Kodiak Island Cooperative Goldeneye Nest Box Project
2015 Progress Report

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and

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This project is a cooperative effort of the Alaska Department of Fish and Game, Kodiak National Wildlife Refuge, Konaig Corporation, U.S. Coast Guard - Integrated Support Command Kodiak, Lesnoi Corporation, and various private individuals.

Cover photo- First Barrow's goldeneye hen to use the Aurel Lake nest box AL-1 prior to release after banding on June 18, 2015.

Executive Summary

During the period 12 May to 20 Sept, 2015, nest boxes located at eight different lakes on the Kodiak road system and Karluk Lake on the Kodiak National Wildlife Refuge were checked by the author(s). Three of the original 8 Buskin Lake boxes were moved to new locations on Buskin Lake in 2015. Also another new road system nest box was added at Nyman Lake, located on the U.S. Coast Guard base in 2015. However, Lake Rose Tead nest box, RT-1, was taken down, keeping the total number of Project boxes available in 2015 at 47.

Occupancy rate of available project nest boxes used by Barrow's goldeneye (*Bucephala islandica)* hens was 38% (18 of 47 boxes) in 2015, up from 34% in 2014, though down from the 40% in 2013, But this was still an increase from the 35% in 2012 and double the 2011 box occupancy rate of 19%. None of the 3 moved boxes on Buskin Lake, or the twice moved KP-1 box on Kalsin Pond, nor newly added Nyman Lake nest box were used during the 2015 nesting season.

The 2015 estimated average clutch size of 6.8 eggs (range 2-14) from the 18 occupied project goldeneye boxes was down from the 2014 and 2013 clutch averages of 7.2 and 7.3 eggs, but still higher than the estimated clutch averages of 5.7 and 6.1 eggs found in 2012 and 2011, respectively. Similar to 2014, a large number of unhatched eggs were found in 2015. But only 2 nest boxes contained clutches comprised of only unhatched eggs in 2015 as compared to 4 boxes in 2014. The depressed 76% estimated hatching success in 2015 and dismal 2014 estimated hatching success of 62% are both substantially below the early Project average estimated hatching success of 92% over the previous 3 years.

Capture and banding of goldeneye hens using Project nest boxes was continued in 2015 with the first Barrow's goldeneye hen using box AL-1 on Aurel Lake banded on 18 June.

The Kodiak nest box project was initiated in the spring of 2010 in an attempt to provide additional goldeneye nesting habitat and collect basic nesting ecology information. To date, over 400 Barrow's goldeneye young have been hatched from project nest boxes.

Introduction

Kodiak Island is located at the far western edge of Barrow's goldeneye (*Bucephala islandica)* range. The specie is a common cavity nesting sea duck breeding throughout the archipelago's freshwater ponds, lakes, lagoons, and protected bays. Kodiak supports an extensive resident Barrow's goldeneye breeding population (primary author's unpub. data), and based on the large number of hunter band returns, a large migrant wintering population. Kodiak's wintering goldeneye are a highly prized target of both Kodiak subsistence and sport hunters. However, little is known of the resident breeding population's nesting ecology, size, or the contribution to the heavily hunted Kodiak wintering goldeneye population.

Study Area

Located in the northwestern Gulf of Alaska, the Kodiak Archipelago is separated from the Alaska mainland by 30 miles of water in Shelikof Strait. Kodiak National Wildlife Refuge occupies approximately 757,000 ha on Kodiak and Afognak Islands (Figure 1). The Archipelago is influenced by a maritime climate with an annual mean temperature of about 4 C°. Total annual precipitation varies from >250 cm along the eastern coast of the Archipelago to <60 cm over the western areas adjacent to Shelikof Strait. Mountains, several over 1220

m with permanent glaciers, traverse more than half the length of Kodiak Island. Vegetation ranges from Sitka spruce (*Picea sitchensis*) forest on the northern end of the Archipelago to treeless tundra on the southern end of the Archipelago. The approximate locations of the eight Kodiak road system nest box lakes, Karluk Lake, and Hidden Basin are depicted in Figure 2.

Recommended Methods

1. An extension ladder is used to access the nest boxes to assess their status with the exception of the nest boxes at ground level at Lee, Caroline, and Aurel Lakes due to lack of large trees in the vicinity.
2. A minimum single annual nest box check for usage is recommended during the period 15 May to 15 August.
3. Banding capture of hens should be attempted during the period 15 May to 1 July which increases the probability the clutch hasn't hatched out yet and the hen will still be occupying the box.

   A small landing net attached to an adjustable pole (Figure 3) is put in position over the box entrance prior to placement of the ladder and is used to capture incubating hens at occupied nest boxes for banding. Captured hens have standard body measurements taken and are banded with standard 7A stainless steel bands provided by the US Bird Banding Laboratory.
4. The number of eggs, young, or egg membranes from hatched eggs found in the nest boxes are used to estimate clutch size (CS) and hatching success (HS). Membranes estimated to be more than 60% the size of a whole egg are counted as a single egg (Figure 4).
5. Wood shavings are added to boxes as needed in order to maintain adequate amounts of nesting material in the box. When an early period box check is conducted and unhatched clutches are present in the boxes, shavings should still be added to the box beneath the eggs. A wood shaving depth in of >2 inches appears to be a major factor in the initial and continued use of a nest box.

The 2015 box checks on the 26 Kodiak road system nest boxes and 21 Karluk Lake boxes located on the Kodiak National Wildlife Refuge were conducted from 12 May to 20 Sept.

Results

Of a total of 47 project nest boxes installed on the nine Kodiak lakes available for use by goldeneye in 2015, the 18 occupied boxes (38%) had an estimated average clutch size (CS) of 6.8 eggs/box. Nest box clutch sizes ranged from 1-14 eggs/box.

Estimated 2015 hatching success (HS) of the nest box clutches was only 76% with 6 clutches having 1-14 unhatched eggs. Two of these clutches contained only unhatched eggs with no down indicating that incubation was never initiated.

Road system and Karluk Lake nest box installation dates and use histories from 2010-2015 nesting seasons are presented in Tables 1 and 2, respectively. Results from each of the

project lakes are as follows:

Orbin Lake

Nest box OL-1 (Table 1;Figure 5) was checked for activity on 1 June and was empty indicating the clutch was abandoned. The unhatched eggs were removed from the box and shavings added. The private land that OL-1 is located on is being sold, so the box will be moved ~75ft down slope to the road right-of-way immediately adjacent to Orbin Lake.

Nest box OL-2 (Table 1;Figure 5) was visited on 1 June and contained a 5 egg membranes and 3 unhatched eggs. Only one of the unhatched eggs had an embryo inside. All 3 unhatched eggs were removed from the box and were collected along with the 5 egg membranes before shavings were added.

No hens with broods or lone broods of Barrow's goldeneye were seen on Orbin Lake at any time during 2015.

Lee Lake

Nest box LL-1 (Table 1;Figure 5) was checked 6 June. The box contained 8 eggs with no down in the box indicating incubation was never initiated. The 8 unhatched eggs were removed and collected before shavings were added.

A Barrow's goldeneye hen with a brood of 8 ducklings were observed and reported by local resident, D. Hueman, on Lee Lake on the same day (6 June). Certainly this was not a brood from nest box LL-1. However, in previous years at least two goldeneye hens have been observed with broods on Lee Lake at the same time indicating the presence of another goldeneye nest site in the vicinity of the Lee Lake besides the nest box.

Caroline Lake

Box CL-1 was checked for use on 9 June (Table 1;Figure 5) and was found to contain 14 unhatched eggs. Similar to LL-1, no down was found around or covering the eggs indicating again that incubation of this clutch was not initiated. The unhatched eggs were removed and collected before shavings were added.

Aurel Lake

Box AL-1 was checked first 6 June (Figure 5;Table 1). A Barrow's goldeneye hen flushed from the box as it was being checked but before it could be captured. A clutch of 6 eggs was found in the box. A second check of the box on 18 June resulted in the capture and banding of the AL-1 hen. The 6 egg clutch was unhatched, but the eggs were still being incubated. The box was checked again 20 July and all 6 eggs of the clutch had hatched out. The membranes were collected and shavings were added to the box. No broods were observed on Aurel Lake during the July visit but a goldeneye hen with a brood of 4 nearly grown (Class 3c) and a pair of red-throated loons with 2 large young were present on adjacent Caroline Lake. It is not known if the hen and brood were from Aurel Lake's box AL-1.

Buskin Lake

The Buskin Lake nest boxes (Table 1;Figure 5) were initially checked on 12 May. Eight of the nine Buskin Lake nest boxes were found to be unused during this visit. Box BL-3 was the exception and contained a family of red squirrels (*Tamiasciurus hudsonicus*) which were evicted prior to the box being taken down. Box BL-3, BL-8, and BL-5 were subsequently moved to new locations (Figure 5) to hopefully entice future use. A second check of the Buskin Lake boxes was conducted on 19 June and revealed boxes BL-1 to BL-8 still had not

been used. However, box BL-9 contained membranes from 4 goldeneye eggs that appeared to have hatched several days previously and 1 unhatched egg. During the May visit 38 days prior to the 19 June box check, a pair of Barrow's goldeneye had been present in the vicinity of BL-9. Taking into account an approximate 32 day incubation period, the hen had to have initiated egg laying and incubation in the box almost immediately after the 12 May visit. This nest box's clutch marks the first time any Buskin Lake nest boxes or larger road system lakes have been used by goldeneye since the Project was initiated in 2010.

Lake Rose Tead

Lake Rose Tead nest boxes were checked to determine activity status on 26 June (Table 1;Figure 6). Red squirrel activity was again found in 5 boxes with RT-4 and RT-10 the only boxes spared from being stuffed with moss by the squirrels (Table 1). Box RT-5 appeared to have been prospected but whether the species had fur or feathers could not be determined. Red squirrels had occupied all 3 of these boxes every prior year but not RT-2 and RT-3. The opposite was true in 2015

Box RT-7, closest to the outlet of Lake Rose Tead and adjacent to a well-used campsite was taken down. This box had acquired several new bullet holes in addition to annual red squirrel use every year since initiation of the project. Therefore, a new Lake Rose Tead location for the box will be sought.

Kalsin Pond

The status of the 3 Kalsin Pond nest boxes was checked on 27 June (Table 1;Figure 6). None of the nest boxes had been used by goldeneye or disturbed by red squirrels. The shavings were replenished in all three boxes.

No waterfowl broods of any species were observed on the Pond during the box check. In previous years a minimum of 6-8 waterfowl broods comprised of mallard, green-winged teal, american wigeon, or common merganser species would have been present on Kalsin Pond at this time of the year. The water level of the Pond was very low during 2015 and likely contributed to this absence of waterfowl broods.

Karluk Lake

The 21 Karluk Lake nest boxes were checked for use activity on 18-20 September (Figure 7). Thirteen of the 21 boxes had been used by Barrow's goldeneye during 2015, resulting in a box occupancy rate of 62%, up from 52% in 2014, down from the 67% in 2013 and up from 2012's 60% occupancy rate (Table 2).

The 2015 estimated average clutch size (CS) for the 13 of 21 Karluk Lake nest boxes containing eggs was 6.3 eggs/clutch (range 2-10)(Table 2) which was down from 7.2 and 7.4 eggs/clutch from 2014 and 2013 respectively, but up from the 4.6 eggs/clutch in 2012 and 5.6 eggs/clutch in 2011.

A total of 4 unhatched eggs were found from 3 Karluk nest boxes during 2015 (2 boxes w/1 unhatched;1 box w/2 unhatched) as compared to 7 boxes with 29 unhatched eggs in 2014 (Table 2). The reduced number of Karluk Lake boxes and clutch sizes of unhatched eggs resulted in the rebounding of very poor estimated hatching success (HS) of 63% seen in 2014 to a estimated hatching success of 95% (HS) for the 13 nest box clutches in 2015 (Figure 7). The 2015 approximate average estimated hatching success (HS) is similar to that seen for the Karluk project nest boxes prior to 2014.

Two Karluk nest boxes, KL-4 and KL-13 were successful in hatching out clutches for the first

time in 2015 (Figure 7;Table 2). During 2014, KL-4 contained a single unhatched egg with no down, but in 2015, ten years after installation, the box finally hatched a clutch of 5 goldeneye eggs . KL-13 had been moved in 2013 and also produced for the first time in 2015 hatching out a clutch of 4 goldeneye.

Unfortunately, the other 2 Karluk nest boxes KL-8 and KL-14, that had never been used and were moved to new locations in 2014 (Figure 7,Table 2) continued their non-use tradition in 2015 despite the move.

All the hatched egg membranes were collected and all boxes had shavings added.

Hidden Basin

Lynne and Wayne Murphy provided the following information that was collected from their seven nest boxes positioned within a 230 meter circle adjacent to salt water at their Hidden Basin homestead (Figure 4). They checked their boxes by ladder and photographed the box interiors to determine the extent of goldeneye use. Three of seven boxes contained evidence of eggs or egg fragments resulting in an occupancy rate of 43%. Boxes HB1 and HB3, active in 2014, were again used by nesting goldeneye during 2015. Box HB1 hatched out a brood of 5 which departed the box on 2 July. HB3 contained a minimum of 4 hatched egg membranes and 3 unhatched eggs. Lastly, Box HB7, which had fallen and was not put back up until after nesting season and therefore was not available for use in 2014, appears to have set a new project record in 2015 for the brood hatched latest in the nesting season. The Murphys observed a Barrow's goldeneye hen and her newly hatched brood of 2 just down the beach from box HB7 on 7 August.

Discussion

Project nest box results from the 2015 nesting season had similarity to past years, in that several boxes containing large unhatched clutches like the previous 2 years were again found in 2015. These non-incubated clutches are the primary reason for the Project's reduced hatching success rate in 2014 and 2015. Nest boxes located on both large and small project lakes and boxes on or off the road system (Karluk 2014; Lee & Caroline-2015) contained non-incubated clutches indicating little influence by either parameter. A possible cause for this type of clutch in project nest boxes may be weather related as in both years Kodiak experienced unusually warm dry spring conditions. If or how these early season weather conditions influence the number of non-incubated clutches or unhatched eggs can only be speculated. Unlike 2014, no Karluk Lake nest boxes contained non-incubated clutches in 2015. The unhatched eggs in the 3 boxes with hatched out clutches in 2015 contained embryos when broken open (Figure 7;Table 2). In contrast, none of the 22 unhatched eggs from the 2015 non-incubated clutches in Lee and Caroline nest boxes had embryos. Two of the 3 unhatched eggs from Orbin Lake OL-2 also did not have embryos (Table 1;Figure 5). The hen's decision to incubate a clutch or just add eggs to another hen's clutch could be triggered by spring weather conditions but just as easily could be related to her age or breeding experience. Are all the eggs in these non-incubated clutches from the same hen known to have used the box the previous year or a product of multiple hens “dumping” them in a convenient nest, and is only made more interesting by the size of these clutches? Hopefully, funds will be available in the future to genetically compare feather and egg membrane samples from the LL-1 and CL-1 box hens banded in 2014 and the egg membrane samples collected from the 2015 unhatched clutches to help answer that question.

Similarily, the explanation for why most of Karluk Lake's northeastern nest boxes were again unused during 2015 (Figure 7;Table 2) is unknown. Project box use to date appears reasonably correlated to the early spring presence of a goldeneye pair in the immediate area of a nest box with increasing odds of box use as numbers of goldeneye pairs present in the vicinity of the box increases. Conducting spring goldeneye pair counts to collect data for comparison to historic 2004-2007 Karluk Lake survey data could reveal whether there has be a change in pair distribution or numbers on Karluk Lake. These data could also help evaluate what the addition of Project nest boxes has had on Karluk Lake's Barrow's goldeneye breeding population numbers.

Project road system nest boxes on smaller lakes (<20 acres) getting Barrow's goldeneye use during the second year after installation continued in 2015. The new small lake nest box installed on Aurel Lake in 2014 was used for the first time this year. However, Buskin Lake box BL-9, as the first road system large lake Project nest box to be used by a goldeneye hen, will hopefully mark the start of use of other large lake nest boxes. New box installations on small road system lakes would seem to indicate box BL-9's use had little to do with the author's decoy experiment (described in 2014 progress report) and more to do with just being in a new location for 2 breeding seasons. BL-9 will hopefully see continued use in 2016 along with other 2015 large lake moved box installations on Buskin Lake and Kalsin Pond. If the pattern seen during the second breeding season for box installations on smaller lakes continues those hopes may be realized.

Squirrel use of installed project nest boxes on all the 3 large road system lakes has been problematic since the Project was initiated (Table 1). Nest box occupation by red squirrels has undoubtedly been a factor in the small vs large road system lake nest box use differences particularly at Lake Rose Tead and Kalsin Pond box locations. Whether moving locations of boxes BL-3 and KP-1 will promote goldeneye use or just provide a different batch of red squirrels new dens remains to be seen. To date, it appears squirrels will continue to use a box if left in the same location and that use precludes any goldeneye hens from using the nest box. Given the density of red squirrel populations on these 3 larger lakes, additional nest boxes will likely also have to be moved to combat further red squirrel nest box infestations.

The numbers of Project banded Barrow's goldeneye continued to increase with the capture/banding of the first goldeneye hen to use Aurel Lake box AL-1 in 2015. While small, this increasing sample of banded hens can only serve our capability to gain knowledge about Kodiak's resident female Barrow's goldeneye nesting population annual survival data and reproductive capabilities. This effort is planned to continue in 2016.

Acknowledgment

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Table 1. Installation dates and goldeneye use of project road system nest boxes 2010-2015.

Nest Box	Install Date	Lake	2010	2011	2012	2013	2014	2015
AL-1	04/01/2014	Aurel	-	-	-	-	NU	C6-H6
CL-1	04/04/2013	Caroline	na	na	na	P	C7-H7	C14-H0
LL-1	06/19/2011	Lee	na	na	C5-H5	C7-H5	C4-H4	C8-H0
OL-1	02/25/2010	Orbin	NU	NU	C14-H12	C15-H13	C12-H0	NU
OL-2	03/01/2011	Orbin	na	C8-H5	C7-H6	C13-H12	C10-H8	C8-H5
NL-1	04/27/2015	Nyman	na	na	na	na	na	NU
BL-1	07/13/2010	Buskin	na	NU	NU	NU	NU	NU
BL-2	07/13/2010	Buskin	na	P	NU	NU	NU	NU
BL-3	07/13/2010	Buskin	na	SU	NU	NU	NU	NU
BL-4	07/13/2010	Buskin	na	P	NU	NU	NU	NU
BL-5	07/13/2010	Buskin	na	P	NU	NU	NU	NU
BL-6	07/13/2010	Buskin	na	P	NU	NU	NU	NU
BL-7	07/13/2010	Buskin	na	P	NU	NU	NU	NU
BL-8	07/13/2010	Buskin	na	P	NU	NU	NU	NU
BL-9	02/05/2014	Buskin	-	-	-	-	NU	C5-H4
KP-1	05/10/2010	Kalsin	NU	SU	SU	SU	SU	NU
KP-2	05/10/2010	Kalsin	NU	P	NU	NU	NU	NU
KP-3	05/10/2010	Kalsin	NU	SU	NU	NU	*C7-H7*	NU
RT-1	04/29/2010	Rose Tead	NU	P	SU	SU	SU	SU
RT-2	04/29/2010	Rose Tead	NU	P	NU	NU	NU	SU
RT-3	04/29/2010	Rose Tead	NU	NU	NU	NU	NU	SU
RT-4	04/29/2010	Rose Tead	NU	SU	SU	SU	SU	NU
RT-5	04/29/2010	Rose Tead	NU	SU	SU	SU	SU	P
RT-7	05/04/2010	Rose Tead	NU	SU	SU	SU	SU	R
RT-8	05/04/2010	Rose Tead	NU	SU	SU	SU	SU	SU
RT-9	05/04/2010	Rose Tead	NU	SU	SU	SU	SU	SU
RT-10	05/04/2010	Rose Tead	NU	SU	SU	SU	SU	NU

na = not installed yet
C# = estimated clutch size
H# = estimated number of eggs hatched
NU = not used
P = nest cup formed in box but no down
SU = box used by red squirrel
Italics = use by common merganser
R = box removed

Table 2. Installation dates, goldeneye use history of Karluk Lake project nest boxes 2010-15, plus Karluk's 2015 box estimated total number of eggs, unhatched eggs, estimated number of eggs per box clutch, percentage of box use, and estimated hatching success.

Nest Box	Install date	2010	2011	2012	2013	2014	2015
KL-1	06/19/05	NU	NU	3	4	NU	NU
KL-2	06/19/05	NU	NU	5	6	NU	2
KL-3	06/19/05	NU	NU	4	6	NU	NU
KL-4	06/19/05	NU	NU	NU	NU	1*	5
KL-5	06/26/05	U	NU	5	6	NU	NU
KL-6	07/11/10	na	NU	7	2	2*	10-1*
KL-7	06/26/05	NU	9	NU	8	7-2*	7
KL-8	08/06/14	NU	NU	NU	NU	M	NU
KL-9	06/11/06	U	NU	8	10	10-1*	9
KL-10	07/08/10	na	6	12	12	9-1*	9
KL-11	07/11/10	na	2	NU	3	5-4*	8
KL-12	07/11/10	na	7	NU	8	18*	NU
KL-13	07/12/12	na	NU	M	NU	NU	4
KL-14	08/06/14	na	NU	NU	NU	M	NU
KL-15	07/11/10	na	NU	NU	13	6	6
KL-16	07/09/10	na	5	2	5	3	3
KL-17	07/09/10	na	NU	2	NU	6	6
KL-18	07/09/10	na	NU	NU	P	NU	8-2*
KL-19	07/09/10	na	NU	7	3	NU	5-1*
KL-20	07/10/10	na	4	NU	NU	NU	NU
KL-21	07/10/10	na	8	5	NU	4	NU

	2015
Total Eggs	82
Unhatched	4
Eggs/Clutch	6.3
Hatch Succ.	95%
Box Use	62%

* # Unhatched eggs

na = not installed yet
U – used in 2010 no clutch data
NU = not used
# = estimated clutch size
M – moved due to lack of use

Figure 1. Location of the Kodiak Island Archipelago.

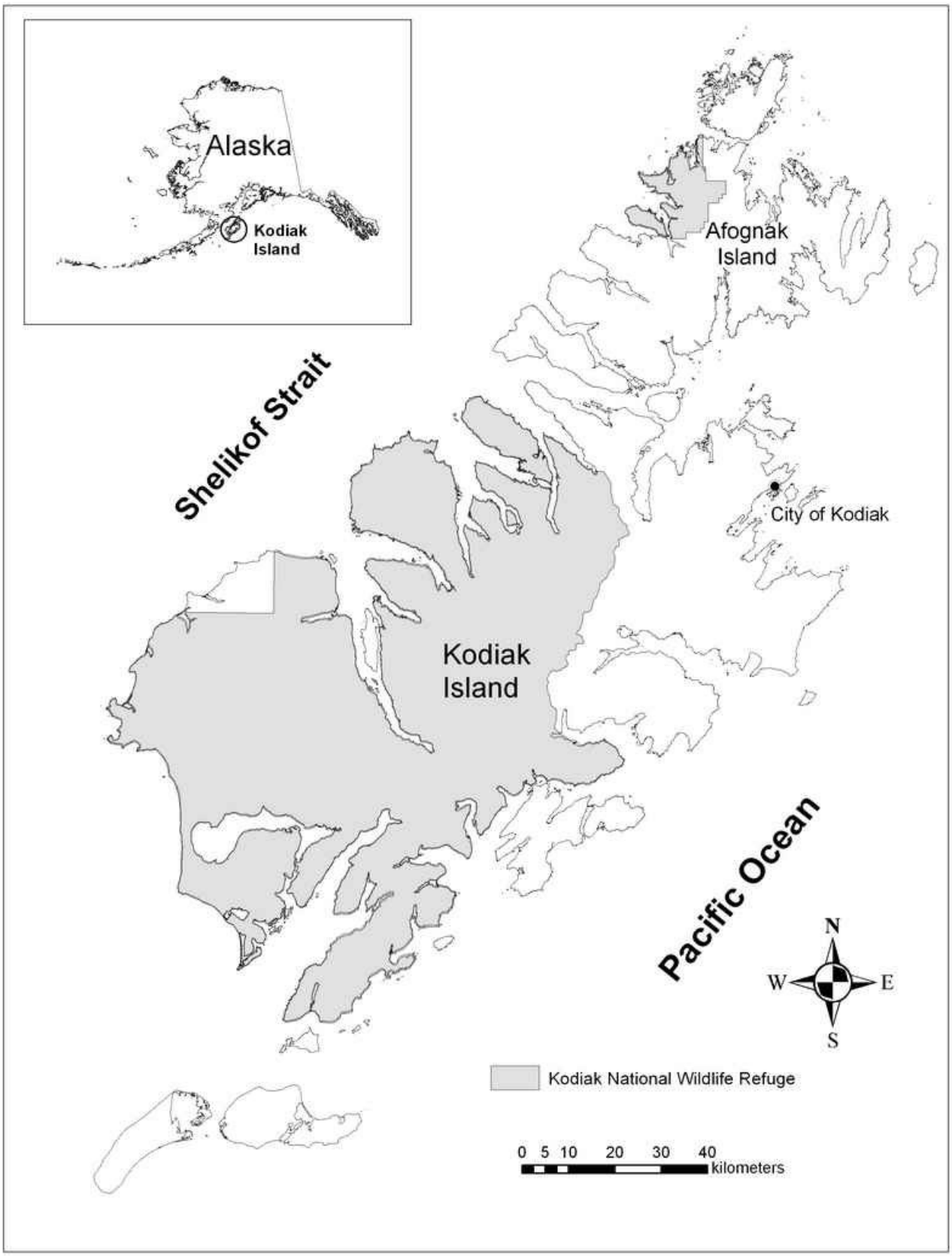

Figure 2. Kodiak Island Goldeneye Project 2015 nest box lake locations.

Figure 3. Landing net attached to the adjustable pole used to capture nest box hens.

Figure 4. Examples of a >60% Barrow's goldeneye egg membrane remnant's size. Each remnant of this size is counted as a single hatched egg.

Figure 5. Buskin, Nyman, Orbin, Lee, Caroline, and Aurel Lakes 2015 nest box locations with alpha code nest box names for each of the northern road system project lakes.

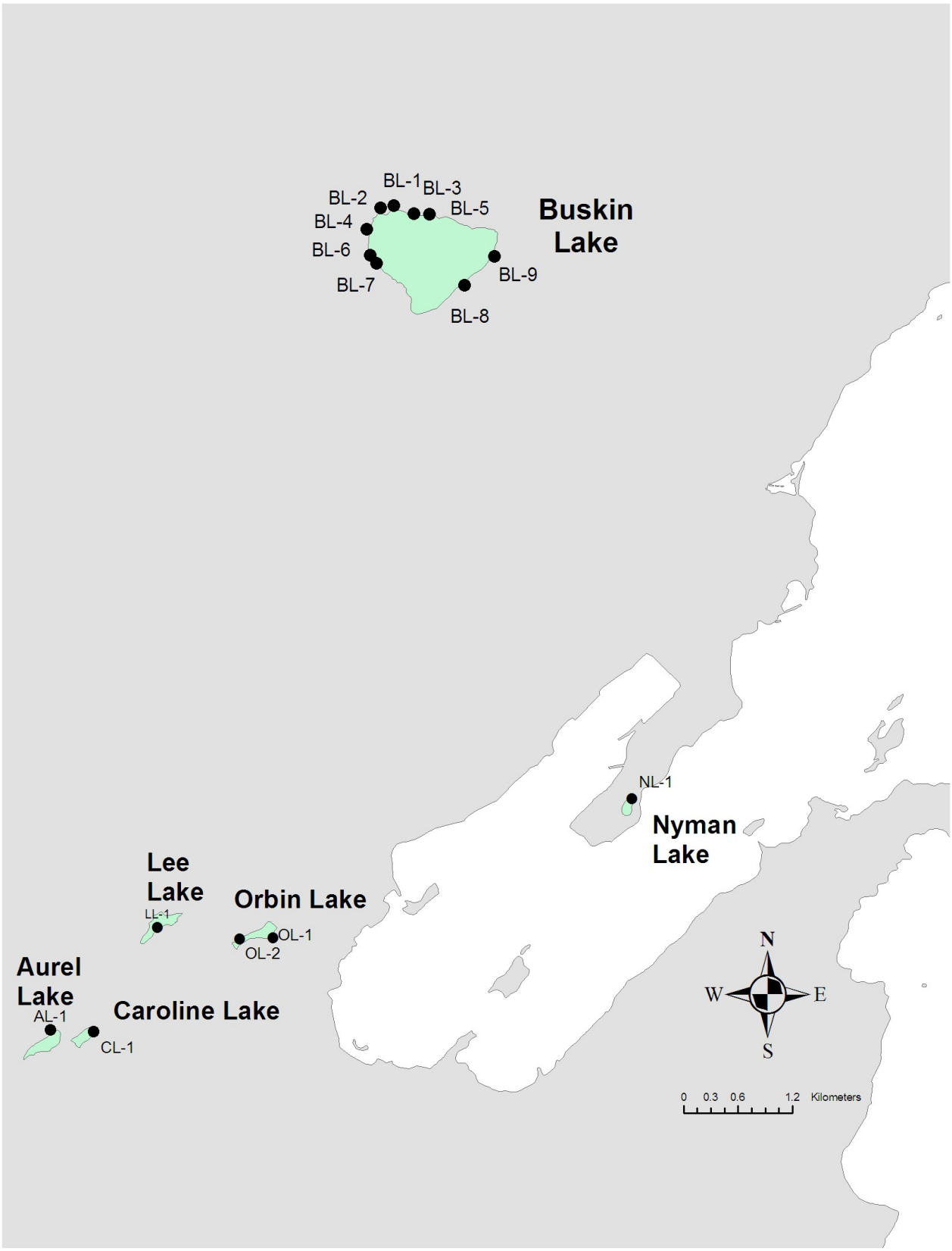

Figure 6. Kalsin Pond and Lake Rose Tead 2015 nest box locations with alpha code nest box names for each project lake on southern Kodiak road system.

Figure 7. Map of Karluk Lake goldeneye nest box locations with individual box labels and 2015 box status.