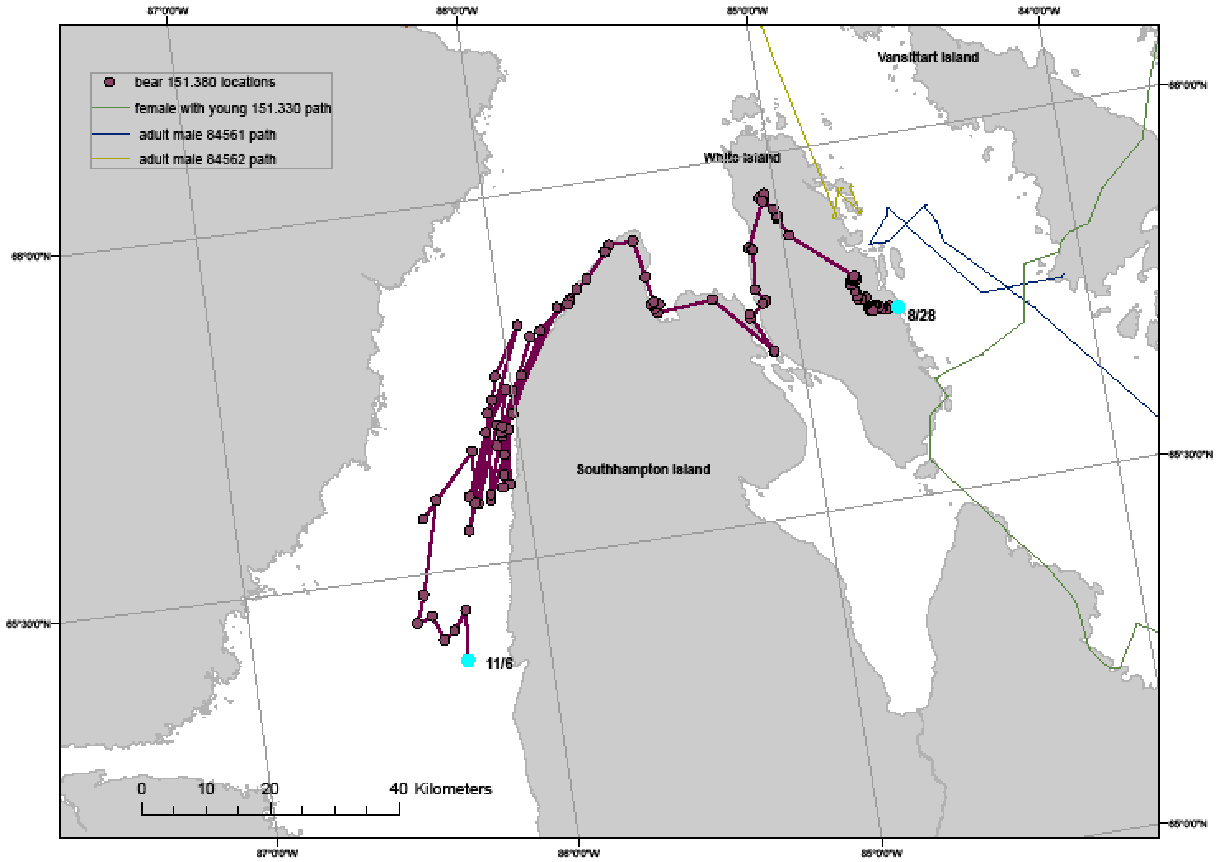

Figure A26. Point to point movements of adult female polar bear with 1 cub of the year, transmitter #165.740, September to November, 2008.

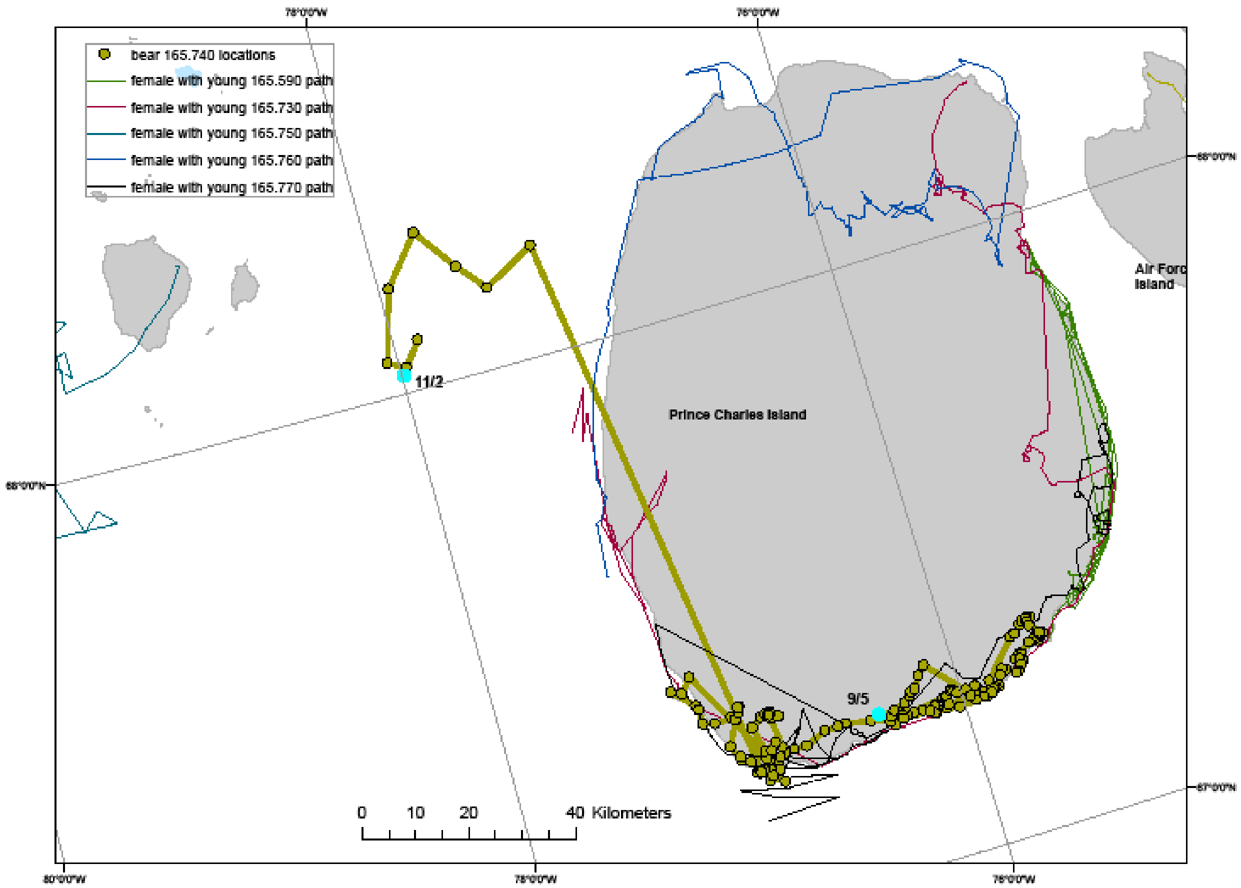

Figure A27. Point to point movements of adult female polar bear with 1 cub of the year, transmitter #165.730, September to November, 2008.