

AN ABSTRACT OF THE THESIS OF

Robert Ashley CortHELL for the M. S. in Fish and Game Management
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Title Comparative winter survival of wild and game
farm pheasants on Eliza Island, Washington

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Information concerning comparative winter survival of wild and game farm pheasants on Eliza Island, Washington was obtained during the period from December 31, 1948, to April 4, 1949. This study was an integral part of a series of studies designed to determine more of the life history and management of the ring-necked pheasant. Information gained in these studies will be applied in practical management of the ring-necked pheasant by the Oregon State Game Commission and the Washington State Department of Game.

The studies were carried out on Eliza Island which is located in northern Puget Sound about eight miles south of Bellingham, Washington. The isolated condition and small size of the island makes it possible to work with known numbers of birds and determine exact end results.

Three studies have already been completed at Eliza Island previous to this one. They include a nesting study in which a group of game farm hens that had laid a complement of eggs at the game farm were released on Eliza Island to determine if they could successfully nest. There was a net loss of birds even after adding the reproduction of the year. This was followed by a winter survival study involving a group of game farm hens. Results of this study show a survival rate of 35 per cent for the three month period. Following this in an orderly sequence was another nesting study where game farm hens were released before they had laid eggs at the game farm. There was a gain in population when adding the reproduction of the year.

The next study involved comparative winter survival of wild and game farm pheasants. The birds on Eliza Island during this winter study did not suffer from lack of food, water or cover, essential to the survival of the birds. The winter weather was more severe than is usual for the area, but the birds showed no ill-effects from the weather. Predators seemed to present the only obstacles to survival. Pheasants are considered as having fallen victim to predators as follows: Cooper's hawk-7; great horned owl-5 and cat-2. Predation accounted for 44 per cent of the total population.

A differential in survival between game farm reared birds and wild pheasants was noted. Sixty-four per cent of the wild birds survived, while only 36 per cent of the game farm birds survived. Hens, whether wild or game farm, were the first to be taken by the predators.

The results of this study show that survival of game farm birds is low when compared to wild birds. The hen, whether wild or game farm, is apparently more vulnerable to predation and loss than the cock bird. This seems to indicate the need of special attention for the hen in any practical management program.

COMPARATIVE WINTER SURVIVAL OF WILD AND GAME FARM
PHEASANTS ON ELIZA ISLAND, WASHINGTON

by

ROBERT ASHLEY CORTHELL

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Professor of Fish and Game Management

In Charge of Major and Department

Redacted for privacy

Chairman of School Graduate Committee

Redacted for privacy

Dean of Graduate School

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Figure 1

Aerial view of Eliza Island
(U. S. Army Air Corps Photograph)



COMPARATIVE WINTER SURVIVAL OF WILD AND GAME FARM
PHEASANTS ON ELIZA ISLAND, WASHINGTON

INTRODUCTION

The material in this manuscript is concerned with a study of the winter mortality factors affecting the ring-neck pheasant, Phasianus colchicus, on Eliza Island, Washington, from December 30, 1948, to March 13, 1949. On Eliza Island, a series of studies are being conducted on the life history of the ring-neck pheasant by the Oregon Cooperative Wildlife Research Unit¹, under the direction of Arthur S. Einarsen, Biologist, U. S. Fish and Wildlife Service.

The purposes of the studies are: (1) To furnish the Oregon State Game Commission, the Washington State Department of Game, and other agencies with information that may help these organizations in the practical management of the ring-necked pheasant; (2) To provide experience and training for graduate students in the theory and practice of game management, especially in wildlife research.

The specific aim of the study described herein is to compare the winter survival rate of a group of wild pheasants with an equal number of game farm birds, the two groups being released on Eliza Island at the same time.

¹ United States Fish and Wildlife Service, Oregon State Game Commission, Washington State Department of Game, Wildlife Management Institute and Oregon State College cooperating.

Three studies have already been completed at Eliza Island previous to this study. These include a nesting study in which a group of game farm hens that had laid a complement of eggs at the game farm were released on Eliza Island to determine if they then could successfully reneest in the wild. There was a net loss of birds even after adding the reproduction of the year (Scott, 1948). This was followed by a winter survival study involving a group of game farm hens. Results of this study show a survival rate of only 35 per cent for the three-month period (Nelson, 1949). Following this in an orderly sequence was another nesting study where game farm hens were released before they had laid eggs at the game farm. There was a gain in population when adding the reproduction of the year (Salter, 1949). All pheasants used in these studies were obtained at the Oregon State Game Commission farm at Corvallis, Oregon, or from Washington state game farms.

The history, location, and physical aspects of Eliza Island have been thoroughly covered in the preceding theses (Scott, 1948; Nelson, 1949; Salter, 1949), and will not be covered in detail in this report.

Location

Eliza Island, one of the smaller islands on the eastern edge of the San Juan group, is situated in Bellingham Bay

approximately eight miles west of Bellingham, Washington, and is accessible from Bellingham via the motor vessel Osage which makes a mail and passenger run out to the San Juan Islands and back again each day. See Figures 1 and 2.

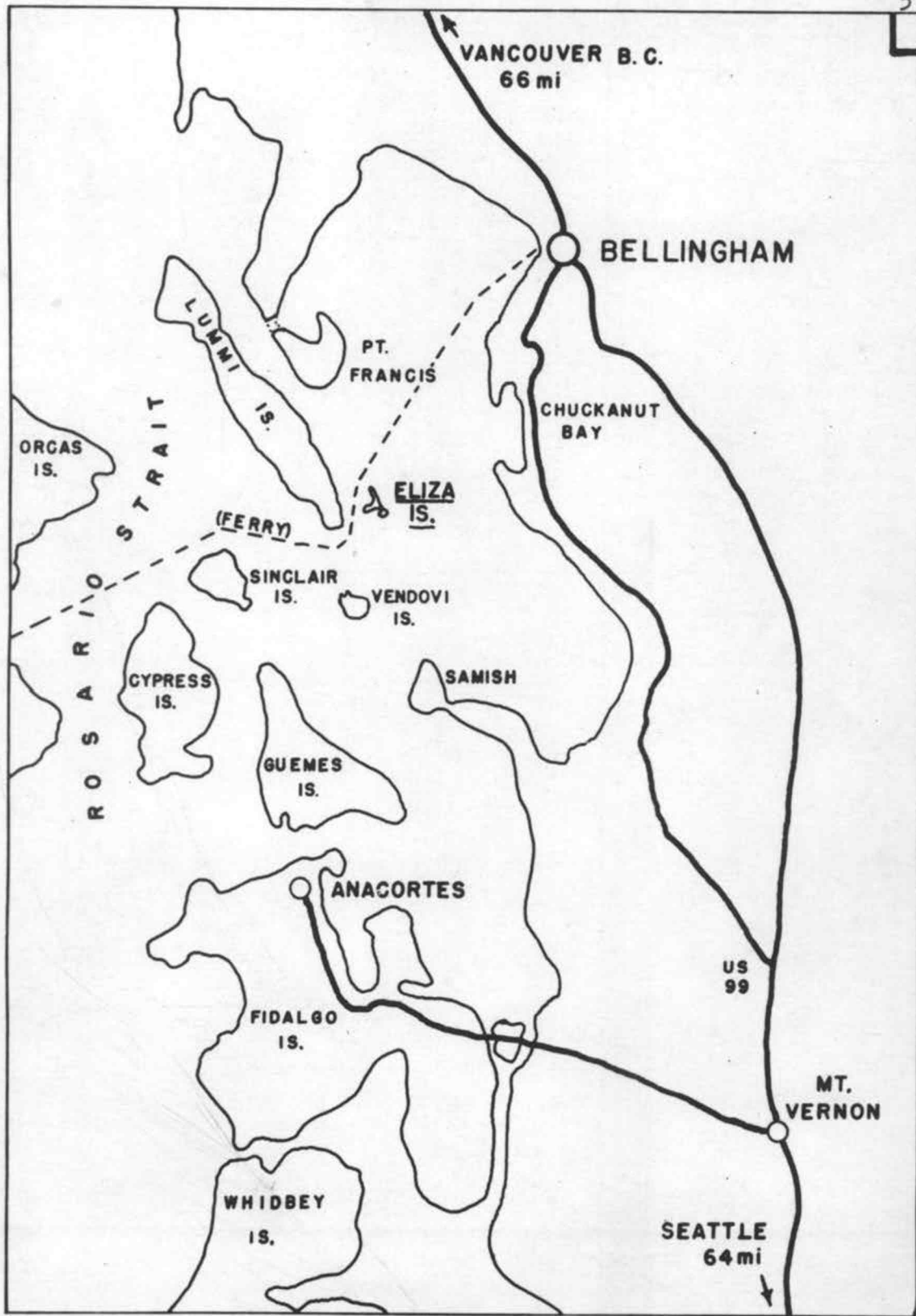
Description

Eliza Island is roughly triangular in shape and has a total area of 158 acres. West Point, which is wooded, grades into the low, flat central area. The low, open grassy center of the island includes about a third of the total land area and located here is a brackish water lagoon, one and one-half acres in extent. An old drainage ditch connects a small fresh water marsh and other low areas with the lagoon. A heavy belt of woods covers the east side of the island, extending continuously from North Point to South Point. The whole of the eastern edge is bordered by an abrupt bank ranging in height from 40 to 50 feet above the beach line. The highest elevation on the island, about 60 feet, is found on South Point.

Figure 2

Sketch map showing regional
location of Eliza Island

(Map by Robert F. Scott)



KEY

- 1. FIELD 1
- 2. FIELD 2
- 3. FIELD 3
- 4. FIELD 4
- 5. FIELD 5
- 6. "CLUMP"
- 7. SHIPWAYS
- 8. OLD DOCK
- 9. BEACH CABIN
- 10. RESIDENT CABIN
- 11. NEW DOCK
- 12. WEST CABIN

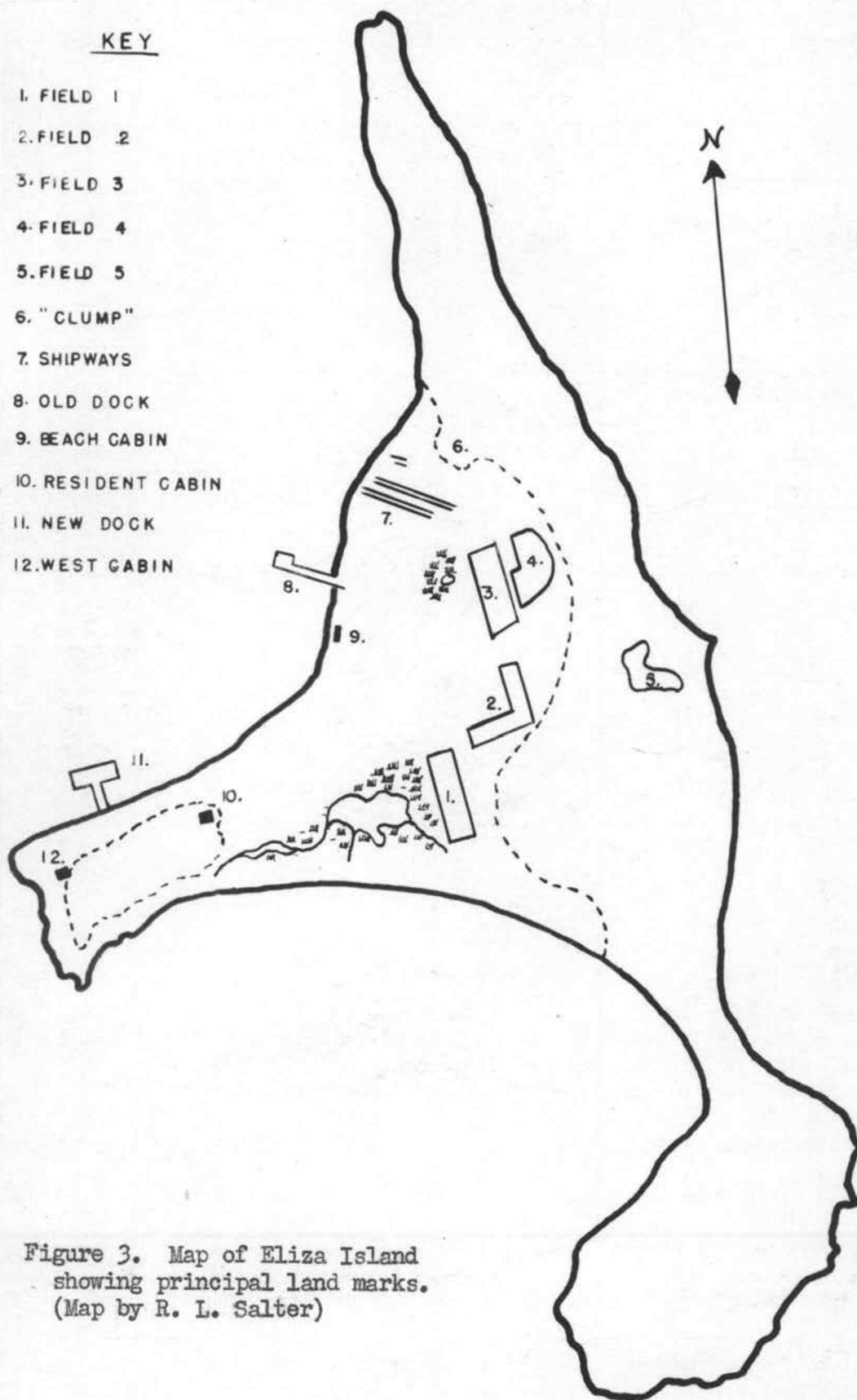


Figure 3. Map of Eliza Island
showing principal land marks.
(Map by R. L. Salter)

PROCEDURE

The Birds

A total of 32 birds, 10 hens and 22 cocks, were used in this experiment. Half of these, 11 cocks and five hens, were obtained by trapping wild stock on Eliza Island during October and November of 1948. These birds were weighed, banded, and placed in a holding pen to await the date of release. This complement of wild birds was matched by 11 cocks and five hens from the Washington State Game Farm at Whidby Island, Washington. The game farm birds arrived at Eliza Island December 30, 1948, and, after being weighed and banded, were consigned to the holding pen for one night preceding the release on December 31. The game farm birds were extremely heavy and fat, a condition which was no doubt due to a comparatively sedentary life at the game farm.

The Release

The release was accomplished by allowing the birds to drift out naturally through holes cut in the sides of the holding pen beginning at 0800 on the morning of December 31, 1948. The release was accomplished in this manner in order to minimize possible mortality that might have resulted from a forced release. Their escape was watched from a place of concealment

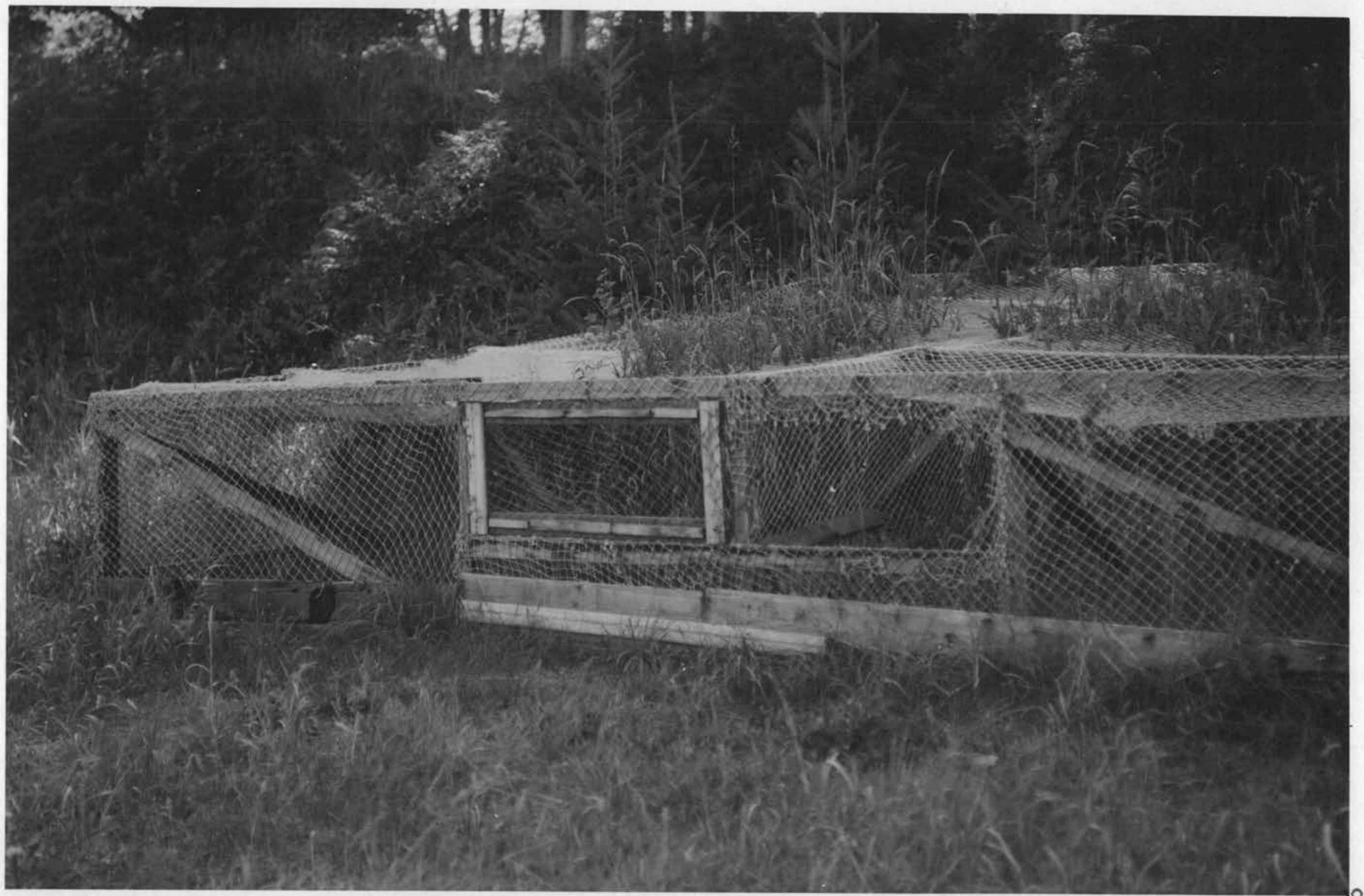
about 40 yards away. As the birds gained their freedom, there was much clucking among the cocks and the "peep-peep" call of the hens was frequently heard. Several short mass flights were observed as the birds gradually dispersed into the wooded cover of West Point, the area immediately adjacent to the holding pen. All but eight of the birds had left the holding pen by 1200. The remaining birds were driven out and three of these flew out over the water in which they were forced to land after short flights of less than 150 yards. One of the pheasants managed to swim to shore unaided while the other two were retrieved by boat, dried out, and released again without further mishap.

This type of release, in which pheasants are allowed to escape confinement at their own discretion, seems to have advantages over the method of violently driving the birds out. Regarding release methods, Buss (1, p. 99) states that instead of dumping pheasants directly from crates into strange cover (violent release), gentle releases should be made wherever possible, allowing the birds to disperse gradually into the surrounding cover. He adds that feeding and watering should continue after the release gate is opened until no birds return. Transported pheasants should be released into auxiliary pens from which gentle releases can soon be made. He believes that the lives of pheasants thus saved would more than repay for the additional work and expense of such a practice. Findings on

Figure 4

Holding pen on West Point.

Note the heavy cover in the background



Eliza show that forced releases result in bird losses.

No food or water was put out for the birds at Eliza Island and they were forced to shift for themselves from the start. This apparently caused no hardship as a very abundant natural food and water supply was immediately available.

Rate of Dispersal

The newly released birds exhibited a strong tendency to remain near the holding pen release site, many of them returning daily to enter the holding pen to look for food. No indication could be found that any birds had left West Point the first day but on the second day, January 1st, a cock was seen to fly across the open flat area to the eastern woods. On the third day, bird sign was found throughout the more favored areas and by the tenth day, some of the birds had visited all parts of the island. However, a concentration remained on West Point until warmer weather broke up the snow and ice six weeks later.

A check for fresh tracks was made immediately following each fresh snowfall. The first track check was made on January 22 and only five or six sets of fresh tracks could be found in all other areas exclusive of West Point. This was found to be true with each succeeding snowfall until about February 1st when more birds began to use the upper flat

adjacent to the east woods. February 21st marks the end of the snow and the advent of warmer weather. At this time, most of the birds moved into other favored areas around the island.

The Harvest

In order to obtain complete information on the birds and to prepare the island for the next study, it was necessary to remove the survivors. The most practical and effective way of doing this is by a hunting harvest with the aid of a good bird dog. Consequently, on March 13, following the critical winter period, harvesting of the surviving birds was begun. The harvest was completed on March 31. A cripple that had escaped the hunters and later died was not found until April 4th. A total of 13 birds was harvested, eight of these being wild birds and five of game farm stock.

Field Methods

It was desirable to observe the birds as constantly as possible without unduly disturbing them. A complete set of daily field notes was kept during the period of study with particular emphasis on bird losses. The principal means of gathering information was through daily field trips. An effort was made to cover all portions of the island once a week. However, most of the time was spent in areas where the pheasants were known to be concentrated.

About half of the time in the field was spent in a systematic search or "gridding" of a definite and pre-determined area. This was accomplished by walking back and forth along parallel lines until the selected area had been thoroughly covered. The other half of the field time was utilized in general wanderings in which an attempt was made to take a different route or trail each trip. The practice of general wanderings seemed to produce more results. This probably can be explained by the fact that only the more favored areas were traversed whereas in the "gridding" method, much of the time is spent on unfavorable ground. The general wandering method proved much more interesting to the observer, thereby making him more alert.

Many valuable observations were made either from the living quarters with the aid of a 20-power spotting scope, or incidentally while engaged in maintenance work. A good dog was available and proved a great help in the field, especially in indicating the presence of birds undetected by the observer.

Results obtained by various methods of search emphasize the fact that the amount of information gained is in direct relation to the total time spent in the field.

OBSERVATIONS

Food

A wide variety of natural foods is available to the pheasant on Eliza Island and this natural supply could undoubtedly support a fairly large population. This has been supplemented by the addition of five small cultivated fields located in the more favorable areas of habitat. With the addition of these cultivated fields, conditions found in typical pheasant habitat in the western parts of Oregon, Washington, and California are more nearly simulated.

A maximum food supply was available from the date of release until January 21st when the first snow covered the ground. Snow blanketed the ground continuously from January 21st to February 21st. This was the critical period as far as availability of food for pheasants was concerned. Several observations were made of pheasants feeding by scratching through the snow, especially at field no. 5, an oat field. The birds would scratch down through the four inches of snow covering the ground and an area ten feet in diameter would be scratched up during the feeding period which usually lasted about 30 minutes. On another occasion when nearly eight inches of snow covered the ground, two cocks were seen to eat heads of orchard grass that remained protruding above the snow. On February 21st, food was

again available in normal quantities and was further supplemented by young green vegetation. Nelson (4, p. 52-53) found that the most commonly taken winter foods on Eliza Island were vetch seeds, wheat, oats, and green material.

Food was apparently not a critical factor during this winter study. No known mortality from lack of food was indicated and all birds examined were in good condition and of normal weight.

Winter Cover

Leopold (3, p. 313) describes winter cover for pheasants as follows: "In snow country, the most essential property is dense winter foliage or thorns. Dense winter foliage is obtainable only in non-deciduous or evergreen species, such as the conifers. Dense foliage is not necessary if the cover has thorns (blackberry, rose), or if the branches are so matted as to exclude predators without either thorns or foliage." Eliza Island more than meets these cover type requirements. The cover types found on Eliza are listed by Nelson (4, p. 24) as follows: (1) Woods, a. bare floor, b. salal floor, c. grass floor, d. deciduous shrub floor; (2) Open areas, a. salal and fern, small shrubs, etc; (3) Swales grown to tussocks of sedge, juncus, etc.; (4) Cultivated hay meadows; (5) Grain fields.

Cover for wintering pheasants can be divided into three categories according to the daily activities of the birds:

(1) Roosting cover. Roosts were most often found in the juncus and sedge clumps near the fresh water marsh, in thick patches of old vetch vines mixed with orchard grass immediately behind the holding pen on West Point and in thick salal brush in mixtures of dead grass and fern, especially on West Point. Other places frequently chosen for roosts included bare forest floor, young Douglas fir thickets, and an old pile of abandoned chicken wire in the flat near the lagoon.

(2) Escape cover. Good escape cover was amply provided by thick clumps of salal, blackberry brambles and low dense thickets of conifers. A handful of feathers was often found near some thick covert where the pheasant, after surviving the first attack of the predator, was able to escape into the dense confines of the nearby covert. A large pile of abandoned chicken wire in the middle flat near the lagoon often served as emergency escape cover, but on one occasion proved fatal to a cock that became firmly enmeshed in the wire. In its frantic efforts to escape, the cock was killed and partially eaten by the hawk which then was unable to drag the remainder of the pheasant from the wire to continue eating it.

(3) Loafing cover. The loafing periods of pheasants on Eliza Island during the winter seemed to be spent in random wanderings about the island, much of the time being spent in the

woods edge where the snow was not quite so deep. Pheasants were often observed to squat and rest for considerable periods of time near where they had been feeding. This was especially true when fairly deep snow conditions prevailed. When alarmed by the observer, these birds made for the nearest cover in great haste. It would seem that the requirements for loafing cover in winter are about the same as the requirements for escape cover.

Lack of winter cover, then, is not a factor on Eliza Island as many types are present in greater variety and abundance than in average Pacific Coast pheasant habitat.

Weather

Eliza Island, though located in the coastal rainbelt, receives less precipitation than many inland areas because it is in the rain shadow of Vancouver Island and the Olympic Mountains. The average yearly rainfall is less than 20 inches while snow and low freezing temperatures are normally rarely encountered. Complete daily weather records were kept at Eliza Island. Temperature records were taken by a recording thermometer which ran continuously. The precipitation was measured and recorded daily by means of a standard rain gauge and the velocity and direction of the wind was determined. The degree of cloudiness was also estimated.

The winter of 1948-49 was more severe than is usual on Eliza Island, with snow and freezing temperatures occurring for prolonged periods of time. However, the total precipitation was somewhat less than the 30-year average for Bellingham, Washington, as shown by Table 1.

TABLE 1

Rainfall for the First Three Months of 1949
Compared with the 30-Year Average in Bellingham, Washington

Month	Rainfall, 1949	30-Year Average
January	1.01	4.74
February	4.48	2.98
March	2.58	3.22

A total of 20 inches of snow was recorded for the three-month period and snow was on the ground continuously for more than a month from January 18th through February 21st. The ground and open water ponds remained frozen during most of January and February, as the average daily temperature for this period was near the freezing mark. See Table 2.

TABLE 2

A Comparison of Average High and Low Monthly Temperatures
at Eliza Island for the First Three Months of 1949

Month	Average High	Average Low
January	36.9	32
February	39.6	35
March	47.2	41.5

The coldest day recorded at Eliza was plus 20 degrees Fahrenheit on February 12th. Colder weather was usually experienced in conjunction with northeast winds while the warmer weather was accompanied by southeast winds. Winds up to 40 miles per hour were not uncommon.

The winter weather did not appear to place undue hardship on the pheasants except that the covering of snow and the frozen ground limited the availability of their food supply to a certain extent. The constant winds are thought to have been the cause of some of the broken tail feathers noted in a few cocks.

Condition

The condition of the birds when harvested at the end of the study was excellent. No indication of malnutrition or disease was evident; however, the game farm birds showed a weight loss of from five to 12 ounces per bird, while nearly all of the wild birds showed slight gains in weight. See Table 3.

TABLE 3

A Comparison of Weights of Wild and Game Farm Birds
Before Release and After Harvest

Wild Birds	Weight at Release	Weight at Harvest
Male # 33105	48 ounces	49 ounces
33110	49	51
33113	58	43
33115	46	54
Female 67836	31	32
47809	38	39
Game Farm Birds		
Male 33129	52	46
33119	52	43
33124	51	39
Female 65210	33	32

The weight loss in the game farm birds may be due to the fact that they were forced to shift for themselves after leading a comparatively sedentary life on the game farm. Finding strange food in a new environment and increased exercise undoubtedly contributed to this loss in weight. Some of the game farm birds were excessively fat, when released, and had difficulty in flying.

An examination of the gonads was made on all the harvested birds. The testes of the males had become much larger than is normal on a fall or winter bird, about the size of a small acorn, while the ovaries of all the females were found to show no enlargement from the winter state.

Some of the birds carried the scars of unsuccessful predator attacks.

Territory and Social Behavior

During the course of the study, daily sight records of birds seen were kept and, from an examination of these records, it has been found that birds were seen in groups of two or more 45 per cent of the time. Nelson (4, p. 22) reported seeing birds in groups of two or more 84 per cent of the time during the same months. The greater degree of pheasant gregariousness indicated in Nelson's study can only be explained by the fact that all but one of the birds used by him were hens. In

the study under discussion, the majority were cocks (22 cocks and 10 hens). Further evidence supporting the premise that the hens are more gregarious on Eliza Island during the winter is the fact that in the present study hens were seen with other birds 75 per cent of the time and in the company of other hens 65 per cent of the time, as compared to the overall average of 45 per cent when the cocks are also included.

A definite territory for each individual bird did not exist. However, some cocks were known to inhabit definite niches while others appeared to be wide ranging. One cock with a crippled leg was nearly always seen in the same place at field No. 5. Another cock, easily recognized by the pattern of his broken tail feathers, made almost daily visits to the refuse pile in back of the chicken house.

The hens traveled widely during most of the study period. With the advent of warmer weather about February 21, the entire population of hens were always seen together and never in the company of any cocks. When flushed into the woods, the hens would shortly return to the flat where they remained until driven out by hunting pressure. It is interesting to note that during this same period no cocks were flushed in the flat but were located in the woods edge all the way around the flat.

RESULTS

Predation

Predation accounted for a loss of 44 per cent of the total pheasant population on Eliza Island during this experiment, with all other losses amounting to about 12 per cent. Predation was almost absent until February 16. During this period of six weeks from the release date to February 16, only three kills were found. From February 16th to the conclusion of the study on March 13th, predation losses continued at a constant high level with 11 kills occurring during this four-week period.

All known predation losses were apparently due to the activities of the following animals: a feral cat, great horned owls, and Cooper's hawks. See Table 4.

TABLE 4

Pheasant Losses to Each Predator Species

Predator	Males	Females	Total
Cooper's Hawk	6	1	7
Great horned Owls	3	2	5
Feral Cat	-	2	2

Other potential predators observed on the island during this study include bald eagles and sharp-shinned hawks. Bald eagles were observed daily flying over the island but not a single instance of pheasants being molested by these eagles was ever recorded. The eagles were great scavengers and obtained much of their food by picking up dead birds and fish from the beach. However, live sea birds and water fowl were often captured by these birds.

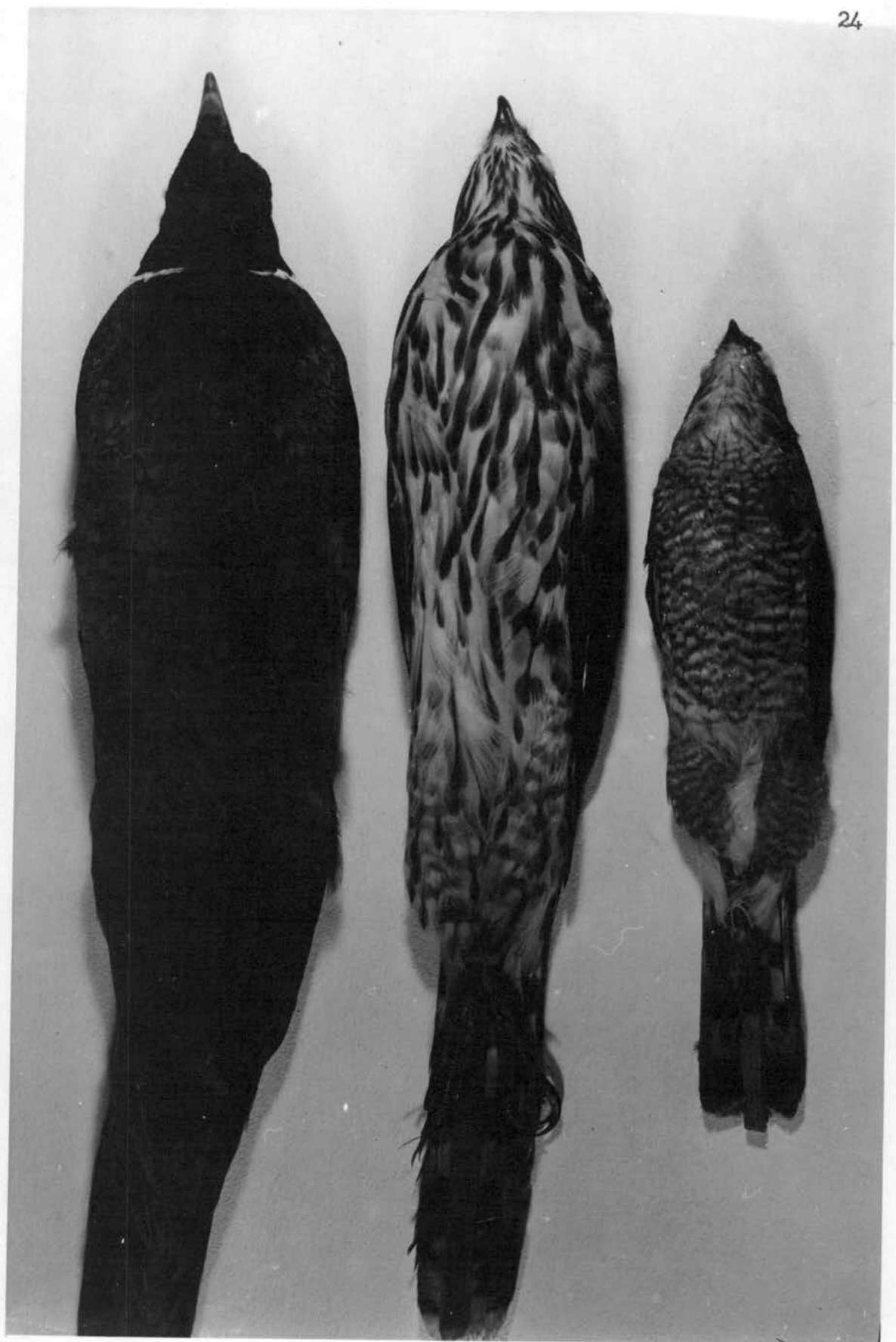
Sharp-shinned hawks were present during most of the study. It is often difficult to distinguish sharp-shinned hawks from Cooper's hawks because of their similar appearance and habits, the size differential being about the only character usable at a distance. Many songbird kills were found and these were thought to have been largely the work of the sharp-shinned hawks. Einarsen (2, p. 8) states that songbirds, quail, young poultry, and even adult pheasants, fall prey to the sharp-shinned hawk. It is possible that a pheasant or two may have been killed by sharp-shinned hawks but, because they were not seen at the kill, all predation losses of this nature were determined to be the work of the Cooper's hawk.

Only confirmed evidence was accepted as proof of a pheasant kill. This evidence consisting of either some part of the body of the pheasant or all of the feathers of the body and wings. Groups of feathers were often found marking the spot

Figure 5

A size comparison of Ring-necked pheasant (left),
Cooper's hawk (center), and sharp-shinned hawk (right).

(From museum specimen)



where some predator had apparently made an unsuccessful attempt to capture a pheasant. Frequently, the Cooper's hawk would follow its prey and strike again if not successful the first time. More often, the pheasant escaped after the first onslaught, leaving only a handful of feathers to mark the location of the encounter. Such feather groups indicated good reason for a very thorough search of the area and, on two occasions, such searches led to pheasant kills. Three of the pheasants shot at the conclusion of the study had old wounds about the body where new feathers were growing back in.

The feral cat succeeded in killing only two pheasants, and both of these were taken within five days after the start of the study. A cat kill can usually be distinguished from avian predator kills by the manner in which the heavy bones are bitten through showing typical teeth marks. Remains of a cat kill usually consisted of scattered feathers, heavy body bones, wing tips and parts of the head and bill. On one occasion only feathers remained, other parts of the bird having been eaten or carried away. This was definitely known to be a kill because most of the large wing feathers were found. It seems remarkable that a cat could eat such a meal but evidence of this animal's appetite was often observed on the beaches where an average nightly meal consisted of the whole body of a large water bird or sea gull. The cat was extremely wild and apparently

Figure 6

Feral Cat. This predator killed 37 pheasants from June, 1947, to March, 1949. The cat was trapped at the conclusion of this study.



completely nocturnal in habits. This animal was later live-trapped and held in captivity for three months. An attempt was made to tame it but to no avail, as he remained hostile and aloof to the end, never adjusting to a diet usually normal for domestic cats. The cat was removed from the island.

Great horned owls are thought to have taken five birds in six days to earn the distinction of being the most deadly and efficient predators present on Eliza Island. These birds are believed to have been present on the area for a period of two weeks judging from the fresh owl pellets, excreta, and observed kills. Characteristic remains of a pheasant killed by an owl usually consisted of a short piece of the large intestine, part of the gizzard, and a few scattered large feathers. On two occasions, wings were found along with the other remains. Many fresh owl pellets were found under dense groves of trees around the woods-house. Of all the pellets examined, only four contained identifiable pheasant remains. Sea bird remains were most commonly found in the owl pellets. Band recoveries from owl kills are rare but one pellet was found that contained the leg bones of the pheasant with the band still attached. In the case of the great horned owls at Eliza Island, the lack of a mammalian buffer species is probably more than compensated for by the large number of sea birds available to these birds.

Cooper's hawks were common pheasant predators on Eliza Island. These birds have been credited with killing seven pheasants during the study period. All of the Cooper's hawk kills were located in the woods or immediately adjacent to the woods. This suggests the hawks' preference for cover in making a successful attack.

A vicious persistence was exhibited by the Cooper's hawk when attacking a pheasant. If unsuccessful on the first strike, the hawk would often continue the pursuit by running in along the ground. One Cooper's hawk was flushed from a pheasant that it had just killed underneath a thick tangle and, in the excitement, the hawk experienced considerable difficulty getting out of the tangle, on our approach.

The Cooper's hawk characteristically left the complete skeleton of the pheasant kill amidst a large pile of feathers, and band recovery from the kill was almost always assured. The hawk usually started his meal by eating into the visceral region from the left side. A bird the size of a Cooper's hawk obviously could not completely consume a pheasant at one meal but would return repeatedly until the skeleton was picked clean of flesh. On one occasion, a freshly killed and partly eaten pheasant was discovered on the ground in some heavy grass. For convenience, it was retrieved and placed in the crotch of a nearby tree before the field trip was continued. Upon

revisiting the area two hour later, the observer found that the hawk had returned, dragged the pheasant from the tree, and had eaten another meal.

Analysis of Predation

A total of 14 predator kills was found during the experiment. Four of these were identified as game farm birds; three were wild birds and seven kills remain unidentified. Failure to find the identification band is responsible for the large number of unidentified kills. Because half of the kills are unidentified, no true comparison can be made between wild and game farm birds on the basis of predation. It is then necessary to make this comparison on the basis of survival. See "Survival".

The predation losses occurring in this study amounted to 44 per cent of the total population as compared to a 65 per cent total predation loss during the previous winter study as found by Nelson (4 p. 31-46). Three possible reasons for the higher predation rate found by Nelson are: (1) The majority of the birds used in his study were hens while in this study, cocks made up the major part of the population. Thus, hen pheasants appear to be more vulnerable to predation than do the cocks. (2) Predation did not occur to any great extent during the first six weeks of the 1949 study due to the lack of predators present, but during the 1948 winter study, the predation pressure was

heavy and constant for the whole period. (3) Fewer birds (32) were used in 1949. Nelson used 56 birds. The lower density, coupled with the fact that half the birds used in 1949 were wild stock, apparently assured a better survival during the 1949 period.

Other Losses

Three cocks remain unaccounted for. A band taken from a hen used in this study was found on the beach near Anacortes, Washington, and was returned to us on June 14, 1949. (Anacortes lies approximately 10 miles south of Eliza Island). The hen had apparently flown off the island, drowned, and was carried up onto the Anacortes beach by the drifting tides. This is believed to have probably been the fate of the three missing cocks.

Survival

Survival of the winter population of pheasants on Eliza Island was measured from December 31, 1948, to March 13, 1949, and was determined by shooting all the birds still surviving at the conclusion of the study. This number was then compared with the population figures at the beginning of the study period. The principal objective of this experiment was to compare the net survival of game farm birds with wild birds.

Of the total of 14 birds surviving the experimental period, nine, or 64 per cent, were wild birds. Only five, or 36 per cent, were game farm birds. The total net survival for all classes of birds combined was 44 per cent. A fact that must be kept in mind is that the number of birds used does not constitute a large enough sample to give conclusive results. The results do indicate significant trends which, when compared with results from the work already done and that now being undertaken, should turn up some data useful in practical field management of the ring-necked pheasant.

The only known factor that directly affected survival of pheasants during the 1949 winter study on Eliza Island was predation. The degree of predation depended upon: (1) kind of predator present; (2) number of predators present; and (3) length of time each predator remained on Eliza Island. Other factors, which we shall term indirect factors, probably had a considerable effect on the amount of predation. Some of these are as follows: (1) classes of birds present (wild, game farm, sex, age, etc.); (2) weather; (3) availability of a buffer species; (4) population density; and (5) distribution of the pheasants.

As previously stated, there were two main classes of birds, wild birds and game farm birds. Of the wild birds, a total of seven cocks and two hens survived the study for a combined survival rate of 64 per cent. Of the game farm birds, a

total of three cocks and two hens were collected, making a combined survival rate of 36 per cent for the game farm birds.

See Table 5.

TABLE 5

A Comparison of the Survival of the Two Main Classes of Birds

Class of Birds	Male	Female	Per Cent Survival
Wild birds	7	2	64
Game farm birds	3	2	36

Judging from the above evidence, wild birds appear to have nearly twice the chance for survival as compared to game farm birds. Nelson's data supports this conclusion (4, p. 43). The difference might have been more marked if predation had occurred to any great extent during the first half of the study before the game farm birds had much of a chance to become acclimated to their new surroundings. A chronological record of predation was kept during the study and this shows that the game farm birds bore the brunt of the early predation and that it was not until the numbers of these game farm birds were reduced

that the wild birds, especially the cocks, were taken by predators to any great extent.

The apparent difference in survival between the wild birds and the game farm birds in this study lies between the cocks. Out of the total of 11 cocks released for each class, the wild birds show a survival rate of 64 per cent, whereas the game birds have a 27 per cent survival rate. The case of the game farm cocks is probably somewhat distorted as at least two of the three birds that remain unaccounted for are believed to be game farm birds.

Both wild and game farm hens show a survival rate of 40 per cent. Due to the small sample of hens used, five of each class, these figures probably do not show the true picture. Evidence supporting this belief is that all of the predation on the hens had taken place on or before the 21st of February. Up until this time, only one cock had been killed by predators while five hens had been taken. From February 21 on to the conclusion of the study, the four remaining hens were always seen together and only in the open fields. The fact that they were living entirely on the open flat lessened their chances of being taken by the Cooper's hawk which was the only active predator present at this time, and which seems to prefer nearby trees or cover from which to launch his attack.

It is significant that the hens, whether wild or game farm birds, were the first to be taken and, therefore, appear to be more vulnerable than males to predation. A comparison with Nelson's winter study supports this conclusion (4, p. 31-46). Nearly all birds used by Nelson were hens and the total winter survival of these hens was only 32 per cent. This seems to emphasize the fact that the surviving hen is the key to successful pheasant management. This would only seem logical when it is realized that each and every hen that is lost materially affects the potential production of young, while the ratio of cocks to hens can drop to a low figure and still not affect maximum production providing sufficient hens are still present. This is true because the cock pheasant, being a polygamous bird, can mate with many hens and still insure good fertility.

Summary and Conclusions

1. The research study undertaken on Eliza Island during the winter of 1948-49 was concerned with the comparative survival of wild and game-farm reared pheasants. This was the fourth in a series of studies designed to gather life history facts that can be applied in practical management of the ring-necked pheasant.

2. On the morning of December 31, 1948, 16 game farm pheasants and 16 wild birds were released from the holding pen

on West Point. No food was put out for them and they were forced to shift for themselves from the start.

3. Three days after being released, the birds had visited most areas of the 158-acre island. A concentration of birds remained on West Point, near the release site, during the greater part of the study.

4. A shooting harvest was started on March 13, 1949, and continued until April 4, 1949, when the last bird was believed to have been accounted for.

5. Following the release, the island was covered systematically on foot daily from December 31, 1948, to March 13, 1949, during which time observations and data were gathered on the pheasant population.

6. No evidence of a shortage of pheasant food was ever noticed. A wide variety of natural foods were available and this supply was further supplemented by five small cultivated fields.

7. Much excellent winter cover was present on Eliza Island, probably being present in greater abundance than in average Pacific Coast pheasant habitat.

8. While the winter of 1948-49 was more severe than is usual at Eliza Island, the pheasants apparently suffered no ill effects from the winter weather.

9. The condition of the surviving birds was excellent. No indication of malnutrition or disease was noted. The wild birds showed slight average gains in weight whereas the game farm birds lost from five to 12 ounces per bird.

10. The pheasants on Eliza Island, during the winter of 1948-49, showed a lesser degree of gregariousness (46%) than was found by Nelson (84%) during the winter of 1947-48. The apparent difference was that the birds used by Nelson were hens whereas the majority used in this study were cocks. This leads to the conclusion that hens are more gregarious than are the cocks on Eliza Island during the winter.

11. The total predation losses occurring during this study amounted to 44 per cent of the original population. Predators responsible for these losses were the Cooper's hawks (seven birds), great horned owls (five birds), and a feral cat (two birds).

12. One hen attempted to fly off the island and was drowned. Three cocks remain unaccounted for, and it is believed that they may also have drowned.

13. A differential survival rate is noted between game-farm reared birds and birds of wild stock. Only 36 per cent of the game-farm reared birds survived the winter as compared to 64 per cent survival for wild birds. Nelson found survival for the winter of 1947-48 to be only 35 per cent when mostly game

farm hens were used.

14. During the first six weeks of the 1948-49 study, hens, whether wild or game farm birds, were taken by the predators before any of the cocks were taken.

15. The above facts lead to the conclusion that survival of the hen, which appears to be more vulnerable to predation and loss, is the critical factor in any moderately successful management program for ring-necked pheasants.

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APPENDIX

TABLE 6

Scientific Names of Birds Mentioned in Context

Common Name	Scientific Name
Bald eagle	<u>Haliaeetus leucocephalus washingtonii</u> (Townsend)
Cooper's hawk	<u>Accipiter cooperii</u>
Great horned owl	<u>Bubo virginianus saturatus</u> (Ridgway)
Sharp-shinned hawk	<u>Accipiter striatus velox</u> (Wilson)

TABLE 7

Common and Scientific Names of Plants Mentioned in Text

Common Name	Scientific Name
Blackberry	<u>Rubus</u> sp.
Bracken fern	<u>Pteridium aquilinum</u>
Douglas fir	<u>Pseudotsuga taxifolia</u>
Rush	<u>Juncus</u> spp.
Oats	<u>Avena</u> sp.
Orchard grass	<u>Dactylis glomerata</u>
Salal	<u>Gaultheria shallon</u>
Sedge	<u>Carex</u> sp.
Vetch	<u>Vicia</u> spp.
Wheat	<u>Triticum</u> sp.

TABLE 8

Recapitulation of Ring-necked Pheasant Survival
on Eliza Island

Pheasants liberated:	
Wild birds16
Game farm birds	<u>.16</u>
Total32
Pheasant losses:	
Cat.	2
Cooper's hawk	7
Great horned owl	5
Drowning	<u>1</u>
Total15
Harvested or considered as having survived:	
Wild birds	9
Game farm birds	<u>5</u>
Total14
Total pheasants accounted for29
Total pheasants unaccounted for	<u>.3</u>
Total	.32
