Evaluation of Animal Control Measures on Pet Demographics in Santa Clara County, California, 1993- 2006

A prospective cross-sectional study of 1000 households was implemented in 2005 to evaluate characteristics of the owned and unowned population of dogs and cats in Santa Clara County, California. The same population was previously studied 12 years earlier. During this time period, the county instituted in 1994 and then subsequently disestablished a municipal spay/neuter voucher program for cats. Dog intakes declined from 1992-2005, as they similarly did for an adjacent county (San Mateo). However, cat intakes declined significantly more in Santa Clara County than San Mateo, with an average annual decline of approximately 700 cats for the 12 year period. Time series analysis showed a greater than expected decline in the number of cats surrendered to shelters in Santa Clara County during the years the voucher program was in effect (1994-2005). The net savings to the county by reducing the number of cat shelter intakes was estimated at approximately $1.5 million.

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15   Abstract

17   A prospective cross-sectional study of 1000 households was implemented in 2005 to evaluate

18   characteristics of the owned and unowned population of dogs and cats in Santa Clara County,

19   California. The same population was previously studied 12 years earlier. During this time

20   period, the county instituted in 1994 and then subsequently disestablished a municipal

21   spay/neuter voucher program for cats. Dog intakes declined from 1992-2005, as they similarly

22   did for an adjacent county (San Mateo). However, cat intakes declined significantly more in

23   Santa Clara County than San Mateo, with an average annual decline of approximately 700 cats

24   for the 12 year period. Time series analysis showed a greater than expected decline in the

25   number of cats surrendered to shelters in Santa Clara County during the years the voucher

26   program was in effect (1994-2005). The net savings to the county by reducing the number of cat

27   shelter intakes was estimated at approximately $1.5 million.

29   *Keywords*: animal euthanasia, animal population groups, epidemiology, population control,

30   population policy

33

34

35   The greatest threat to the lives of cats and dogs in contemporary American society does

36   not come from infectious or noninfectious disease, but rather from the threat of being unowned

37   or becoming unwanted and susceptible to abandonment or relinquishment to shelters. Each year

38   millions of healthy and potentially adoptable pets are euthanized for lack of ownership or

39   residence; the most palpable manifestation of this is witnessed at local municipal or private

40   animal shelters. The financial burden of managing this overabundance of pets to communities

41   across the United States is enormous and incalculable.

42   Scientific investigations into pet population dynamics have evolved from the purely

43   descriptive to the analytic, particularly with respect to studying determinants of relinquishment.

44   Many studies, some done on a quasi-national level, have sought to quantify characteristics of

45   animals as well as their owners that appear to be proscriptive for an impairment of the

46   human-animal bond . The cumulative effect of these studies has led to a better understanding of

47   why relinquishment occurs, but the enduring challenge remains how to use such information to

48   implement prevention and/or intervention strategies. The prototypical example of these

49   strategies is almost certainly the establishment of community spay and neuter programs. Such

50   programs can be sponsored either by municipalities or humane organizations, both of which

51   often jointly serve critical animal control needs in communities and frequently join together in

52   collaboration to achieve their mutual goals.

53   Santa Clara County, California is an opportune place to study the results of intervention

54   strategies. As of 2005 the 1,291 square mile county contained 1.76 million people (in an

55   estimated 603,000 households, averaging 2.92 persons per household), with more than half

56   (945,000) living in San Jose, and over 200,000 more living in the cities of Sunnyvale and Santa

57   Clara; no other city in the county exceeded 65,000 people . The ethnic distribution was

58 approximately 44% Caucasian, 25% Asian/Pacific Islander, 24% Hispanic/Latino, 3%

59 African-American, and 4% other groups . Per capita annual growth has been approximately

60 1.2% and annual household growth has increased approximately 0.8% over the past 15 years .

61 Two major animal shelters are currently in operation: the City of San Jose Animal Care Center

62 (SJACC) which opened in San Jose in 2004, and the Humane Society of Silicon Valley (HSSV,

63 formerly named the Humane Society of Santa Clara Valley) facility in Santa Clara, which at its

64 height was taking in 25,000 animals per year. The latter provided most of the animal sheltering

65 services for the County until late 1992, when for financial reasons, the County ceased animal

66 control services for cats either confined or running loose. Cats could only be taken to the shelter

67 by citizens. This situation remained for 14 months, when HSSV recommenced services for most

68 of the County (although several cities together temporarily provided their own sheltering service

69 until 1996). As of 2005, three additional smaller shelters existed in the county: a county facility

70 in San Martin, which serves the 5% of the population not living within cities; a city facility in

71 Palo Alto, which only serves Palo Alto residents; and a private no-kill facility (Town Cats) in

72 Morgan Hill (a newer shelter – Silicon Valley Animal Control Authority – did not exist at the

73 time of this study).

74   The number of cats entering the HSSV climbed approximately 25% (from 20,000 to

75 25,000 cats) from 1983 to 1990, and remained close to its high until Santa Clara County field

76 services ended in 1992 over a dispute in funding; in 1993 the total number of incoming live cats

77 returned to 20,000). Approximately 60% of incoming animals to HSSV were brought in through

78 field services. Upon resumption of these services in 1994 after an absence of 14 months, the

79 City of San Jose instituted and funded a free spay/neuter voucher program to reduce its number

80 of stray cats, and initiated a similar one for dogs the following year. These two programs ceased

81   in 2003 in anticipation of the opening of the SJACC, but temporarily resumed in 2005 until the

82   latter opened its own low-cost spay and neuter clinic in 2006. Santa Clara County also instituted

83   a low-cost spay/neuter program in 1998 with almost $50,000 in annual funding as seed money

84   that continues to the present (2005 funding was $124,000).

85   Against this backdrop of shelter changes and imminent county-wide reconsideration of

86   animal control practices, a local non-profit organization of cat and dog owners and fanciers[a]

87   commissioned a survey of Santa Clara County residents in 1993. The purpose of this survey was

88   to quantitatively assess the number of owned and unowned cats and dogs in Santa Clara County.

89   Using a telephone survey, investigators interviewed people from 1,031 households throughout all

90   parts of the County except the city of Palo Alto (whose small shelter declined to provide intake

91   statistics), and determined that 51% of households did not own pets, 19% owned only cats, 19%

92   owned only dogs, and 11 % owned both cats and dogs. Households that owned cats had an

93   average of 1.7 cats, and households that owned dogs had an average of 1.3 dogs. In addition,

94   10% of all households (48% of which did not own pets) also cared for an average of 3.4 cats they

95   did not own (strays). Stray cats, sometimes referred to as community cats, are free-roaming,

96   unowned, or feral; the latter do not allow human touch. These figures led investigators to

97   estimate that at the time of the survey the number of owned cats in the County was

98   approximately 247,000, and the number of owned dogs was approximately 195,000. Of

99   particular importance was the projection that the County had approximately 169,000 unowned

100   but fed cats (41% of all cats in the County), a figure that does not account for unowned and

101   unfed (feral) cats.

102   The purpose of the current study, conducted in 2005, was to revisit the population of cats

103   and dogs in Santa Clara County 12 years following the earlier study, and to correlate cat and dog

104   population changes with the institution or disestablishment of animal population control

105   programs, including vouchers, field services, and low-cost spay and neuter facilities. The

106   hypothesis was that these programs would be associated with a reduction in the pet populations

107   in Santa Clara County that differed from that of an adjacent comparison county, with resultant

108   cost savings to the county.

109

110   **Materials and Methods**

111   *Study population*

112   The same private survey firm used in 1993 was commissioned to conduct a similar

113   random telephone survey of 1,000 households throughout Santa Clara County except Palo Alto

114   (which has its own small shelter and did not participate in 1993). An EPSEM (equal probability

115   of selection method) phone list of residential landline telephone numbers for the survey was

116   purchased from a private company.[1] Three attempts were made at each number over successive

117   nights. Over 7,000 calls were attempted to reach 1000 respondents.

118   People who agreed to be questioned were asked about pet ownership, pet characteristics,

119   method of pet acquisition, indoor versus outdoor status, neutering and cat declawing status,

120   feeding of unowned cats and dogs, and city of residence within county.

121   Animal shelter entry information was obtained from Santa Clara County Animal Control,

122   Humane Society of Silicon Valley, San Jose Animal Care and Services, and for comparative

123   purposes the Peninsula Humane Society and SPCA in neighboring San Mateo County and Los

124   Angeles County Animal Control. San Mateo County was chosen for comparative purposes, as it

125   most closely resembled Santa Clara County, as opposed to the other four more rural surrounding

126   counties.

127

128 *Statistical analysis*

129 An autoregressive integrated moving average (ARIMA) time series analysis was used to

130 estimate and project the trend in number of shelter intakes. The 1982-1993 Santa Clara County

131 shelter intake records (from before the launch of the spay/neuter voucher program) were used for

132 projecting the expected numbers of shelter intakes from 1994 to 2005. The observed numbers of

133 shelter intakes between 1994 and 2005, during which the spay/neuter program was in place, were

134 then compared with the projected numbers to assess the effect (i.e., change in numbers of shelter

135 intakes) of the spay/neuter voucher program. Autocorrelation function (ACF) and partial

136 autocorrelation function (PACF) plots were used to select appropriate ARIMA models and to

137 evaluate the model fit. Corresponding 95% confidence limit of the ARIMA projections were also

138 presented. A stochastic model was constructed to estimate the number of additional cats that

139 would have been born and taken into the shelters between 1994 and 2005 had the spay/neuter

140 program never been implemented. The key parameters, their corresponding probability

141 distributions for owned and unowned cats, and the data sources are listed in Table 1. This model

142 was also used for benefit-cost analysis of the voucher program. The software program @Risk

143 (version 5.0.0, Palisade Corp., Ithaca, New York) was used for the simulation with 10,000

144 iterations. Median and the 5th and 95th percentiles were reported.

145

146 **Results**

147 *Dogs*

148 Twenty nine percent of responding county households resported that they owned dogs

149 (unchanged from 1993); the average household owned 1.9 dogs, representing an increase from

150   1.3 dogs in 1993. Using US census data led to an estimate of 332,000 owned dogs in Santa Clara

151   County (assuming Palo Alto has the same ownership frequency). Registered and unregistered

152   purebred dogs were 33% and 18% (total = 51%) of the dog population, respectively; the

153   remainder (49%) of dogs was either mixed or unknown breeds. Dogs were acquired from a

154   variety of sources; the most common were friends or relatives (30%), breeders (25%), public or

155   private animal shelter (15%), with the remainder (less than 10% each) coming from a breed

156   rescue group, a newspaper advertisement, found as stray, being born at home, acquired from a

157   pet store, and rare other sources (Fig.1).

158   Seventy five percent (75%) of owners reported surgically sterilizing their dogs. Among

159   those that declined to alter them, 28% of owners said this was a deliberate decision, and none

160   claimed that cost was a justification for not sterilizing. Thirty three percent (33%) of the

161   unaltered dogs were intended for breeding purposes, and 17% were puppies too young for

162   surgery. Of the 99 unaltered dogs, 70 (70.7%) were male and 29 (29.3%) were female.

163   Twenty one households (2%) in the survey acknowledged feeding dogs they did not own,

164   with an average of 2.3 dogs per feeding household. An examination of zip codes indicated that

165   these dogs were predominantly found in the downtown and north and east sides of the city of San

166   Jose. With some exceptions, these areas are in the lower socio-economic range of households in

167   San Jose. Using US census data, this leads to an estimate of approximately 15,650 transiently or

168   permanently stray dogs throughout the county, or 4.7% of the county's dog population.

169

170   *Cats*

171   Twenty five percent of households reported owning cats, representing a decrease from

172   30% in 1993 ($p = 0.013$). With an average of 1.7 owned cats per household (a figure unchanged

173 since 1993), the county's owned cat population was estimated at 256,000 cats. Most cats (85%)

174 were characterized as domestic varieties; only 3% were claimed to be registered pedigree (a

175 figure unchanged since 1993), while others were described as unregistered pedigreed or

176 unknown breed. The percentage of cats kept strictly indoors rose from 33% in 1993 to 49% in

177 2005 ($p < 0.001$); only 8% were currently described as strictly outdoors, down from 14% in 1993

178 ($p < 0.001$).

179   The most common source of owned cats was from a friend or relative (42% in 2005

180 versus 33% in 1993), followed by being found as a free-roaming homeless cat (20% in 2005

181 versus 32% in 1993), a public or private animal shelter (16% in 2005 versus 12% in 1993), a

182 breed rescue group (9% in 2005 versus 2% in 1993), a breeder (4% in both years), an ad in a

183 newspaper or adopted or purchased in a pet store (2% in 2005 versus 6% in 1993), a negligible

184 percentage born at home (<1% in 2005 versus 6% in 1993), and the remainder coming from

185 various minor or unknown sources. The p-value comparing the source distribution of owned cats

186 between 2005 and 1993 was < 0.001.

187   In 2005 most cat owners (92.8%) had their cats surgically sterilized, compared to 86% in

188 1993 ($p < 0.001$). Within the 7.2% of cats not spayed or neutered, 48% had owners that

189 deliberately did not want their cats to be sterilized, 13% had owners who wanted to retain the cat

190 for breeding, 13% were kittens, 13% had owners claiming that the costs were prohibitive, and the

191 remainder gave two or more reasons (the most common of which was lack of time to transport

192 the cat for surgery). Thus, only approximately 6% of owned cats were sexually mature and

193 capable of breeding, approximately half of which were female. However, less than one-half of

194 1% of owners of sterilized female cats allowed their cats to have a litter prior to sterilization.

195   The rate of reproduction of owned cats in Santa Clara County was 89 cats per 1000

196   households, in contrast to the higher rate of 112 kittens per 1000 households in the 1996 National

197   Council on Pet Population Study and Policy (Salman et al., 1998). This may be attributable to

198   the high proportion of altered cats in the county (93%) relative to the comparable 1993 figure

199   and the 2005 national average of 86%. In addition, while in 1993 16% of owned cats had a litter

200   prior to altering, in the current study this figure was less than one-half of 1%. While it was

201   beyond the scope of this study to determine the reasons for this change in attitude, it is likely that

202   greater awareness prompted by considerable multimedia public education about the

203   county-sponsored voucher program instituted in 1993 bore at least some responsibility.

204   When owners were asked about whether their cats were declawed, 8% stated that they

205   were, but 29% of them obtained the cat in that condition. The most common reason given by

206   owners (84%) for declawing was to protect furniture.   Owners not electing to declaw their cats

207   protected their furniture through a variety of means, including having scratching posts and mats,

208   using a spray bottle, clipping the claws, applying double-sided tape, and making loud deterrent

209   noises.

210   Many individuals fed stray cats: 7% of household respondents admitted to feeding an

211   average of 3.2 cats, a decrease from 10% with an average of 3.4 cats in 1993. Relying on U.S.

212   census data, the estimated fed stray cat population is therefore approximately 135,000 cats, or

213   approximately 35% of the total owned and fed free-roaming/unowned cat population in the

214   county (391,000 cats, which represents a drop from 416,000 in 1993). Only 5.5% of these cats

215   were either trapped or taken to be surgically sterilized by their people feeding them. Fifty six

216   percent of the cats were fed daily, while the remaining cats were fed from once every other day

217   to only occasionally. The cats were most commonly fed on the doorstep of a person's home

218 (62%), followed by an office (15%), a park (12%), and a shopping center (<1%). Fed stray cats

219 were either alone or belonged to colonies ranging in size from 2 to 25 cats. Two-thirds of the fed

220 stray cats were too wild to be picked up and were defined as feral; the remaining third were

221 classified as unowned (although some of these may have had owners unknown to the survey

222 respondent). Forty seven percent of the female stray cats were known to have had at least one

223 litter, which is probably a conservative estimate. Over half of the known litters were allowed to

224 remain free and disperse into their neighborhoods. Of the remaining kittens, half were kept by

225 the feeder, while the others were given away or taken to an animal shelter. Of the females who

226 had litters, 58% were not trapped or taken to a veterinarian after having a litter, remaining free to

227 potentially breed again.

228

229 *Population changes at Santa Clara County Animal Shelters*

230 Changes in dog shelter intakes for Santa Clara County (and the Peninsula Humane

231 Society and SPCA shelter in adjacent San Mateo County for comparison) are shown in Fig. 2.

232 Dog intakes declined 13,643 to 8,441 (38.1%) from 1992-2005 in Santa Clara County in the

233 absence of a widely promoted municipally funded spay/neuter program, indicating that other

234 external factors played an important role in the number of stray and surrendered dogs brought to

235 shelters. An external explanation for the observed trend is supported by the findings in adjacent

236 San Mateo County, where dog intakes declined by a similar 35.7% between 1990 and 2004.

237 These proportions were not significantly different ($p = 0.11$).

238 A substantially different picture emerged when examining changes in cat shelter intakes

239 in Santa Clara and San Mateo Counties (Figs. 3 and 4). Intakes in Santa Clara County dropped

240 22,473 to 16,369 (27.2%) from 1993 to 2004 and 22,473 to 16,807 (25.2%) from 1993 to 2005,

241   compared to a drop of 8,252 to 6,078 (26.3%) in San Mateo County from 1993 to 2004.

242   Although the two proportions were similar, there was an overall decline in annual intakes in

243   Santa Clara County of 6,104 cats to 2004 (509 cats per year) for the 12 year period, compared to

244   2,174 cats in the same 12 year period for San Mateo County (181 cats per year). The absolute

245   changes are economically more germane to counties with respect to shelter expenses because

246   expenditures are based on the per diem cost of maintaining individual cats. The results of the

247   ARIMA projections indicated a higher-than-expected decline in the number of cats being

248   surrendered to the shelters in Santa Clara County during the years when the voucher program

249   was in effect, i.e., 1994-2005 (Fig.5). The ARIMA projections further showed that the observed

250   numbers of cats brought in by the field service did not substantially differ from the expected

251   numbers during the same time period (Fig.6).

252   Under the voucher program, 20,419 cats were surgically sterilized from 1994-2001 and

253   an additional 6,231 cats were sterilized from 2001-2003. While the program was initiated at the

254   end of 1994, public interest did not start until mid-1995, when a local television station and

255   newspaper ran a story about it.

256   The San Jose program was initially free to the public; however, various program changes

257   over time were instituted. Veterinarians were reimbursed at a set fee of $25 female and $15

258   male. Pregnancies could add to the veterinarian reimbursement up to $50, and anatomical issues

259   adjusted the price to as high as $150. In 1996 modifications included requiring a $5 co-pay, and

260   a requirement that cat owners obtain a $5 license and rabies inoculation. While these changes

261   increased the veterinarian reimbursement, they also created a negative effect on the program, as

262   voucher requests declined from 5,600 in the first 16 months of the program to only 2,800 for the

263   year following the changes.

264   The San Jose voucher program ended in 2003, but the county program continued.

265   Utilizing assumptions in Table 1, if no voucher program had been initiated, these cats (assuming

266   that 65% were owned, based on the 2005 survey results) would have produced approximately

267   312,000 kittens between 1994 and 2005, and approximately 8,600 additional cats would have

268   entered (6,200 surrendered and 2,500 brought in by the field service) the shelters in Santa Clara

269   County. This would have incurred an additional cost of approximately $2.15 million, with the

270   HSSV charge to cities for stray cat services under their contract cost of $250 per cat. If the cost

271   per cat for spay/neuter surgery in 2001-2002 ($23.21 average for all surgeries) can be assumed to

272   be constant from 1994-2005, then the expected cost of the HSSV voucher program was

273   approximately $620,000. Thus, the net gain of the program from reducing the number of cat

274   shelter intakes was approximately $1.53 million. Not counted would be the added burden of

275   approximately 44,000 cats to the stray population in the county.

276   However, a different picture emerges if the proportion of owned cats surgically altered

277   under the voucher program varied from the 65% figure utilized above. In fact, the proportion of

278   feral cats actually altered in the program considerably fluctuated: from 77% in 2006 to 82% in

279   2007 to 48% in 2008 (the latter data is from San Jose only). Table 2 provides an estimate of how

280   county cat and shelter populations would be expected to change in the absence of the voucher

281   program under different owned versus feral cat ratios. Under all plausible scenarios, ranging

282   from 20% to 80% of the altered cats being feral, the costs to the shelters would have likely

283   exceeded $2 million over the 12-year life of the program, and at the higher proportion of feral

284   cats the costs would have likely exceeded $6 million.   The savings would be expected to grow

285   over additional years. This underscores that voucher programs have not only had a restraining

286   effect for the population control of unowned cats, but for owned cats as well. Moreover, under

287 all such plausible scenarios the voucher program would have resulted in a net savings in

288 expenditure.

289

290 **Discussion**

291   This study documents the multiple positive impacts publically subsidized low-cost spay

292 and neuter programs can have on animal welfare and society needs. These impacts fulfill

293 societal needs that often go unmet in communities: pet population control, prevention of the

294 proliferation of feral dog and cat populations, reduction of communicable (including zoonotic)

295 disease, slowing the flow of animals into shelters both voluntarily and through field services, and

296 reduction in the incidence of humane destruction of animals. But they also extend to issues

297 presumably of more immediate importance to the economic viability of communities; namely,

298 reduction in capital and ongoing expenditures when the latter are proportional to the number of

299 cats that come under a municipality's immediate jurisdiction and care. In contrast, the

300 implication of cessation of such programs is clear, as can be seen in Figures 2 and 3 when the

301 decline in shelter admissions of dogs and cats became attenuated. The problem can only be

302 exacerbated over time as the human (and hence pet-owning) population increases, as in

303 California counties historically experiencing net population growth.

304   The finding that there were over 15,000 dogs (4.7% of the county's dog population)

305 estimated to be transiently or permanently stray throughout the county is troubling from societal

306 and public health standpoints. The absence of a domestic environment can lead stray dogs,

307 which are by nature gregarious, to form packs that can become aggressive and endanger other

308 animals and even humans. The origin of such a large number of dogs is worthy of further

309 research, as this study did not explore whether these were free-roaming dogs or those kept in

310 temporary foster or rescue care.

311   Specific breed information was not available for dogs in Santa Clara County animal

312 shelters. Respondents claimed 51% of their dogs were registered and unregistered purebred dogs.

313 This stands in contrast to a 1996 national survey that found 30% of dogs relinquished to shelters

314 were purebred (Salman et al., 1998), and the Humane Society of the United States estimates that

315 25-30% of shelter dogs are purebred (The Humane Society of the United States, 2011).

316 Nationally, purebred dogs are substantially less likely to be relinquished to animal shelters than

317 dogs of mixed breed (Salman et al., 1998).

318   The dogs with greatest likelihood of successful adoption from county animal shelters are

319 puppies (with pit bull-like breeds an exception). By the time dogs reach the age of one year,

320 though, their risk of unsuccessful adoption following relinquishment rises considerably; again,

321 particularly true in pit bull-like breeds. Aggressive dog behavior is the primary reason dogs are

322 euthanized at the county shelters. To reduce dog intakes, municipalities should consider how the

323 establishment of free or low cost puppy training programs (potentially mandatory for shelter

324 adoptions) might impact shelter populations. A collaborative effort among multiple community

325 agencies, including animal control, non-profits, and local pet industry businesses should be

326 explored.

327   Another important finding is the enumeration of the substantial unowned cat population

328 in Santa Clara County, two-thirds of which are feral. Also notable is that the majority of

329 unowned cats entering the animal shelters in the study were arguably unsuitable for adoption,

330 with over 50% being feral or unweaned kittens. Such cats are often quickly euthanized.

331 Preventing such input defies simplistic solutions, because although 93% of cat owners were

332 willing to have their own pets surgically sterilized, it is unrealistic to expect the 7% of the

333 population that feeds an average of 3 stray cats to assume the hundreds of dollars necessary to

334 surgically alter these cats.

335   Conversely, the cost of not altering the cats is to add 3.5 kittens per year for each stray

336 female, which at the cost to a shelter of approximately $250 per cat would cost a shelter almost

337 $900 in husbandry expenses for those 3.5 kittens. The underscores why low-cost spay and neuter

338 programs directed to reducing the un-owned and feral cat populations continue to be integral to

339 not only reducing cat mortality at the shelters, but also to managing the cost to the various

340 municipalities to handle and house the stray cats. Santa Clara County's contribution of $45 to

341 alter a stray cat under its separate feral spay/neuter program created , an immediate savings of

342 over $200 for just the first litter that permanently results in non-reproducing cats. The county

343 program also subsidized shots, and for a time, FELV testing. The earlier such cats can be

344 sterilized, the greater the potential savings to municipalities. Moreover, if stray cat-feeding

345 citizens can be convinced through public education to avail themselves of population control

346 options by making them more affordable and they are provided with instructions and resources

347 as to how to accomplish this activity, the savings in costs and lives will be substantial. This

348 study shows approximately 93% of county residents did not make an effort to sterilize unowned

349 cats. Only 5.5% of the unowned but fed cats were surgically sterilized. Efforts should be

350 focused on removing barriers and finding ways to encourage those who feed free-roaming cats to

351 take this important step. Because the study shows that 62% of stray cats are fed in people's

352 yards, efforts should be intensified to sterilize cats living in close proximity to homes, rather than

353 less accessible colonies.

354   This study's limitations include the assumption that the participating individuals are

355   representative of the county's population. Interviews were conducted via telephone, with the

356   non-telephone-owning segment of the county excluded by design, and to the extent that this

357   subgroup differs in their pet ownership and practices the findings cannot be generalized to them.

358   However, calls were made to each zip code in the county, and the number of respondents

359   completing the survey in each zip code, were proportionate to their share of the county

360   population. Although the finding that shelter intake declined in association with the inception of

361   the voucher program, the presence of extraneous (confounding) factors associated both with time

362   and shelter intake cannot be ruled out.

363   In conclusion, this study demonstrates the financial and societal value of instituting a

364   low-cost voucher program on a county-wide scale. Although the parameters utilized in the

365   projections and models in this research (e.g., fecundity and mortality) will vary, perhaps

366   substantially, from county to county, they are realistic and based on published observations. It is

367   therefore likely that the qualitative – if not the precise quantitative -- benefits of the voucher

368   program in Santa Clara County will be of significance if incepted elsewhere.

369

370 **References**

372 Cat Fanciers Almanac. (1994). *National Pet Alliance's Survey Report on Santa Clara County's*

373 *Pet Population*. San Jose, CA: National Pet Alliance.

374 Humane Society of the United States. (2011). Adopting from an Animal Shelter or Rescue

375 Group. Available at

376 http://www.humanesociety.org/issues/adopt/tips/adopting_from_shelter_rescue.html

377 (accessed 12 November 2012).

378 Jemmett JE, Evans JM. 1977. A survey of sexual behavior and reproduction in female cats.

379 *Journal of Small Animal Practice* 18:31–37.

380 Kass PH, New JC, Scarlett JM, Salman MD. 2001. Understanding Animal Companion Surplus in

381 the United States: Relinquishment of Nonadoptables to Animal Shelters for Euthanasia.

382 *Journal of Applied Animal Welfare Science* 4:237-248.

383 Levy JK, Gale DW, Gale LA. 2003. Evaluation of the effect of a long-term trap-neuter-return and

384 adoption program on a free-roaming cat population. [Evaluation Studies]. *Journal of the*

385 *American Veterinary Medical Association* 222:42-46.

386 New JG Jr, Kelch WJ, Hutchison JM, Salman MD, King M, Scarlett JM, Kass PH. 2004. Birth

387 and death rate estimates of cats and dogs in U.S. households and related factors. *Journal*

388 *of Applied Animal Welfare Science* 7:229-241.

389 New JG Jr, Salman MD, Scarlett JM, Kass PH, Vaughn JA, Scherr S, Kelch WJ. 1999. Moving:

390 Characteristics of Dogs and Cats and Those Relinquishing Them to 12 U.S. Animal

391 Shelters. *Journal of Applied Animal Welfare Science* 2:83-96.

392   Nutter FB, Levine JF, Stoskopf MK. 2004. Reproductive capacity of free-roaming domestic cats

393   and kitten survival rate. [Research Support, Non-U.S. Gov't]. *Journal of the American*

394   *Veterinary Medical Association* 225:1399-1402.

395   Pedersen NC. 1991. *Feline husbandry: Diseases and management in the multiple-cat*

396   *environment*. Goleta, CA: American Veterinary Publications.

397   Salman MD, New JG Jr, Scarlett JM, Kass PH, Ruch-Gallie R, Hetts S. 1998. Human and

398   Animal Factors Related to Relinquishment of Dogs and Cats in 12 Selected Animal

399   Shelters in the United States. *Journal of Applied Animal Welfare Science* 1:207-226.

400   Scarlett JM, Salman MD, New JG Jr, Kass PH. 1999. Reasons for Relinquishment of Companion

401   Animals in U.S. Animal Shelters: Selected Health and Personal Issues. *Journal of*

402   *Applied Animal Welfare Science* 2:41-57.

403   Scott KC, Levy JK, Crawford PC. 2002. Characteristics of free-roaming cats evaluated in a

404   trap-neuter-return program. *Journal of the American Veterinary Medical Association*

405   221:1136-1138.

406   State of California. (2009a). Table B-3: Total population of California counties as of July 1.

407   Available at http://www.dof.ca.gov/HTML/FS_DATA/STAT-ABS/Toc_xls.htm (accessed

408   12 November 2012).

409   State of California. (2009b). Table B-5: Population and percent distribution by race and Hispanic

410   origin, California, Census 2000. Available at

411   http://www.dof.ca.gov/HTML/FS_DATA/STAT-ABS/Toc_xls.htm (accessed 12

412   November 2012).

413   U.S. Census Bureau. (2012). State & County QuickFacts. Santa Clara County, California.

414   Available at http://quickfacts.census.gov/qfd/states/06/06085.html (accesssed 12

415   November 2012).

416

417 **Footnotes**

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419 [1] Scientific Telephone Samples, Foothill Ranch, California

Key parameters, their values for owned and unowned cats, and the data sources used in modeling cat population dynamics from 1994 to 2005 if no spay/neuter voucher program had been initiated in Santa C

Parameter	Owned cats	Unowned cats	References
Kittens/litter	4.25	3.6	Pedersen, 1991; Scott et al., 2002
Kitten mortality rate (%)	30	75	Jemmett and Evans, 1977; Nutter et al., 2004; Scott et al., 1978
Life expectancy (years)	12	4.7	Levy et al., 2003; New et al. 2004
Litters per female per year	2.1	1.4	Pedersen, 1991, Nutter et al., 2004; Levy et al., 2003; Scott et al., 2002
Percent female	55	45	Levy et al., 2003
Sexually intact (%)	14	94.5	1993 and 2005 surveys
Surrendered to shelter (%)	3.0	7.3	1993 survey and shelter statistics

Projected impact of hypothetical absence of the 12 year spay/neuter program on cat populations, shelter intake, and municipal cost in Santa Clara County.

Median and the 5th and 95th percentiles (in parentheses) are reported (x $1,000).

Percentage of surgeries performed on owned cats	Additional number of owned cats	Additional number of stray cats	Cats voluntarily surrendered to shelter	Cats brought in by field service	Total additional shelter cat intake	Cost to shelter for additional surrendered and stray cats
20	193	265	6	20	25	$6,333
	(110, 388)	(131, 593)	(3, 12)	(10, 44)	(13, 55)	(3,242, 13,817)
30	226	181	7	13	20	$5,034
	(140, 412)	(98, 367)	(4, 13)	(7, 27)	(11, 40)	(2,867, 9,893)
40	239	124	7	9	16	$4,078
	(159, 398)	(73, 226)	(5, 12)	(5, 17)	(10, 28)	(2,549, 7,089)
50	242	84	7	6	13	$3,351
	(173, 368)	(54, 138)	(5, 11)	(4, 10)	(9, 21)	(2,282, 5,291)
60	241	55	7	4	11	$2,823
	(180, 342)	(38, 85)	(5, 10)	(3, 6)	(8, 17)	(2,035, 4,135)
70	236	35	7	3	10	$2,411
	(182, 319)	(25, 50)	(5, 10)	(2, 4)	(7, 13)	(1,814, 3,324)
80	231	20	7	1	8	$2,099
	(182, 303)	(15, 27)	(5, 9)	(1, 2)	(6, 11)	(1,625, 2,792)

Figure 1

Source of acquisition of dogs from Santa Clara County survey, 2005.
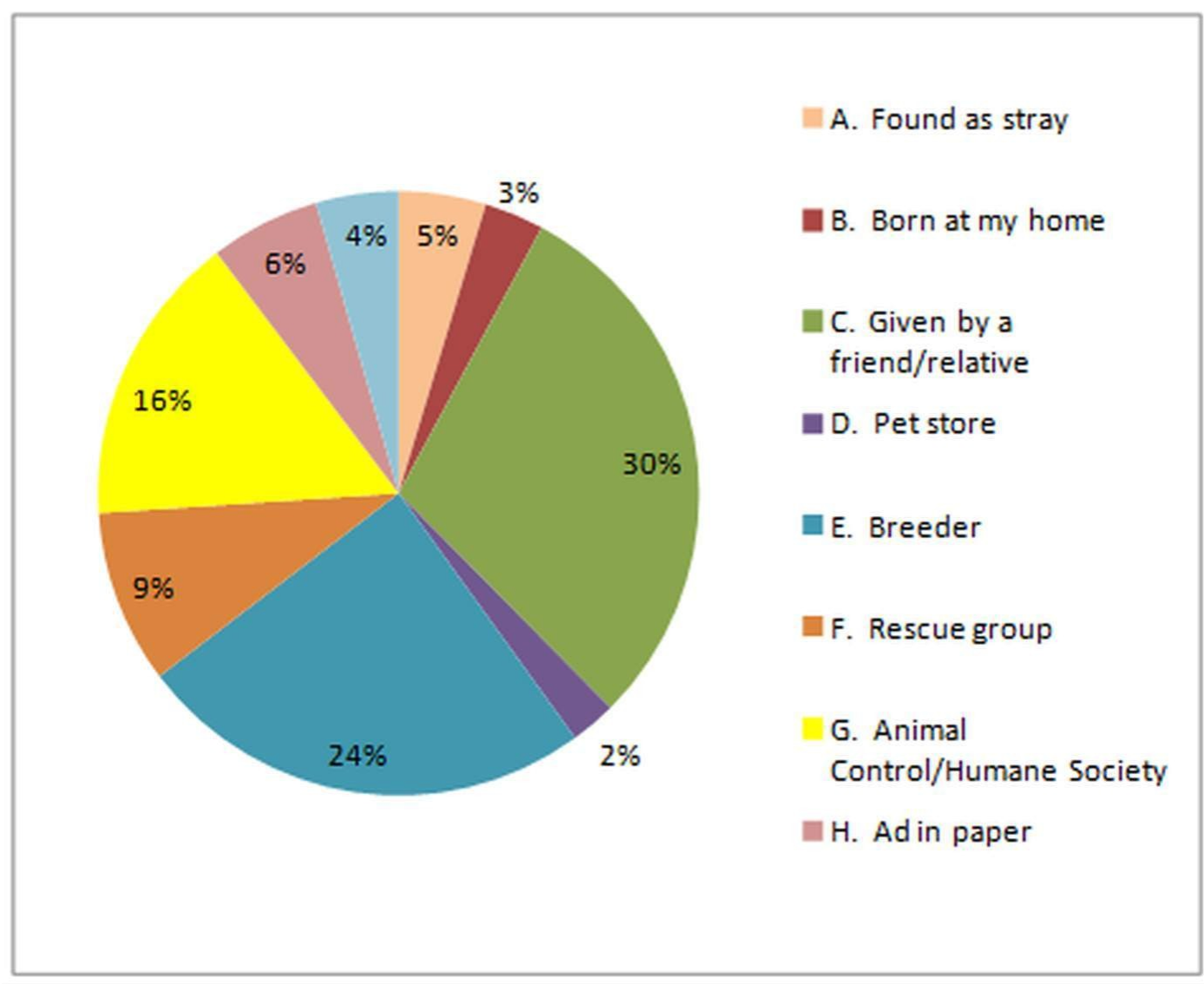
Figure 2

Regression analysis of intake of dogs at shelters in Santa Clara County (r = 0.95) and San Mateo County (r = 0.97) over time (1990 – 2005).
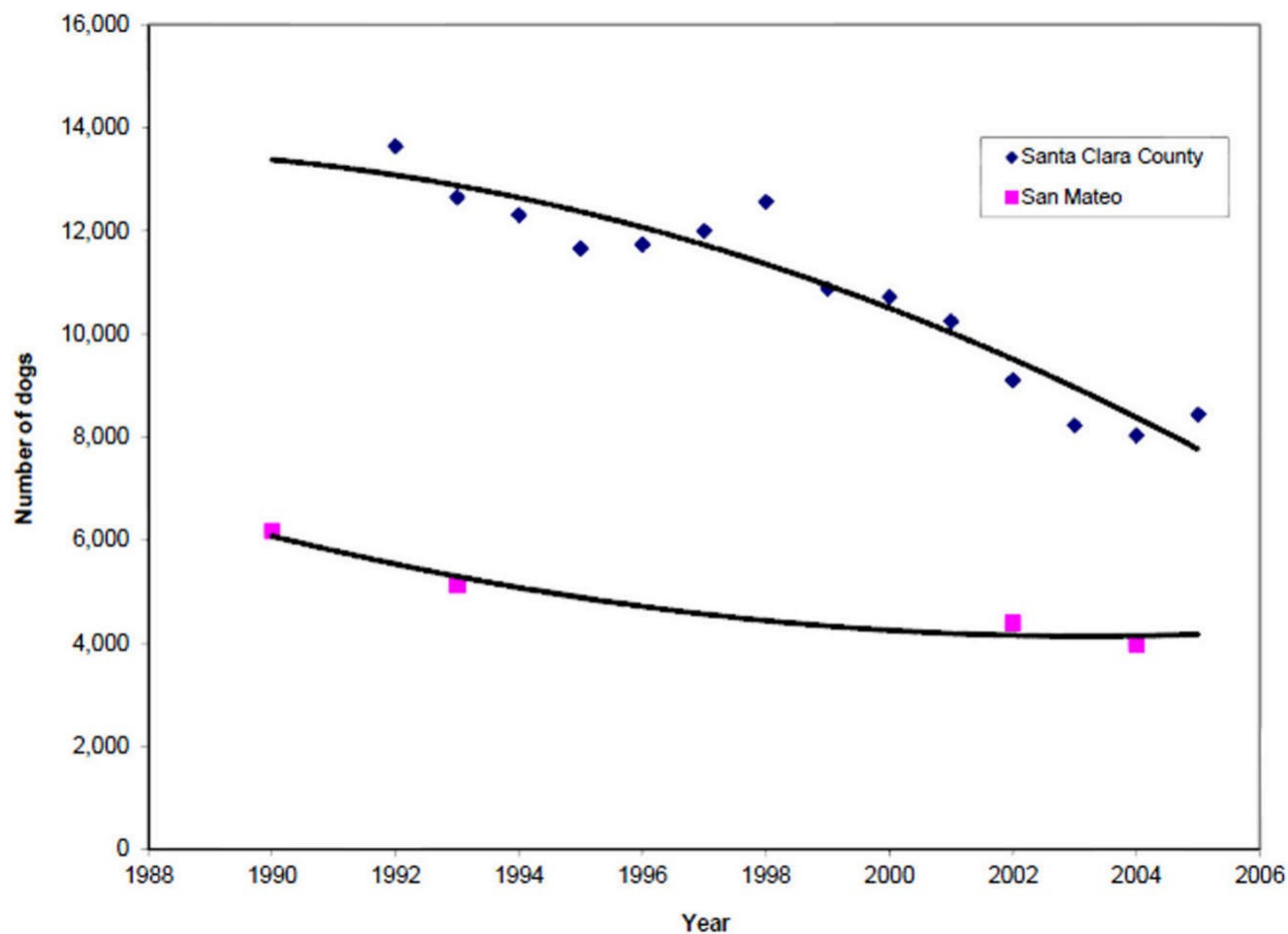
Figure 3

Secular changes in cat intakes in Santa Clara County, 1982 – 2007, indexed by historically relevant events.

SC = Santa Clara; SJ = San Jose; S/N = spay/neuter voucher program.
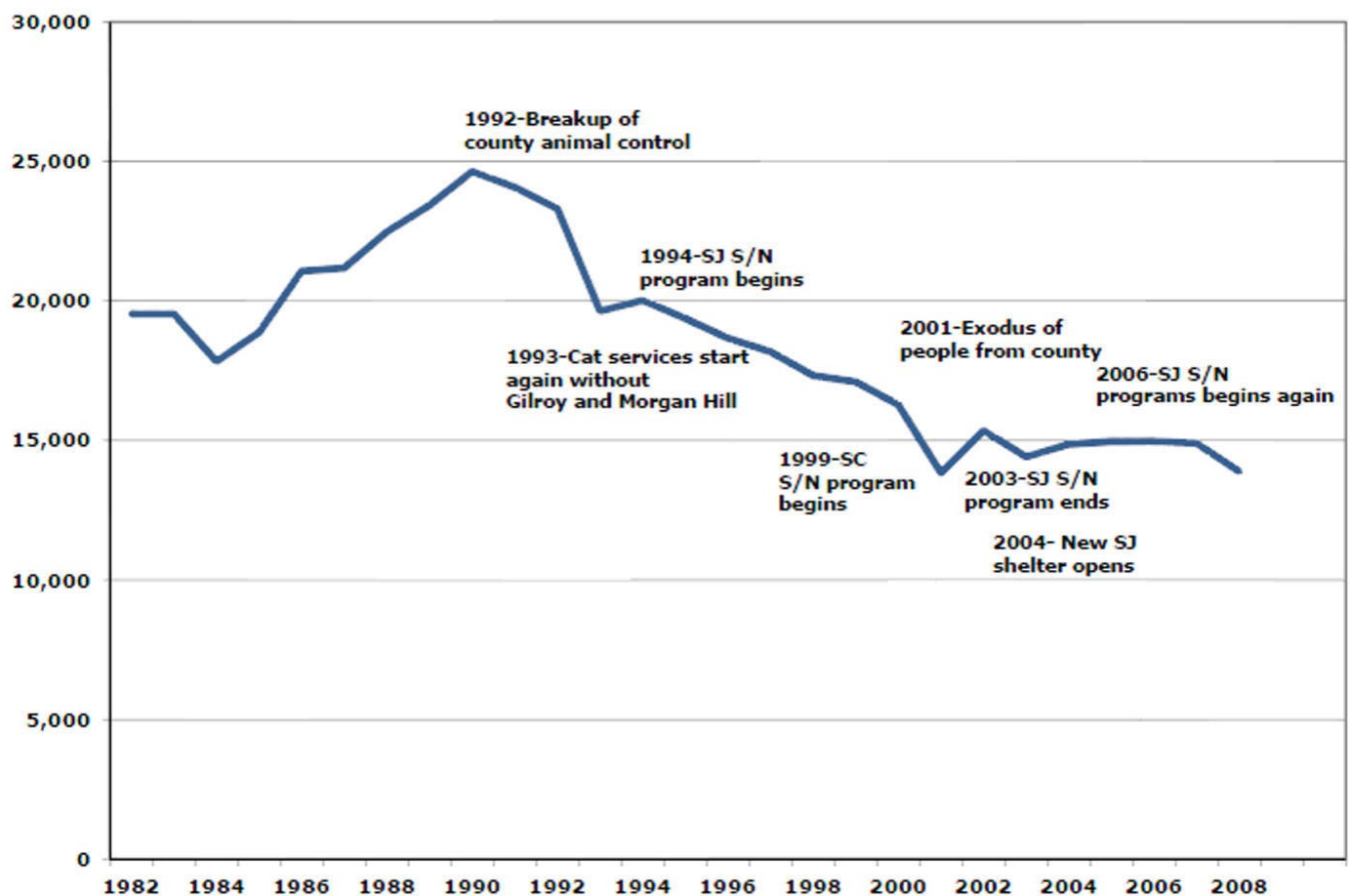
Figure 4

Regression analysis of intake of cats at shelters in Santa Clara (r=0.98) and San Mateo Counties (r>0.99), 1990 – 2006.

Field services in Santa Clara County ended in 1992; at that time 60% of cats were brought in through field services. Field services resumed in November 1993 in some cities.
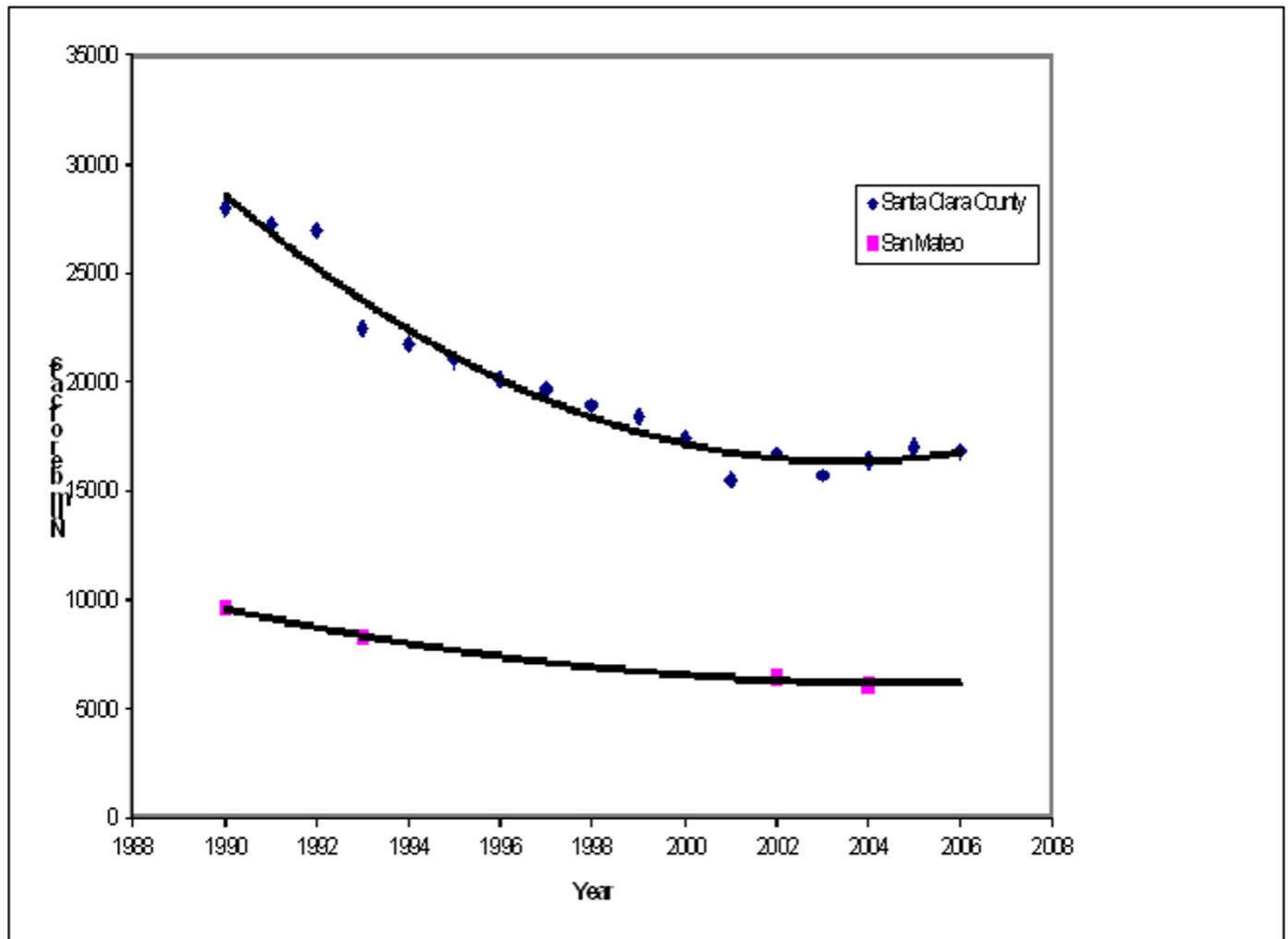
Figure 5

Observed numbers of cats surrendered to the shelters in Santa Clara County versus autoregressive integrated moving average (ARIMA) projected numbers of surrendered cats.

Figure uses the 1982-1993 data (before the launch of the spay/neuter voucher program) shelter data. The lower (LCL) and upper (UCL) 95% confidence limits of the ARIMA projection are also presented.
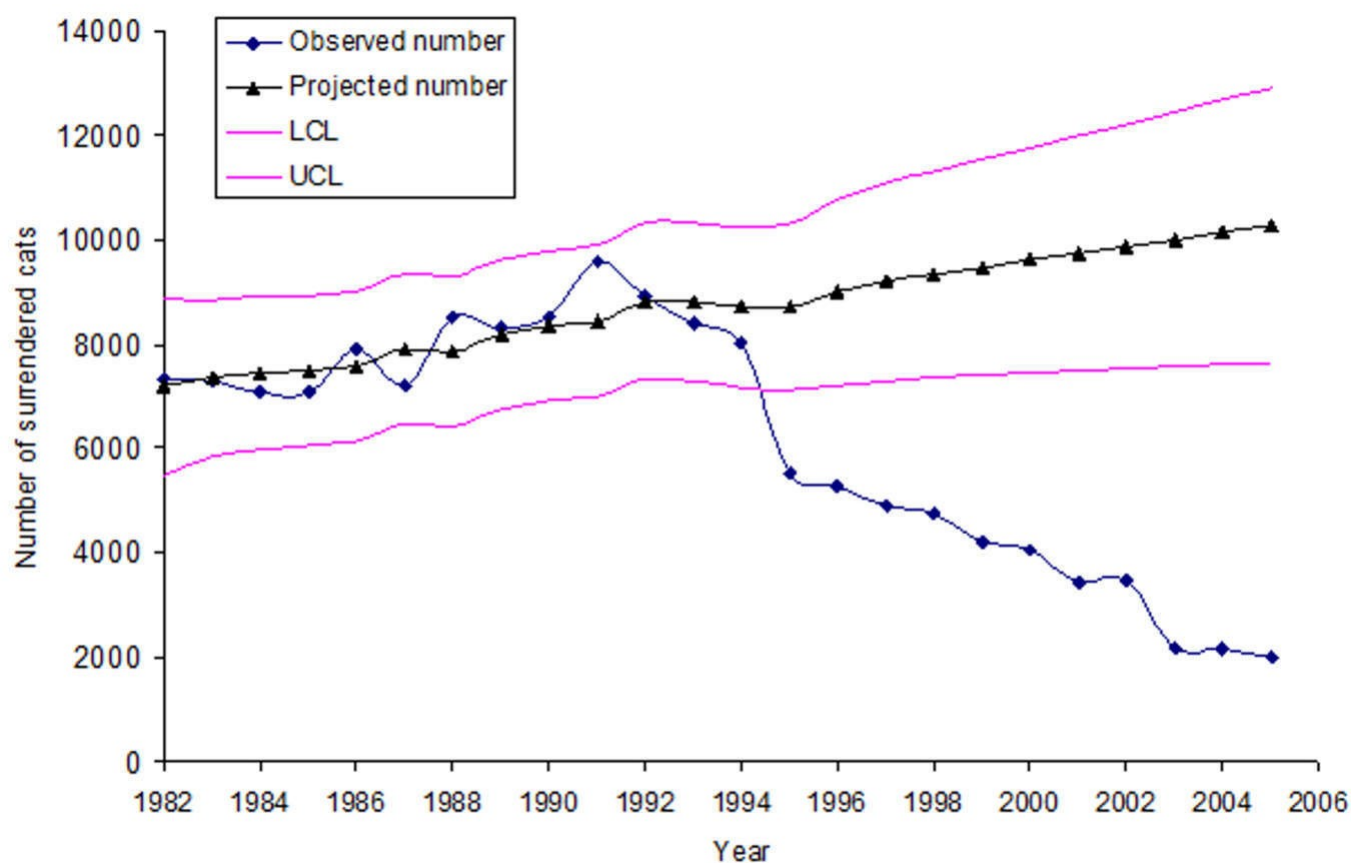
Figure 6

Observed numbers of cats brought to the shelters in Santa Clara County by the field service versus the autoregressive integrated moving average (ARIMA) projected numbers of cats.

Figure shows cats brought in by field service using the 1982-1993 (before the launch of the spay/neuter voucher program, shelter data). The lower (LCL) and upper (UCL) 95% confidence limits of the ARIMA projection are also presented.