

## WILD PIG MANAGEMENT ON A CALIFORNIA PUBLIC HUNTING AREA

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### Abstract.

Population status of the wild pig (*Sus scrofa*) and a management program on Fort Hunter Liggett, California were evaluated with emphasis on public hunting. A check station was utilized to collect biological data from hunter-killed pigs and to investigate hunter attitudes and experience. Field observations were made to supplement data obtained from hunting harvest. Hunting pressure increased and pig take generally decreased over the period 1968-1977. Success averaged one pig per 119 hunter days of effort. Most study area pigs were European phenotypes. Sex ratio of the take was 46 male : 54 female. Dressed weights for pigs of all ages were variable with means of 42.7 kg and 34.1 kg for males and females respectively. Adult males were significantly heavier than adult females. Detailed carcass measurements were recorded from 40 hunter-killed pigs. Forty-seven percent of the pigs taken during 1976-1977 were less than 10 months old. Few pigs older than 24 months were taken. Field observations of 104 pigs during 1977 revealed an average litter size of 5.2 and an adult : young ratio of 1 : 9.4. Oak grassland habitats were most important foraging areas. Conclusions include recognition of the need to investigate sport hunting as a means of controlling pig populations while utilizing their high reproductive potential. A statewide pig survey resulting in stratified pig density mapping is recommended along with an active research program and improved management policy.

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The wild pig in California ranks second only to deer among big game in terms of estimated annual hunter harvest, yet relatively little effort is directed towards research and management of the resource. Future statewide management of wild pig populations would be inhibited by a lack of detailed range distribution and density information. This information is essential to elucidate the potential role of this exotic mammal in altering native plant and animal communities. Growing popularity of wild pig hunting is reflected in the development of a number of fee hunting programs on private lands, particularly livestock and dryland farming operations subject to depredation. However, the high reproductive potential of wild pigs is not widely utilized to the level possible under a sustained yield sport hunting program. Management efforts on public lands are extremely limited as most pigs occur on private lands.

As a result of Department of Fish and Game investigations conducted from 1964 through 1968 (Pine and Gerdes, 1973), basic management strategies were developed for wild pig populations in Monterey County, California. The investigators concluded that populations should be managed where pigs are abundant; sport hunting to control pigs should be encouraged in areas of agricultural damage; where pigs are a valued game animal, the use of dogs for hunting should be restricted if populations are low or declining; and that a five-month hunting season (October-February) could be used for greater enhancement of hunted wild pig populations. However, the study pointed out the lack of a practical field technique which furnished an index of population or harvest trends useful in monitoring the relative condition of populations.

This paper evaluates a wild pig management program at Fort Hunter Liggett, an active U.S. Army installation available for public hunting. A cooperative effort between the U.S. Army and the California Department of Fish and Game, the program was primarily designed to enhance a low-density wild pig population while allowing controlled harvest of the resource. Secondary objectives were to gather a body of biological data useful in increasing basic knowledge of wild pigs while attempting to develop methods of monitoring population trends.

## STUDY AREA

Wild pigs inhabiting Fort Hunter Liggett furnish not only sport hunting opportunities but, offer a unique situation through which biological and hunting information pertinent to management of the species is routinely collected. The 67,206 ha (166,000 acre) Army installation is located in southern Monterey County, California in an area typical of much of the county's pig habitat. Terrain is extremely variable with elevation ranging from approximately 230-1135 m (760-3744 ft). Major plant communities include valley oak grassland (25%), blue oak woodland (40%), mixed shrubland (30%) and dense chaparral (5%). Well defined riparian corridors along stream courses are irregularly distributed throughout the area. The majority of the area is subject to heavy cattle grazing as well as disturbance associated with military activities.

Wild pigs throughout Monterey County are descendants of feral domestic and introduced European wild pigs. The origin of the populations and history of range extension were reported by Pine and Gerdes (1973). For the purposes of this evaluation, wild pigs are considered one species although subspecific differences between European wild pigs, feral domestic pigs and their hybrid are recognized.

Hunting for wild pigs on the study area is available to the public on designated days during a five-month season. Special restrictions include prohibition of dogs and handguns. Otherwise, normal state regulations are in effect. Hunters are required to report to a check station at the beginning and end of each hunting day. A fee of \$4.00 per person per day is charged. Hunter-killed pigs are examined and specific data recorded at the check station. Emphasis of the program is directed towards recreational opportunity rather than trophy hunting. Pig control to limit agricultural depredation and range damage is not an important factor on the area.

## METHODS

### Hunting Program

Wild pig hunting on the area is controlled and regulated out of necessity since unrestricted recreational activity is not compatible with military requirements. First-come, first-served hunting for a limited number of individuals is generally allowed on weekends and federal holidays during the period October-February. This season was established following detailed ecological investigations of local pig populations (Pine and Gerdes, 1973). Pig density as well as phenology of growth and reproduction were given prime consideration in establishing this experimental season. Since a well defined peak in farrowing occurs in March and April, hunting is confined to a period when sows and young are less vulnerable and most young pigs generally have had an opportunity to gain weight and reach desirable size.

In an effort to document pig hunter attitudes, experience, techniques and willingness to travel, a hunter survey was conducted on 19, 20, 26 and 27 February 1977. One hundred ninety hunters were asked to respond to 11 items and furnish basic biographical information at the check station prior to hunting. No assistance was provided to hunters in formulating responses. However, reasonable clarification of survey items was offered. An explanation of possible use of the survey was provided upon request.

### Biological Data Collection

Hunters were requested to make all pigs taken available for examination at the Hunter Liggett check station prior to departing the area each day. Separate data sheets were completed for each pig. Items recorded include physical characteristics associated with differentiation between European and feral domestic strains as described by Stegeman (1939). Sex and general condition were also noted. Dressed weight, weight of the bled carcass with all viscera removed, was taken to the nearest 0.5 kg on a spring-type scale. Additional carcass measurements were taken to the nearest 1.0 cm with a flexible steel tape as follows:

**Shoulder Height**—dorsal crest of the spine to the anterior tip of the front hoof. Prior to measurement, the carcass was laid on its side on a flat surface with front legs extended straight and perpendicular to the longitudinal axis of the carcass. Crest of the spine was identified by placing a straightedge perpendicular to the spine directly above the front leg.

**Body Length**—dorsal edge of the nose to the posterior edge of the last coccygeal vertebra with the tape passing along and in contact with the dorsal midline of the carcass.

**Head Length**—dorsal tip of the nose to the occiput.

**Ear Length**—intertragic notch to the tip of the auricle, not including hair.

**Hind Foot Length**—calcaneum to the outside tip of the hoof.

**Tail Length**—perianal region to the posterior edge of the last vertebra. Prior to measurement, the tail was elevated to the same plane as the spine.

**Chest Girth**—circumference of the chest just posterior to the posterior edge of the scapulae with front legs placed perpendicular to the spine.

### Aging Technique

Detailed age class structure and chronology of farrowing for the Hunter Liggett pig population were reported by Pine and Gerdes (1973) using the basic aging method described by Matschke (1967). This technique was used to estimate the age of 23 pigs taken during the 1977 season. During the period 1969-1975, age estimates were made sporadically. An effort was made to document the proportion of the 1976-1977 reported kill comprised of pigs less than one year of age. Eruption of the lower permanent canine was arbitrarily used to assign pigs to either juvenile or adult status. The mean age at which the permanent lower canine erupts was reported as 284 days or approximately nine and one-half months.

### Field Observations

Field observations of wild pigs were made on the study area between 7 March and 17 September 1977. Information recorded included time, location, number of pigs, coloration, estimated weight, activity and behavior. When possible, pigs were photographed

with a 35 mm SLR camera equipped with a 300 mm telephoto lens using color film. Additional observations of pig activity including wallows, rooting, rubbing, tracks and droppings were also recorded.

## RESULTS AND DISCUSSION

### Hunting Program

A systematically operated check station facilitated collecting hunter use and biological data on wild pigs. Since the check station was an integral part of the normal hunting and fishing program at Fort Hunter Liggett, little additional effort was involved in gathering the information. Located near the main entrance to Hunter Liggett, the check station serves as an information center where all hunters must report both in and out of the field each day. Theoretically, complete reporting of hunting activities on the study area was thereby obtained. Unreported hunting activity is suspected, however, documenting the magnitude of the problem was beyond the scope of this study. Data collection procedures were generally well received by hunters. Although quite valuable in the situation, check stations may not provide a satisfactory method of monitoring pig hunting activity on large areas with little control over ingress and egress of hunters.

Pig hunter survey results indicated most hunters on the study area had relatively little pig hunting experience, yet were quite interested in the sport (Table 1). Information obtained characterized the average hunter as male (99%), 31 years of age (Range 13-66), with less than two years (range 0-40) of pig hunting experience. The average one-way distance traveled to hunt pigs on the area was 294 km (182 miles) with a range of 65-806 km (40-500 miles). Hunting party size averaged four (range 1-11). The majority of hunters indicated a preference to hunt pigs during the period September through May. Little interest was shown for hunting pigs during the summer. A rifle equipped with a scope was the most popular weapon for hunting pigs on the area.

Information obtained in this survey must be evaluated in light of the fact that the typical hunter on the study area was most likely unable to obtain permission or was unwilling to pay fees required to hunt on many private lands where pigs are most abundant and hunter success substantially higher. This selection process tends to account for the level of hunting interest, the limited experience of the average hunter and perhaps the high willingness to travel index (one-way distance from home) exhibited by study area hunters.

The wild pig harvest at Hunter Liggett tended to decline whereas hunting pressure tended to increase, despite fluctuations over the last 10 years (Figure 1). A detailed analysis of pig take and hunter success was obtained by examining nine years of data for February, a month during which only pigs may be hunted (Figure 2). Success for the period evaluated averaged one pig taken per 119 hunter days of effort. Seasonal distribution of the pig take, as characterized in Figure 3, reflects an early peak in October, a slight depression in November and December, followed by a gradual increase through February. Pig kill data for March was obtained prior to 1975 as the season was closed at the end of February after 1974. The early season peak was primarily attributed to vulnerability of young pigs, while the late season peak was attributed to improved hunting conditions following fall rains and resultant increased hunting pressure.

Table 1. Responses received from 190 pig hunters asked to complete questionnaires at Fort Hunter Liggett, February 1977.

<u>Survey Item</u>	<u>Number and Percent of Hunters Responding</u>	
Previously killed a wild pig	44	(24%)
Previously hunted pigs with dogs	14	( 8%)
Aware that pigs may be agricultural pests	122	(66%)
Like to see wildlife agencies place more emphasis on wild pig management	152	(84%)
Like to see a pig hunting information leaflet published	165	(90%)

<u>Type of Weapon</u>	<u>Number and Percent of Hunters Responding</u>	
Rifle with scope	89	(48.0%)
Rifle without scope	73	(41.0%)
Shotgun with slugs	11	( 6.0%)
Archery	9	( 4.5%)
Muzzle loader	1	( 0.5%)

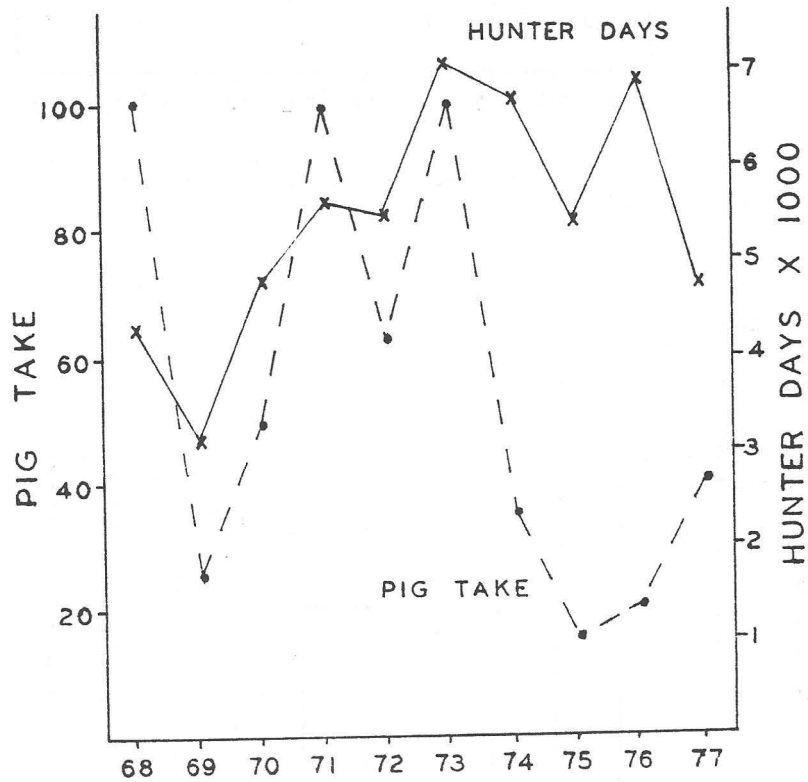


Fig. 1. Pig take and hunter days 1968 - 1977 Fort Hunter Liggett, California.

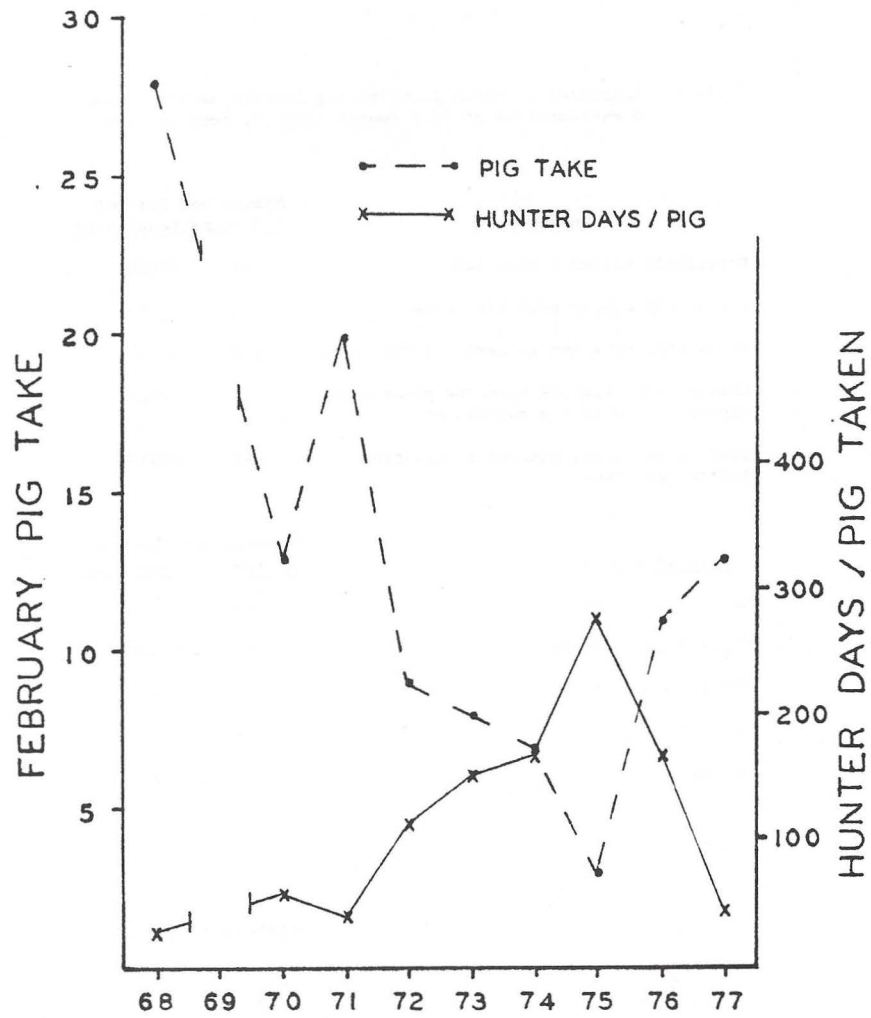


Fig. 2. February pig take and hunter days per pig taken 1968 - 1977. Data missing for 1969.

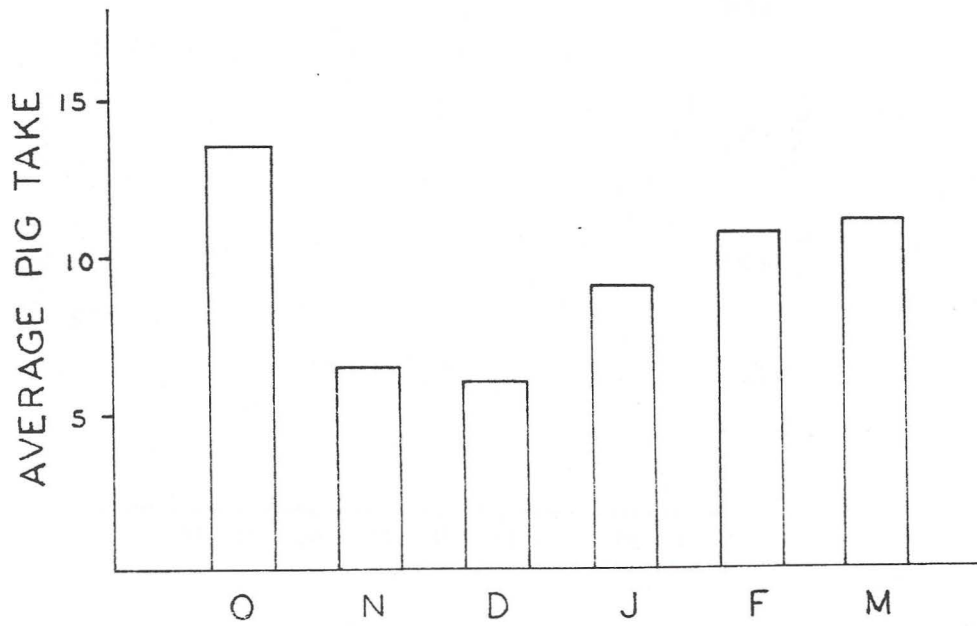


Fig. 3. Average monthly distribution of the pig take during 1968 - 1977.

## Biological Data

Basic phenotypic differences described by Stegeman (1939) including coloration and conformation were used to classify hunter-killed pigs as either European or feral domestic. Partially white or mixed colored pigs were considered feral domestic or hybrids. Pigs of solid dark colors and exhibiting body conformations which included tall heavy shoulders; long, erect hair along the spine; light angular hindquarters; long legs; long, slender head; small, pointed and heavily haired ears; and a long, straight tail were considered the European type. The majority of pigs taken over the past 10 years were of European wild pig ancestry. The percentage of typical feral domestic individuals in the pig take declined over this period (Table 2). This decline reflected by the data was not statistically significant at the 90 percent level when tested by adjusted Chi-square. However, assuming that the composition of the hunter take is representative of the entire population, a long-term trend favoring the European pig is possible.

Further investigation of selective processes responsible for the apparent increase of the European strain and decline of the feral domestic strain is needed. Hunter selectivity is not suspected as success is fairly low and hunters generally shoot the first pig they observe. However, coloration may influence hunting vulnerability. Partially white pigs are more visible than uniformly dark colored pigs which may indirectly affect hunting selectivity.

The sex ratio of the pig take at Hunter Liggett is characterized by slightly more females than males (Table 3). Assuming an expected sex ratio of 50 males : 50 females, the data were subjected to Chi-square testing. The differences were not statistically significant at the 90 percent level. These data closely resemble the ratio of 44 males : 56 females reported by Pine and Gerdes (1973). In light of the fact that many of the pigs taken are young of the year and lack obvious secondary sex characteristics coupled with the fact that hunters are generally inexperienced, it is unlikely that hunter selection greatly influenced sex ratio of the take. However, it is probable that large boars may sometimes be selected over smaller pigs in a group. The solitary nature of adult boars may tend to limit their vulnerability to hunters. Sows with litters, which may be observed primarily during the last month of the season on the study area, are not always killed by hunters. These factors are recognized potential influences on the sex ratio of the hunter take.

The hunting season is closed on Hunter Liggett at the end of February in an effort to protect highly vulnerable sows with young. In situations where a high level of population control is desired, heavy hunting pressure directed towards both sexes during the spring may be effective. Further investigation is required to specifically document potential enhancement of the population by the restrictive hunting strategy employed on the study area.

During the routine examination of hunter-killed pigs, carcasses were classified as either fat or lean. Subcutaneous and intraperitoneal fat deposits were subjectively evaluated to assign individuals a general condition rating. Young pigs taken during October and November were typically quite lean possibly as a result of high energy requirements of growth and maintenance through the critical period of nutritional stress, late summer. Condition of mature pigs was variable although fat levels appeared directly related to acorn availability during fall. A standard condition index such as a specific technique for measuring rump fat may be useful in detailed investigations.

Table 2. Phenotypic expression of European and feral domestic strains among pigs taken at Fort Hunter Liggett October 1967-March 1968 and October 1976-December 1977.

<u>Date</u>	<u>European</u>		<u>Feral Domestic</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
1967-1968	83	73.5	30	26.5
1976-1977	66	79.6	17	20.4

Differences between periods are not statistically significant ( $P > 0.10$ ).

Table 3. Sex ratio of 196 hunter-killed pigs of all ages taken from Fort Hunter Liggett 1972-1977.

<u>Hunting Season</u>	<u>Male</u>	<u>Female</u>	<u>Ratio</u>
1972-1973	44	49	47 : 53
1973-1974	10	18	36 : 64
1974-1975	9	6	60 : 40
1975-1976	9	10	47 : 53
1976-1977	<u>19</u>	<u>22</u>	<u>46 : 54</u>
Totals	91	105	46 : 54

Ratios do not differ significantly ( $P > 0.10$ ) from an expected ratio of 50 : 50.



Field dressed weights of hunter-killed pigs were highly variable. Figure 4 illustrates the range of weights for pigs of both sexes and all ages obtained over a 10 year period. Variability was thought to be related not only to season and habitat conditions but also physiological status of individual animals. Using the t-test, mean weight of adult males was found significantly heavier (99% level) than the mean weight of adult females taken during 1976-1977. No significant difference was found between juvenile male and female mean dressed weights (Figure 5).

Table 4 summarizes carcass measurement data obtained from 40 pigs taken during 1976-1977. Inasmuch as these data quantify characteristics generally used to distinguish European wild pigs from feral domestic strains, information contained in this paper may serve as a general guide for morphological comparisons between the Monterey County wild pig complex and other populations. Although primarily of academic interest, morphological information may prove useful as baseline data for future investigations of wild pigs. To the best of my knowledge no carcass measurement data were previously reported for Monterey County pigs.

### Age Class Structure

Forty-seven percent of the pigs taken over the last two seasons were less than 10 months of age as indicated by absence of permanent canines. In contrast, detailed age estimates indicated that pigs of the year accounted for 74 percent of the hunting harvest during the period October-December 1977. Relatively few pigs older than 24 months were reported taken (Table 5). This abundance of young pigs was attributed to high reproductive success during spring 1977 as a result of good to excellent acorn production the previous fall. Age class structure information obtained at Hunter Liggett may be somewhat biased inasmuch as ages were normally estimated from mandibles collected at the check station where hunters taking older, larger pigs were reluctant to consent to removal. In such cases, these pigs were simply aged as adults. However, it appears that reasonable age estimates can be made by visual inspection of dentition without mandible removal.

Dental cementum annuli may be used to place pigs into respective year classes. This technique is dependent upon extraction of one incisor which should meet the approval of most hunters. However, unless farrowing among the majority of sows in the population was confined to a relatively short period, as is the case with fawning in deer, definition of specific year classes would be difficult. Collection of a representative sample of mandibles or careful dental inspection of hunter-killed pigs appears to be the most practical method of monitoring age class structure of populations. Aging live trapped pigs may furnish supplemental data during the course of detailed investigations.

The obvious incentive to obtain detailed knowledge of population age class structure lies in the ability to develop life tables. Reproductive, survival and mortality rates reflected by the age class structure indicate population condition. This information can then be used to formulate management or control strategies.

### Field Observations

Observations of 104 pigs were made between March and September 1977. An Adult : young ratio of 1 : 9.4 was recorded. Litter size averaged 5.2 with a range of 2-to-9. Well defined groups of young pigs, classified as litters, were sometimes observed without

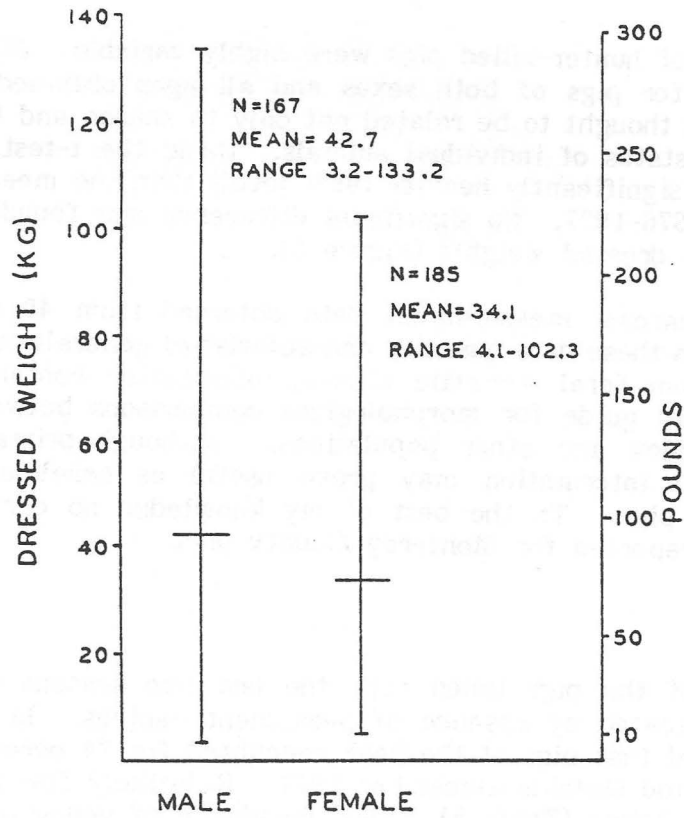


Fig. 4. Dressed weight data for 352 pigs of both sexes and all ages taken 1968 - 1977.

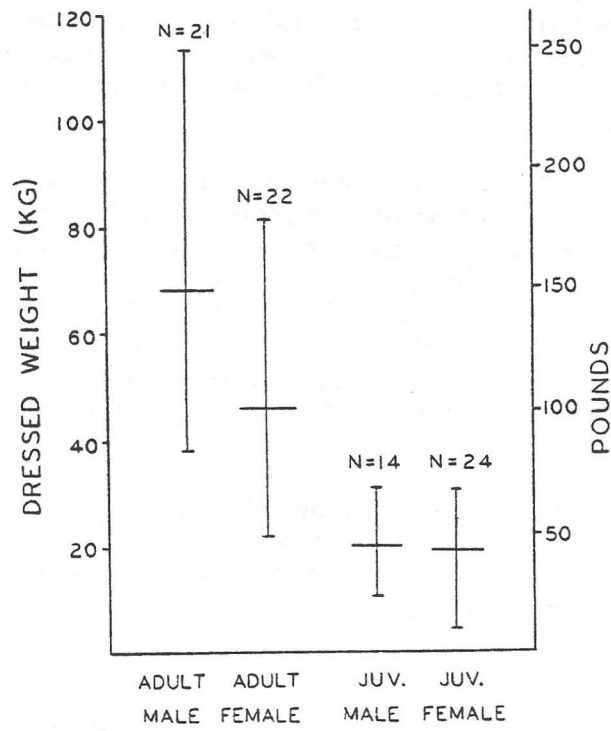


Fig. 5. Dressed weight data for adult males, adult females, juvenile males and juvenile females taken 1976 - 1977.

Table 4. Statistical descriptions by sex and age class of the weights and some carcass measurements of 40 wild pigs taken during the 1976-1977 season at Fort Hunter Liggett.

Weight or Measurement	<u>Adult Male</u>					<u>Adult Female</u>				
	N	Mean	SD	Range	C	N	Mean	SD	Range	C
Dressed Carcass Wt (kg)	14	65.6	21.4	37.7-113.6	32.6	10	56.7	21.0	32.7- 81.8	37.1
Shoulder Height (cm)	14	76.2	11.2	55.9- 94.0	14.7	10	72.6	7.9	61.0- 85.1	10.8
Body Length (cm)	14	162.3	15.5	139.7-184.2	9.5	10	156.0	16.8	127.0-188.0	10.7
Ear Length (cm)	14	14.5	1.8	10.2- 17.8	12.6	10	15.0	2.4	12.7- 20.3	16.3
Hind Foot Length (cm)	14	28.2	3.0	20.3- 31.8	10.8	10	26.4	1.4	24.1- 27.9	5.4
Head Length (cm)	14	35.6	5.5	27.9- 45.7	39.1	10	28.8	15.8	27.9- 35.6	14.0
Tail Length (cm)	14	27.7	4.9	21.6- 38.1	45.5	10	26.9	5.4	22.9- 40.6	51.1
Heart Girth (cm)	13	102.4	15.2	80.0-134.6	37.6	9	98.3	14.4	78.7-114.3	37.1
Weight or Measurement	<u>Juvenile Male</u>					<u>Juvenile Female</u>				
	N	Mean	SD	Range	C	N	Mean	SD	Range	C
Dressed Carcass Wt (kg)	4	28.8	2.7	25.9- 29.1	9.3	11	20.5	9.1	4.5- 31.4	44.7
Shoulder Height (cm)	4	61.0	2.9	58.4- 63.5	4.8	11	56.1	7.9	39.4- 68.6	14.0
Body Length (cm)	4	126.0	4.1	123.2-132.1	3.2	9	113.8	17.3	72.4-128.3	15.2
Ear Length (cm)	4	12.1	1.3	10.2- 12.7	10.5	9	11.4	1.8	7.6- 14.0	15.8
Hind Foot Length (cm)	4	24.1	1.4	22.9- 25.4	6.0	11	21.2	2.5	14.0- 23.5	12.6
Head Length (cm)	5	27.9	3.6	20.3- 30.5	32.3	9	24.9	4.3	15.2- 27.9	43.9
Tail Length (cm)	4	21.8	0.6	21.6- 22.9	7.4	11	18.5	3.1	12.7- 22.9	42.7
Heart Girth (cm)	4	76.5	4.9	69.8- 81.3	16.3	11	70.1	10.5	55.9- 83.8	38.1

SD=Standard Deviation  
 C=Coefficient of variation =  $\frac{SD}{Mean} \times 100$

Table 5. Age class structure of 23 pigs killed during the 1977 season at Fort Hunter Liggett.

<u>Age in Months</u>	<u>Male</u>	<u>Female</u>	<u>Age Group % of Total</u>
0 - 3	-	-	-
3 - 6	5	2	30.5
6 - 9	3	7	43.5
9 - 12	-	-	-
12 - 18	-	2	8.7
18 - 24	1	-	4.3
24 - 36	-	-	-
36 - 42	1	-	4.3
42 - 48	1	1	8.7
48 plus	<u>-</u>	<u>-</u>	<u>-</u>
	11	12	100.0

sows. The majority of young pigs exhibited longitudinal stripes, characteristic of pure strain European genotypes. Sows and young were more readily observed than boars. The activity periods of sows with litters during early spring and young pigs during midsummer appeared to extend through daylight hours to a greater degree than other adults.

Habitat selection reflected a dependence on oak grassland sites as foraging areas. Food habits information reported by Pine and Gerdes (1973) indicated a strong reliance on oak mast, grasses, bulbs, roots, carrion, insects and other items associated with this vegetative complex. While some items were utilized seasonally, grasses were important sources of food throughout the year. Springs, creeks and reservoirs in the oak grassland zone were common locations of pig activity, particularly during late spring and summer. Dense stands of escape cover, primarily chamise (Adenostoma fasciculatum), were evident within approximately 1 km (0.62 mile) of areas most intensively used by pigs. Free surface water distribution of at least one source per 260 ha (1.0 square mile) was estimated as a minimum for preferred pig habitat.

Observations of pigs and their signs such as tracks, rooting, wallows and droppings indicated that population density was not uniform throughout the study area. Forage, water and cover are obvious habitat elements which influence pig population distribution. Further studies are required to elucidate the specific relationships between habitat conditions and population responses to the habitat. Influences of drought, illegal hunting, predation and other factors acting upon wild pigs have not been thoroughly investigated. Unexplained declines in pig populations occurred in much of Monterey County during recent years, yet precipitant increases occurred simultaneously in neighboring San Benito County.

The nomadic nature of this classical opportunistic feeder makes pig habitat evaluation a complex process. Pigs may travel several miles foraging during the night, returning to cover prior to daylight. Hunted pig populations seek more cover than non-hunted pigs. Study area pigs do not appear to have well defined home ranges, but merely take advantage of available food, water and cover until disturbed then may vacate the area for months. These characteristics complicate detailed ecological studies of wild pigs and tend to limit the value of many techniques used to evaluate the habitat of other ungulate species. Hopefully, information presented in this paper will stimulate further investigation of wild pigs.

## CONCLUSIONS AND RECOMMENDATIONS

With the 1976 statewide pig take estimated in excess of 32,000 and tending to double within six years, there is little doubt that the wild pig is an important element of California's wildlife resources. Although reasonable population estimates are lacking, pigs are known to occur in approximately half of the 58 counties in the state. The majority of pigs are found on private lands where the greatest potential for both depredation problems and sport hunting utilization exist. The fact that most populations originated from domestic stock and that wild pigs have been classified as game animals only since 1957, leads to difficulty in unifying attitudes regarding management of the species. Private landowners may desire to control pigs with their own means, yet hunter interest in wild pigs mandates that management policy encourage sport hunting where possible. Equitable solutions to complex problems of pig management may be achieved only by focusing greater attention on this exotic mammal and habitats which

support it. Administratively, it may be difficult to presently justify expenditures on wild pig research and management, yet biologically, wildlife managers cannot afford to continue to neglect the species.

Based on experience obtained at Fort Hunter Liggett and with an appreciation of pig management problems elsewhere, I submit the following recommendations for consideration:

(1) Conduct a statewide survey of wild pig populations. Basic knowledge of pig distribution and population densities is needed to initiate effective management and control of the exotic mammal. Products of the survey should include a detailed distribution map stratified by relative pig densities, indications of population trends and identification of special problem areas.

(2) Initiate detailed ecological investigations of wild pig populations in key areas. Research to develop practical indices of pig population conditions and harvest trends should be encouraged. Although limited information is available from Monterey (Pine and Gerdes, 1973), San Benito (Barrett, manuscript in preparation) and Tehama (Barrett, 1971) Counties, recent major changes in wild pig distribution and abundance make it necessary to conduct further studies. Potential adverse impacts of wild pigs on native plant and animal species should not be overlooked.

(3) Improve the reporting system for obtaining information on wild pig harvest and hunting pressure. An annual hunter survey involving four percent of the license buyers is currently used. However, more detailed information is desirable. A pig tag system, similar to that used for deer, could produce valuable biological data. Questionable cost effectiveness of a tag system may render this alternative undesirable without identification of specific data needs. Hunter check stations in high pig kill areas may furnish valuable data on the harvest, hunting pressure and age class structure of the kill to supplement the existing hunter survey data. Since the majority of pigs are found on private lands, landowner cooperation is essential and should be utilized in gathering meaningful data on a statewide basis.

(4) Develop a clear policy on wild pig management and control. The California Department of Fish and Game Wildlife Management and Wildlife Protection Branches should jointly develop a general policy which considers sport hunting as well as agricultural depredation control. Consideration of incentives to manage pigs on private lands should be a high priority. Problems associated with illegal take and hunting access need to be addressed. Once formulated, the wild pig management policy should be introduced to the public, clarified and promoted by Department employees under an effective public education program. Cooperation with Agricultural Extension personnel may be effective in promoting wild pig management on private lands.

(5) Create a staff position within the Department of Fish and Game to coordinate wild pig research, management and control programs throughout the state. Although a portion of the actual field work could be contracted outside the Department, a qualified individual is needed to direct the effort. This individual could also identify future research needs and develop programs to achieve management objectives.

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