# AERIAL SURVEY OF EMPEROR GEESE AND OTHER WATERBIRDS IN SOUTHWESTERN ALASKA, SPRING 2007

By

Christian P. Dau[1]
and
Edward J. Mallek[2]

Key Words: aerial survey, emperor geese, waterbirds, southwest Alaska.

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[1]U. S. Fish and Wildlife Service
Migratory Bird Management
1011 E. Tudor Road
Anchorage, Alaska 99503

[2]U. S. Fish and Wildlife Service
Migratory Bird Management
1412 Airport Way
Fairbanks, Alaska 99701

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Christian P. Dau, U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Road, Anchorage, AK, 99503

Edward J. Mallek, U.S. Fish and Wildlife Service, Migratory Bird Management, 1412 Airport Way, Fairbanks, AK, 99701

Abstract: The 27th consecutive spring aerial emperor goose survey was conducted from 24-29 April. Adverse weather precluded surveying segments 64-82 and 125-137 so we expanded our count by using the previous 3-year average for segments not flown in 2007. A total of 77,541 emperor geese were estimated (up 1.9% from 2006 and up 21.8% from the 1981-2006 year average) in coastline and estuarine habitats from Jacksmith Bay to central Izembek Lagoon, including all the north side of the Alaska Peninsula and the south side east to Kuiukta Bay. The 3-year average of consecutive spring surveys is now 69,205 birds (up 17.0% from the previous 3-yr average of 59,142). Other species of emphasis included Pacific brant and Steller's eider with observed populations of 47,572 and 14,439, respectively.

Key words: aerial survey, emperor geese, waterbirds, southwest Alaska October 2007

## INTRODUCTION

This survey has annually monitored spring distribution, abundance and population trends of emperor geese and other waterbirds at migratory staging areas throughout southwestern Alaska since 1981. The traditional survey route included coastline and estuarine habitats from the Yukon-Kuskokwim Delta (Y-K Delta) south and west along the north side of the Alaska Peninsula to Unimak Island, and the south side of the Alaska Peninsula east to Wide Bay. Coverage along the south side of the Alaska Peninsula emphasizes known emperor goose staging and use areas and omits areas of marginal habitat where birds have not been seen during previous surveys. A 3-year moving average of these population data, collected in accordance with the Pacific Flyway Emperor Goose Management Plan, is used as the index to established harvest thresholds. The data also assess annual and long-term variation in seasonal migratory phenology and determine trends in distribution and habitat use for emperor geese.

## METHODS

The survey was flown from 24-29 April. Surveys during recent years have been adjusted earlier in response to climatic conditions, including timing of sea ice break-up, within the survey area. Studies of the migration of emperor geese implanted with satellite transmitters also suggested our earlier survey starts are appropriate.

The survey area (Figures 1 and 2) includes a maximum of 143 shoreline/estuarine segments identified on 1:500,000 scale aeronautical and 1:63,360 scale topographical

maps and was previously described by Mallek and Dau (2000). General observations of habitat and survey conditions including wind speed and direction, temperature, sky condition, visibility and tide stage were recorded en route.

An amphibious Cessna 206 (N234JB) flown at a ground speed of approximately 200 km/hr (110 kts) and an altitude of 45m (150 feet) ASL was used. The planned route of flight was Jacksmith Bay, in the southern portion of Kuskokwim Bay south to Bechevin Bay on Unimak Island along the north side of the Alaska Peninsula, and then eastward along the south side of the Alaska Peninsula to Wide Bay. The coastal flight path was approximately 100 meters offshore with deviations, normally within 1.6 km (1 mile) of exposed shorelines, to confirm species identification and estimate numbers. In estuaries, a systematic but meandering flight path was followed to ensure complete coverage. Whenever possible, flights were conducted with <20 knots of wind and primary staging areas were flown at or near high tide as this concentrated geese near shorelines. Observations were made from both sides of the aircraft and voice recorded into two laptop computers using remote microphones. Computers received input from the aircraft Global Positioning System (GPS) saving coordinates for each observation. Specialized record and transcribe programs were used to process these data (J. Hodges, MBM-Juneau).

SURVEY CONDITIONS

Climatic conditions this spring were comparable to 2006 and continue to support our observed trend towards earlier, mild springs. Emperor geese were congregated in Alaska Peninsula estuaries as in previous years. Offshore sea ice in 2007 was absent throughout the survey area however, estuaries north of Cape Newenham had considerable ice cover and floating and grounded ice was common at river mouths. Estuaries along the north side of the Alaska Peninsula were ice free. Adverse weather west of central Izembek Lagoon (segments 63-82) and east from Chignik Lagoon (segments 125-137) prevented us from surveying those areas.

April 24: Kuskokwim Bay to King Salmon (segments 14-33). Survey conditions were favorable with east-southeasterly winds of 10 kts, 2500 foot overcast ceilings and temperatures increasing from 27-37°F. There was no snow in lowland habitats south to Nanvak Bay and then 10% snow cover east to Tongue Point. Ice conditions were: freshwater ponds were frozen, Jacksmith Bay was ice free, Carter, Goodnews, Chagvan and Nanvak bays had 20%, 20%, 70% and 60% ice cover, respectively. Small areas of shore fast sea ice were present from Cape Pierce to Tongue Point. With the exception of the Kvichak River mouth, which had considerable floating and grounded ice, the remainder of Bristol Bay was ice free.

April 25: King Salmon to Cold Bay (segments 33-48, 86-118). Survey conditions were favorable from King Salmon to Cape Seniavin where ceilings deteriorated. We rerouted to Chignik Lake and had favorable survey conditions along the south side of the Alaska Peninsula to Cold Bay. Along the north side of the peninsula, winds were northeast at 10 knots, ceilings were 800 foot overcast to 1,000 foot scattered and temperature was 36°F.

Along the south side of the peninsula, winds were southeast at 5 knots, skies were 2,000 foot overcast and temperature was 37°F. There was no snow cover in lowlands. Larger freshwater ponds along the north side of the peninsula were frozen while most ponds were open along the south side of the peninsula. All estuaries were ice free and associated river mouths had abundant floating and grounded ice.

April 28: Izembek Lagoon/Cold Bay to Cape Seniavin (segments 49-63, 83-85). Survey conditions were fair from the northern portion of Cold Bay and the central Izembek Lagoon area north to Cape Seniavin. Low ceilings and poor visibility prevented surveying areas to the southwest (i.e. segments 64-82) and turbulence prevented surveying along the south side of the Alaska Peninsula from Chignik Lagoon east. Winds near Cold Bay were south southeast at 15 knots, ceilings were 1,000 feet overcast and temperature was 40°F. North to Cape Seniavin, winds were southeast at 15 knots and the skies were scattered to overcast with a ceiling of 2000 ft. There was no onshore snow cover. Tides were mid to high at Izembek Lagoon and in the Nelson Lagoon complex.

April 29: King Salmon to Wide Bay. Adverse weather prevented this attempt to access southern Alaska Peninsula segments from Chignik Lagoon to Wide Bay. Winds of $\geq$ 30 knots, low ceilings and precipitation were encountered.

RESULTS/DISCUSSION

No sea ice was present within the survey area with the exception of a few small areas along the north shore of Bristol Bay and in bays north of Cape Newenham. Coastal snow cover was very light along the north shore of Bristol Bay and absent elsewhere (Table 1). Migratory phenology of emperor geese appeared normal and we found no reports of emperor geese north of Cape Newenham prior to the survey (K. Bollinger, pers. comm.). Observations from Unalaska, in the eastern Aleutian Islands, suggested most migrants departed by 15 March, with the last sighting in early April (D. Magone, S. Golodoff, pers. comm.). Hence, most birds were believed to be in our survey area. Emperor goose and other waterbird numbers are summarized by segment in Table 2.

Emperor Goose

The 2007 emperor goose estimate of 77,541 was 1.9% above the 2006 estimate of 76,108 (Table 3) and 21.8% above the long-term average of 63,647 (1981-2006; 95% CI = 6,018). The observed count of 75,464 birds in 2007 was expanded by adding the 2004-2006 average counts for missed segments 64-82 (74 birds) and segments 125-137 (2,003 birds) to arrive at the estimate of 77,541. The current 3-year average management index of 69,205 birds increased 17.0% from the previous average of 59,142 (2004-2006, Table 3). Emperor goose migratory phenology appeared comparable to recent years. Chagvan Bay, north of Cape Newenham, had 389 birds versus 180 seen in 2006 and the long-term average of 942 birds. No emperor geese were seen in northern Bristol Bay (Cape Newenham to Kvichak River). Most were observed in estuaries along the northside of the Alaska Peninsula (96.1% of total birds in 2007; long-term average 91.4%, Table 4).

Ten-year and 27-year growth rates for emperor geese are non significant and are illustrated in Figure 3.

Pacific brant

We observed a total of 47,572 brant during the survey (Table 2), 32,512 (68.3%) of which were in Izembek Lagoon and adjacent areas. Chagvan Bay had 10,965 brant versus 1,509 in 2006 and the long-term average of 9,967. Nanvak Bay, which had 2,611 brant, was not surveyed due to fog in 2006 but supports a long-term average of 3,888. Adverse weather this year precluded surveying most preferred brant use areas along the southside of the Alaska Peninsula.

Steller's Eider

We observed 14,439 Steller's eiders (Table 2), 52.5% below the 2006 count of 30,395 and 63.2% below the long-term average of 39,186 for the current survey area beginning south of Kuskokwim Bay. Most Steller's eiders (10,947 birds, 75.8% of the total) were observed from Port Heiden to Izembek Lagoon. No Steller's eiders were observed in accessible areas along the southside of the Alaska Peninsula.

Equal sex ratio of adult plumaged birds recorded by the right seat observer (88.5% of 61 flocks observed), suggested paired birds predominated. Only one flock of predominately brown plumaged Steller's eiders, either unpaired females and/or subadults, was observed in 2007.

CONCLUSIONS

The spring 2007 emperor goose population estimate of 77,541 is 21.8% above the long-term survey average of 63,647 (1981-2006). The current 3-year average population of 69,205 (2005-2007) is 17.0% above the previous 3-year average of 59,142 (2004-06) and 11.3% above and the long-term average of 3-year indices (62,155; 1983-2006). The Pacific Flyway Emperor Goose Management Plan establishes a management threshold of 80,000 geese in spring for consideration of legalized harvest. The current 3-year average is 13.5% below this threshold.

Growth of the emperor goose population is adversely affected by continuing illegal harvest (Wolfe and Paige 2002; C. Wentworth pers. comm.), low annual productivity through 2005 and low juvenile survival (Schmutz et al. 1997). Harvest is likely under estimated since data are not collected from all use areas in Alaska and Chukotka. Legalized subsistence harvest beginning in 2003 does not allow take of emperor geese, however, illegal harvest of unknown magnitude continues. Hence, there is concern that the cumulative impacts of harvest and natural mortality continue to approach or exceed recruitment into the breeding population. These concerns point out the immediate need for 1) a comprehensive statewide assessment of current take, 2) increased efforts to reduce take and 3) continued monitoring of survival rates.

A bright spot is the record high productivity documented in 2006 (35.2% juveniles or an estimated 28,499 juveniles in fall 2006, Dau et al. 2006) which followed 10 consecutive years of below average productivity. From 1996-2005 the average was 10,258 juveniles in the fall (i.e. 13.8% juveniles). It would be beneficial to initiate management procedures, such as reducing adult harvest and control of predator numbers, that would help facilitate continued high productivity rates.

Recovery of the emperor goose population continues to be hampered by a combination of mortality factors which approach or exceed recruitment of breeding age geese into the population. Primary factors limiting recovery of the population and realistic management options to control and monitor these factors are:

1) Illegal hunting year-round but primarily in spring, summer and fall. Comprehensive harvest surveys are needed in Alaska and Russia to assess harvest. Options to eliminate or greatly reduce harvest should be initiated.

2) Predation during nesting and brood rearing as indicated by low productivity in recent years and chronic low survival of juveniles from pre-fledging through winter (Schmutz et al. 1997). Predator management on the Y-K Delta should be initiated and evaluated as a means to increase recruitment of breeding birds into the population (Bowman et al.1997). Monitoring of age and season specific survival rates should be continued.

3) Wintering ecology of emperor geese is poorly understood. Mortality of juveniles is high and management options to reduce it are limited. However, it is important to investigate and determine the severity of factors such as climate, predation, hunting, and pollution/contaminants so that appropriate beneficial actions can be undertaken.

4) Annual monitoring of spring and fall population sizes and trends as well as distribution, habitat use and productivity are of continuing management importance.

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Figure 1. Map of emperor goose aerial survey segments 1-36 in southwest Alaska, 1992-2007.

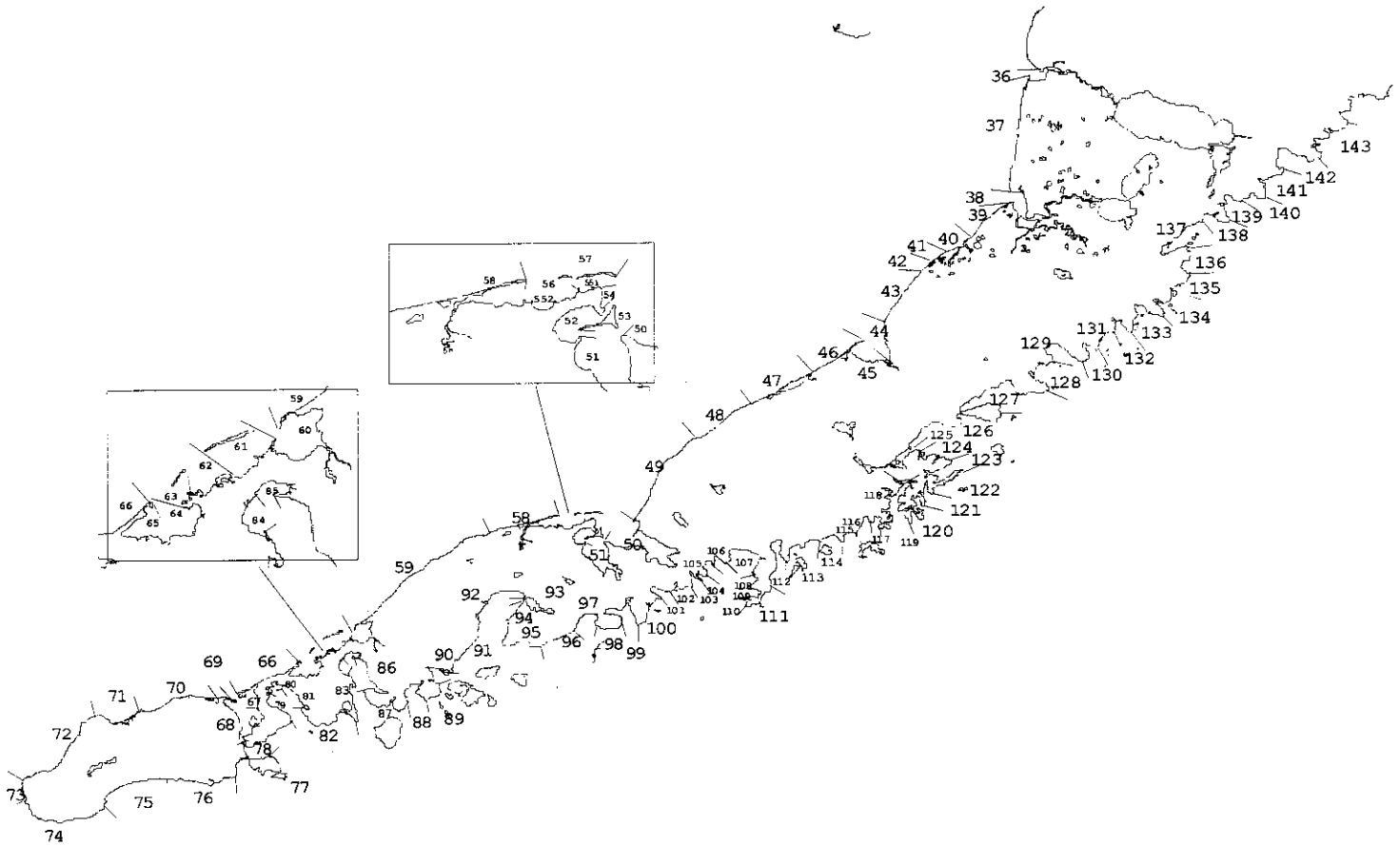

Figure 2. Map of emperor goose aerial survey segments 36-143 in southwest Alaska, 1992-2007.

Table 1. Snow and ice conditions during the spring emperor goose survey in southwest Alaska, 24-29 April, 2007.

| AREA | SNOW COVER[1] | MARINE ICE COVER[2] |
|---|---|---|
| Kokechik Bay | - | - |
| Hooper Bay | - | - |
| Hazen Bay | - | - |
| Carter Bay | 0 | 20 |
| Goodnews Bay | 0 | 20 |
| Chagvan Bay | 0 | 70 |
| Nanvak Bay | 10 | 60 |
| **Relative Phenology[3]** | **Early** | **Early** |

[1] Percent snow cover on near-shore freshwater marshes.
[2] Percent of marine ice cover in estuary.
[3] Subjective habitat conditions (early, average, late).

Table 2. Waterbird and mammal observations by segment, southwest Alaska, 24-29 April 2007.

| SPECIES | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 32 | 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amer. Green-winged Teal | | | | | | | | | | | | | | | | | | |
| Arctic Tern | | | | | | | | | | | | | | | | | | |
| Bald Eagle(ad) | | | | 1 | | | | | | 1 | | | 2 | | | | | |
| Bald Eagle(juv) | | | | | | | | | | | | | | | | | | |
| Beluga Whale | | | | | | | | | | | | | | | | | | |
| Pacific Brant | | | | | | | 10965 | 2611 | | | | | | | | | | |
| Black-legged Kittiwake | | | | | | | | | 3 | | 65 | | | | | | | |
| Black Scoter | | | 5 | | | 6 | | 8 | 10 | 1 | 8 | 3 | 3 | | 137 | 43 | 229 | |
| Bufflehead | | | | | | | | | | | | | | | | | | |
| Canada Goose | | | 8 | | | | | | | | | | | | | | | |
| Common Eider | | | | | | | | | | | | | | | 21 | | | |
| Common Loon | | | 1 | | | | | | | | | | | | | | | |
| Common Merganser | | | | | | | | | | | | | | | | | | |
| Common Murre | | | | | | | | | | | 3 | | | | | | | |
| Common Raven | | | | 1 | | | | | | | | | | | | | | |
| Double-crested Cormorant | | | | | | | | | | | | 2 | | | | | | |
| Emperor Goose | | | | | | | 389 | 2 | | | | | | | | | | |
| Gadwall | | | | | | | | | | | | | | | | | | |
| Brown Bear | | | | | | | | | 2 | | | | | | | | | |
| Greater Scaup | | | | 7 | 315 | | 20 | | | 2 | | 25 | | | | 155 | 142 | |
| Gray Whale | | | | | | | | | | | | | | | | | | |
| Harlequin Duck | | | | | | | | | 5 | 2 | | | 21 | 4 | | | | |
| Harbor Seal | | | | | 1 | | | | | | | | | | | | | |
| King Eider | | | 18 | | | | | | | 1 | | | | | | | | |
| Large Gull | | 12 | 17 | 7 | 32 | 8 | 418 | | 21 | 53 | 487 | 2526 | 88 | 119 | 126 | 5 | 412 | 8 |
| Long-tailed Duck | | | 8 | 1 | | 15 | | 135 | | 2 | 159 | 50 | | 23 | 302 | 1 | 4 | |
| Northern Harrier | | | | | | | | | | | | | | 1 | | | | |
| Mallard | | | | | | | | | | | | | | | | | | |
| Mew Gull | 12 | 43 | | 51 | 6 | 19 | | 123 | 18 | 20 | 162 | 743 | 84 | 379 | 195 | 18 | 76 | 116 |
| Moose | | | | | | | | | | | | | | | | | | |
| Northern Pintail | | 2 | | | | | | | | | 45 | | | | 2 | | 27 | |
| Northern Shoveler | | | | | | | | | | | | | | | | | | |
| Parasitic Jaeger | | | | | | | | | | | | | | | | | | |
| Pacific Loon | | | | | | | | | 2 | | | | | | 1 | | | |
| Pelagic Cormorant | | | | | 18 | 2 | 2 | 21 | 1 | 35 | 204 | 48 | 179 | 2 | | | | |
| Pigeon Guillemot | | | | 2 | 6 | | | | | | | | | | | | | |
| Porpoise | | | | | | | | | | | | | | | | | | |
| Red-breasted Merganser | 5 | 4 | 2 | | 17 | | 10 | 25 | | 171 | 148 | 40 | 14 | | 56 | 2 | 3 | 3 |
| Red Fox | | | | | | | | | | | | | | | | | | |
| Red-necked Grebe | | | | 1 | | 5 | | | | | | | | | 48 | | | |
| Red-throated Loon | | 12 | 6 | 5 | 5 | 2 | | | 8 | 7 | 6 | | | 1 | 197 | 3 | 1 | |
| Sabine's Gull | | | | | | | | | | | | | | | | | | |
| Sea Otter | | | | | | | | | | | | | | | | | | |
| Small Shorebird | | 190 | | | | | | | | | 25 | | | | | | | |
| Steller's Eider | | 85 | 57 | 14 | 923 | 5 | 1750 | 240 | | 2 | | 108 | | | 2 | | | |
| Steller's Sealion | | | | | | | | | | | | | | | | | | |
| Surf Scoter | | | | | | | | | | | | | | | | | | |
| Tundra Swan | | | | | | | | | | | | | | | | | | |
| White-fronted Goose | | | | | | 8 | | | | | | | | | | | 2 | |
| White-winged Scoter | | | | | | 6 | | | | 10 | | | | | 1 | | | |

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 24-29 April 2007.

| SPECIES | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amer. Green-winged Teal | | | | | | | 400 | | | | | | | | | |
| Arctic Tern | | | | | 50 | | | | | | | | | | | |
| Bald Eagle(ad) | 4 | | | | 1 | | | | | | | 4 | | 2 | | |
| Bald Eagle(juv) | | | | | | | | | | | | | | | | |
| Beluga Whale | 1 | 10 | | | | | | | | | | | | | | |
| Pacific Brant | | | | | | | | | | 5 | | | | | | |
| Black-legged Kittiwake | | | | | | | | | | | | | | | | 500 |
| Black Scoter | | 150 | 36 | 98 | 36 | 558 | 15 | | 50 | 450 | 311 | | 215 | 20 | 282 | 1722 |
| Bufflehead | | | | | | | | | | | | | | | | |
| Canada Goose | | | | | | | | | | | | | | | | |
| Common Eider | | | | | | | | | | | | | 100 | | | |
| Common Loon | | | | | | | 2 | | | | | | | | | |
| Common Merganser | 24 | | 4 | | | | | | | | | | | | | |
| Common Murre | | | | | | | | | | | | | | | 1 | |
| Common Raven | | | | | | | | | 1 | | 1 | | | | | |
| Double-crested Cormorant | | | | | | | | | | | | | | | | |
| Emperor Goose | | | 668 | 18 | 2942 | | 5229 | | | | 5030 | 14197 | 120 | 9139 | | |
| Gadwall | | | | | | | | | | | | | | | | |
| Brown Bear | | | | | | | | | | | | | | | | |
| Greater Scaup | | 45 | | 26 | 67 | | 115 | | | 2 | 4 | 5 | | | | |
| Gray Whale | | | | 3 | | 1 | | | | 2 | | | 3 | 1 | 2 | 4 |
| Harlequin Duck | | | | | | | | | | | | | | | | 57 |
| Harbor Seal | | 2 | | 1 | | | 215 | 1 | | | 1 | 1252 | | 60 | 2 | 1 |
| King Eider | | | | 5 | | 42 | | | | 20 | | | | | | |
| Large Gull | 324 | 121 | 186 | 56 | 527 | 12 | 534 | 3 | 42 | 43 | 32 | 787 | 54 | 2241 | 418 | 416 |
| Long-tailed Duck | | 49 | 2 | 15 | | 41 | 43 | | | 83 | 337 | | 75 | 183 | 680 | 479 |
| Northern Harrier | | | | | | | | | | | | | | | | |
| Mallard | | | | | | | 2 | | | | | | | | | |
| Mew Gull | 59 | 282 | 327 | 78 | 232 | 221 | 86 | 7 | 205 | 11 | 191 | 409 | 7 | 805 | 780 | |
| Moose | | | | | | | | | | | | | | | | |
| Northern Pintail | 4 | | 20 | 9 | 50 | | 22 | | 95 | | 100 | 177 | | | | |
| Northern Shoveler | | | | | | | | | | | | | | | | |
| Parasitic Jaeger | | | | | 1 | | | | | | | | | | | |
| Pacific Loon | | 2 | | | | 1 | | | | | | | | | | |
| Pelagic Cormorant | | | 3 | 1 | 2 | | | | | | | | | | 52 | 3 |
| Pigeon Guillemot | | | | | | | | | | | | | | | | |
| Porpoise | | | | | | | | | | | | | | | | |
| Red-breasted Merganser | 7 | 13 | 12 | 4 | 25 | 27 | | | | 7 | | | | | | |
| Red Fox | | | | | | | | | | | | | | | | |
| Red-necked Grebe | | | | | | | | | | 5 | | | 1 | | | 5 |
| Red-throated Loon | | 26 | 1 | 13 | | 12 | 4 | | | | | | | | 2 | 1 |
| Sabine's Gull | | | | | | | | | | | 2 | 20 | | 50 | | |
| Sea Otter | | | | 1 | | | | | | | | 136 | | | | |
| Small Shorebird | | | 130 | 10 | 750 | | 1050 | | 5 | | 40 | 480 | | 2000 | | |
| Steller's Eider | | 6 | | | | 80 | 220 | | | | 20 | 405 | 1100 | 4204 | 305 | 70 |
| Steller's Sealion | | | | | | | | | | | | | | | | |
| Surf Scoter | | | | | | | | | | 7 | | | | | | |
| Tundra Swan | 71 | | 2 | | | | 3 | | | | | | | | | |
| White-fronted Goose | 55 | 1 | | | | | | | | | | | | | | |
| White-winged Scoter | | | | 2 | | 1 | | | | | 1 | | | | 1 | 20 |

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 24-29 April 2007.

| SPECIES | 50 | 51 | 52 | 53 | 54 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 83 | 84 | 85 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amer. Green-winged Teal | | | | | | | | | | | | | | | | |
| Arctic Tern | | | | | | | | | | | | | | | | |
| Bald Eagle(ad) | 7 | | 2 | 2 | 1 | 2 | 12 | 3 | 1 | 2 | 3 | 1 | 4 | | | |
| Bald Eagle(juv) | 11 | | | | | | 2 | | | | | | | | | |
| Beluga Whale | | | | | | | | | | | | | | | | |
| Pacific Brant | | | 2 | | | 20 | | 9 | | 1385 | 9885 | 5 | 20877 | 10 | | 350 |
| Black-legged Kittiwake | | | | | | | | | | | | | | | | |
| Black Scoter | | 489 | 29 | 99 | 103 | 366 | | 1012 | 437 | | | | 6 | 3 | | 60 |
| Bufflehead | | | | | | | | | | | | | | | | |
| Canada Goose | | | | | | | | | | | | | | | | |
| Common Eider | | | | | | 78 | 5 | | | | | | | | | |
| Common Loon | | | | | | | | | | | | | | | | |
| Common Merganser | | | | | | | | | | | | | | | | |
| Common Murre | | | | | | | | | | | | | | | | |
| Common Raven | | | 1 | | | | | | | | | | | 1 | | |
| Double-crested Cormorant | | | | | | | | | | | | | | | | |
| Emperor Goose | 9244 | 10 | 1669 | | 440 | 4212 | 95 | | | 8423 | 639 | 52 | 509 | 195 | | 375 |
| Gadwall | | | | | | | | | | | | | | | | |
| Brown Bear | | | | | 1 | | | | | | | | | | | |
| Greater Scaup | | | 420 | | | | | | | | | | | | | |
| Gray Whale | | | | | | | | 2 | | | | | | | | |
| Harlequin Duck | | | | | | | | | 5 | | | | | 13 | 5 | |
| Harbor Seal | 750 | | | | | | | | 2 | | | 30 | | | | |
| King Eider | | | | | | | | | | | | | | | | |
| Large Gull | 3755 | 448 | 311 | 51 | 1360 | 2260 | 5797 | 1740 | 871 | 128 | 5575 | 1370 | 1017 | 98 | 16 | 355 |
| Long-tailed Duck | | | | | | | | 80 | | | | | | | | |
| Northern Harrier | | | | | | | | | | | | | | | | |
| Mallard | | | | | | | | | | | 25 | | | | | |
| Mew Gull | 240 | | 192 | | | | | | | 302 | | | | 50 | | 190 |
| Moose | | | | | | | | | | | | | | | | |
| Northern Pintail | | | 155 | | | | | 1 | | 129 | 50 | | | | | 50 |
| Northern Shoveler | | | 9 | | | | | | | | | | | | | |
| Parasitic Jaeger | | | | | | | | | | | | | | | | |
| Pacific Loon | | | | | | | | 7 | | | | | | | | |
| Pelagic Cormorant | | | | | | | | | | | | | | | | |
| Pigeon Guillemot | | | | | | | | | | | | | | | | |
| Porpoise | | | | | | | | | | | | | | | | |
| Red-breasted Merganser | 12 | 25 | 26 | | 22 | | | | 1 | | 15 | | | | | |
| Red Fox | | | | | | | | 1 | | | | | | | | |
| Red-necked Grebe | 1 | | | | | | | 6 | | | | | | | | |
| Red-throated Loon | | | | | | | | | | | | | | | | |
| Sabine's Gull | | | | | | | | | | | | | | | | |
| Sea Otter | 804 | 8 | 4 | 10 | | 817 | 1 | 1 | 1 | | | 130 | | | 50 | 2 |
| Small Shorebird | | | 270 | | | 50 | 1500 | 460 | | 1500 | | | | | | |
| Steller's Eider | 1050 | | | | | 2788 | | | | | 452 | | 15 | | | 75 |
| Steller's Sealion | | | | | | | | | | | | | | | | |
| Surf Scoter | | | | | | | | | | | | | | | | |
| Tundra Swan | | | | 2 | | | | | | | | | | | | |
| White-fronted Goose | | | | | | | | | | | | | | | | |
| White-winged Scoter | 4 | | | | | | | | | | | | | | | |

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 24-29 April 2007.

| SPECIES | 86 | 88 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 99 | 101 | 102 | 103 | 104 | 105 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amer. Green-winged Teal | | | | | | | | | | | | | | | | |
| Arctic Tern | | | | | | | | | | | | | | | | |
| Bald Eagle(ad) | 3 | | 2 | 3 | 26 | 6 | 8 | 2 | 2 | 1 | 3 | | 1 | | | |
| Bald Eagle(juv) | | | | | 22 | | | 1 | | | 1 | | | | | |
| Beluga Whale | | | | | | | | | | | | | | | | |
| Pacific Brant | | | 1315 | | 128 | | | | | | | | 5 | | | |
| Black-legged Kittiwake | | | | | | | | | | | | | | | | |
| Black Scoter | 16 | | 96 | 8 | 160 | 94 | 251 | 212 | 6 | 15 | 77 | 250 | 124 | 10 | | 41 |
| Bufflehead | | | | | | | | 5 | | | 65 | | | | | |
| Canada Goose | | | | | | | | | | | | | | | | |
| Common Eider | | | | | | | | | | | | | | | | |
| Common Loon | | | 2 | 10 | 1 | 6 | 3 | 5 | 3 | | 9 | | 17 | 1 | | |
| Common Merganser | | | | | | | | | | | | | | | | |
| Common Murre | | | | | | | | | | | | | | | | |
| Common Raven | | | | | | | | | | | | | | | | |
| Double-crested Cormorant | | | | | | | | | | | | | | | | |
| Emperor Goose | | | 294 | 4 | 569 | 179 | | 20 | 152 | 8 | 60 | | 10 | 17 | | |
| Gadwall | | | | | | 1 | | | | | | | | | | |
| Brown Bear | | | | | | | | | | | | | | | | |
| Greater Scaup | | | | | | | | | | | | | | | | |
| Gray Whale | | | | | | | | | | | | | | | | |
| Harlequin Duck | 200 | 5 | 49 | 2 | 20 | 147 | 333 | 20 | 132 | 4 | 117 | 65 | 290 | 41 | 23 | 91 |
| Harbor Seal | | | | | | 75 | | | | | 42 | | 1 | | 10 | |
| King Eider | | | | | | | | | | | | | | | | |
| Large Gull | 14 | 2 | 445 | 14 | 87 | 290 | 408 | 287 | 254 | 2 | 94 | 1 | 128 | 1 | 10 | 12 |
| Long-tailed Duck | | | | | | 12 | | | | | | | | | | |
| Northern Harrier | | | | | | | | | | | | | | | | |
| Mallard | | | | 2 | 2 | | | | | | | | | | | |
| Mew Gull | 1 | 10 | | | 25 | 213 | 45 | 10 | 20 | 6 | 11 | | | | 4 | |
| Moose | | | | | | | | | | | | | | | | |
| Northern Pintail | | | | | | | | | | | | | | | | |
| Northern Shoveler | | | | | | | | | | | | | | | | |
| Parasitic Jaeger | | | | | | | | | | | | | | | | |
| Pacific Loon | | | | | | | | | | | | | | | | |
| Pelagic Cormorant | | | | 4 | 3 | 3 | 20 | 51 | 1 | 1 | 1 | | 25 | 9 | | |
| Pigeon Guillemot | | | | | | | | | | | | | | | | |
| Porpoise | | 2 | | | | 1 | | | | | | | | | | |
| Red-breasted Merganser | 10 | 36 | 273 | 5 | 107 | 388 | 1 | 7 | 13 | | 9 | | | | | |
| Red Fox | | | | | | | | | | | | | | | | |
| Red-necked Grebe | | | 3 | 43 | | 11 | | 9 | 2 | | 2 | 5 | 23 | | | |
| Red-throated Loon | | | | | 1 | | | | | | | | | | | |
| Sabine's Gull | | | | | | | | | | | | | | | | |
| Sea Otter | 12 | | | | 29 | 62 | | | 60 | | | | 1 | | | |
| Small Shorebird | | | | | 750 | 380 | 200 | | | | | | | | | |
| Steller's Eider | | | | | | | | | | | | | | | | |
| Steller's Sealion | | | | 1 | | | | | | | | | | | | |
| Surf Scoter | | | | | | 10 | 17 | | 4 | | | | | | | |
| Tundra Swan | | | | | | | | | | | | | | | | |
| White-fronted Goose | | | | | | | | | | | | | | | | |
| White-winged Scoter | | 9 | | | | 11 | 59 | 40 | | | | 23 | | | | |

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 24-29 April 2007.

| SPECIES | 106 | 107 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 551 | 552 | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amer. Green-winged Teal | | | | | | | | | | | | 400 |
| Arctic Tern | | | | | | | | | | | | 50 |
| Bald Eagle(ad) | 1 | 1 | 2 | | 2 | 1 | | | | | 4 | 123 |
| Bald Eagle(juv) | | 1 | | | | | | | | | | 38 |
| Beluga Whale | | | | | | | | | | | | 11 |
| Pacific Brant | | | | | | | | | | | | 47572 |
| Black-legged Kittiwake | | | | | 15 | | 915 | | | | | 1498 |
| Black Scoter | 8 | 93 | 154 | 61 | 7 | 25 | 10 | 31 | | 104 | | 8853 |
| Bufflehead | | | 50 | | | | | | | | | 120 |
| Canada Goose | | | | | | | | | | | | 8 |
| Common Eider | | | | | | | | | | | 40 | 244 |
| Common Loon | | 4 | | 1 | | | | | | | | 65 |
| Common Merganser | | | | | | | | | | | | 28 |
| Common Murre | | | | | | | | | | | | 4 |
| Common Raven | | | | | | | | | | | | 5 |
| Double-crested Cormorant | | | | | | | | | | | | 2 |
| Emperor Goose | | 5 | 725 | | | | | | | 4241 | 5583 | **77541** [1] |
| Gadwall | | | | | | | | | | | | 1 |
| Brown Bear | | | | | | | | | | | | 3 |
| Greater Scaup | | 2 | | | | | | | | 8 | 2 | 1362 |
| Gray Whale | | | | | | | | | | | | 18 |
| Harlequin Duck | | 4 | 32 | | | | | | | | | 1687 |
| Harbor Seal | | 70 | | | | | | | | | | 2516 |
| King Eider | | | | | | | | | | | | 86 |
| Large Gull | 10 | 103 | 266 | 9 | 95 | 67 | 450 | 1 | 11 | 468 | 6101 | 44942 |
| Long-tailed Duck | | | | | | | | | | | | 2779 |
| Northern Harrier | | | | | | | | | | | | 1 |
| Mallard | | | 10 | | | | | | | 50 | 10 | 101 |
| Mew Gull | | 35 | 115 | 3 | | 20 | 14 | 11 | | 202 | 153 | 7638 |
| Moose | | | 1 | | | | 4 | | | | | 5 |
| Northern Pintail | | | 10 | | | 75 | | | | 144 | 955 | 2122 |
| Northern Shoveler | | | | | | | | | | | | 9 |
| Parasitic Jaeger | | | | | | | | | | | | 1 |
| Pacific Loon | | | | | | | 1 | | | | | 7 |
| Pelagic Cormorant | | 18 | 6 | 7 | | 27 | | | | | | 728 |
| Pigeon Guillemot | | | | | | | | | | | | 8 |
| Porpoise | | | | | | | | | | | | 3 |
| Red-breasted Merganser | | 3 | 169 | | | | | | | | | 1717 |
| Red Fox | | | | | | | | | | | | 1 |
| Red-necked Grebe | 7 | 7 | | | | 3 | 1 | | | | | 188 |
| Red-throated Loon | | | | | | | | | | 1 | | 314 |
| Sabine's Gull | | | | | | | | | | | | 72 |
| Sea Otter | | | | | | | | | | | 2 | 2131 |
| Small Shorebird | | | | | | | | | | 1000 | 1000 | 11790 |
| Steller's Eider | | | | | | | | | | 150 | 313 | 14439 |
| Steller's Sealion | | | | | | | | | | | | 1 |
| Surf Scoter | | 9 | | | | 2 | | | | | | 49 |
| Tundra Swan | | | | | | | 2 | | | | | 80 |
| White-fronted Goose | | | | | | | | | | | | 66 |
| White-winged Scoter | | 10 | | | | | | | | | | 198 |

[1] **Total observed(75464) + previous 3-yr average for segments 64-82(74) and 125-137(2003) = 77541.**

Table 3. Spring Emperor Goose Survey, southwest Alaska, 1981-2007.

| YEAR | DATES | POPULATION SIZE | | 3-YEAR AVG. | % CHANGE | OBSERVERS |
|---|---|---|---|---|---|---|
| | | NUMBER | % CHANGE | | | |
| 1981 | 4/23-4/27 | 91267 | | | | R.King/C.Dau |
| 1982 | 5/2-5/4 | 100643 | 10 | | | " |
| 1983 | 4/25-4/29 | 79155 | -21 | 90355 | | " |
| 1984 | 4/26-5/4 | 71217 | -10 | 83672 | -7 | " |
| 1985 | 5/12-5/16 | 58833 | -17 | 69735 | -17 | " |
| 1986 | 5/4-5/7 | 42231 | -28 | 57427 | -18 | " |
| 1987 | 4/30-5/4 | 51633 | 22 | 50899 | -11 | " |
| 1988 | 5/2-5/6 | 53784 | 4 | 49216 | -3 | " |
| 1989 | 5/3-5/6 | 45800 | -15 | 50406 | 2 | " |
| 1990 | 4/28-5/4 | 67581 | 48 | 55722 | 11 | " |
| 1991 | 5/2-5/7 | 70972 | 5 | 61451 | 10 | " |
| 1992 | 4/30-5/5 | 71319 | <1 | 69957 | 14 | " |
| 1993 | 4/30-5/5 | 52546 | -26 | 64946 | -7 | " |
| 1994 | 4/29, 5/2-6 | 57267 | 9 | 60377 | -7 | " |
| 1995 | 5/3-5/6 | 54852 | -4 | 54888 | -9 | " |
| 1996 | 4/27-4/30 | 80034 | 46 | 64051 | 17 | " |
| 1997 | 4/25-4/28 | 57059 | -29 | 63982 | <-1 | " |
| 1998 | 5/4-5/7 | 39749 | -30 | 58947 | -8 | " |
| 1999 | 4/27-5/1 | 54600 | 37 | 50469 | -14 | " |
| 2000 | 4/28-5/3 | 62565 | 15 | 52305 | 4 | E.Mallek/C.Dau |
| 2001 | 4/29-5/4 | 84396 | 35 | 67187 | 28 | " |
| 2002 | 5/3-5/6 | 58743 | -30 | 68568 | 2 | " |
| 2003 | 4/29-5/3 | 71160 | 21 | 71433 | 4 | " |
| 2004 | 4/30-5/3 | 47352 | -33 | 59085 | -17 | " |
| 2005 | 4/20-4/23 | 53965 | 14 | 57492 | -3 | " |
| 2006 | 4/27-5/2 | 76108 | 41 | 59142 | 3 | " |
| 2007 | 4/24-4/29 | 77,541 | 2 | 69205 | 17 | " |

Table 4. Primary staging sites and proportions of emperor geese from 2007 aerial survey of southwest Alaska in comparison to long-term averages.

| Location (Segment/s) | 2007 Number (%) | 1981-2006 Number (Avg. % Total) |
|---|---|---|
| Chagvan Bay/Nanvak Bay (20, 22) | **391 (<1)** | **1290 (2)** |
| Egegik Bay (36-37) | **686 (<1)** | **954 (1)** |
| Ugashik Bay (38) | **2942 (4)** | **1643 (3)** |
| Cinder River Estuary (39-43) | **5229 (7)** | **6729 (11)** |
| Port Heiden (44-45) | **19227 (25)** | **19724 (31)** |
| Seal Islands Lagoon (46-47) | **9259 (12)** | **8050 (13)** |
| Port Moller/Nelson Lagoon (50-54, 56-58, 551-552) | **25494 (34)** | **18668 (29)** |
| Izembek Lagoon (60-65) | **9623 (13)** | **3084 (4)** |
| Pavlof Bay (91-92) | **867 (1)** | **262 (<1)** |
| Ivanof Bay (112) | **725 (1)** | **447 (<1)** |
| Chignik Bay (125) | NA | **229 (<1)** |
| Wide Bay (136-137) | NA | **1195 (<1)** |

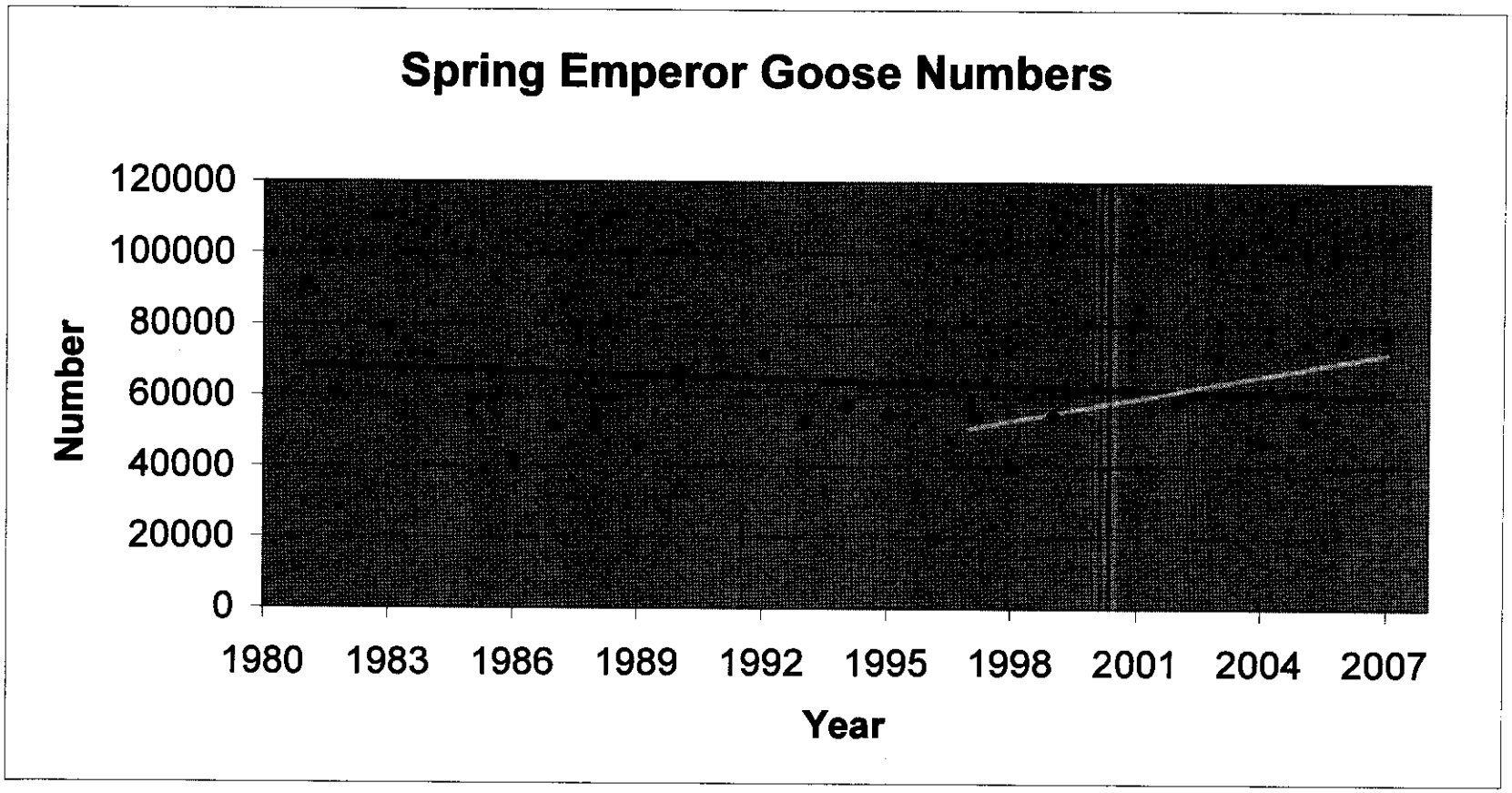


Figure 3. Spring emperor goose numbers 1981-2007 (blue). Trend information was derived from simple linear models. Twenty-seven year trend (1981-2007, red): mean = 64,162, slope = -338, p = 0.38, mean annual growth rate = -0.53%. Ten year trend (1998-2007, yellow): mean = 62,618, slope = 2,115, p = 0.20, mean annual growth rate = 3.38%.