

**Availability and Use of Nonlead Rifle Cartridges and Nontoxic Shot for Hunting in California, with
Reference to Regulations used in Various Jurisdictions**

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Survey of California Ammunition Retailers to Assess Availability of Nonlead Ammunition

**Dr. Vernon G. Thomas, Professor Emeritus
Department of Integrative Biology
College of Biological Science
University of Guelph, Guelph, Ontario N1G 2W1, Canada.**

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**Contact Information:
E-mail: ythomas@uoguelph.ca
Tel.: 1 519 824 4120 Ext 52738**

About the Author

Dr. Vernon George Thomas was educated at Oxford from 1963-66, earning a BA degree in Physiology, Psychology, and Philosophy. He obtained his PhD degree in Ecology in 1975 at the University of Guelph, and was then hired as a professor to be part of the Wildlife Management Program. His teaching and research specialities at the graduate and undergraduate levels included Wildlife Management, Natural Resources Policy, Ornithology, Mammalogy, Ecology, and Developmental Biology. He retired in 2010, but remains at the University as a Professor Emeritus. His main research focus in later years has been the transfer of science to environmental policy and law, especially in protected areas creation, invasive species control, reducing environmental contamination from lead, and promoting use of managed pollinators in agriculture and biodiversity conservation. He has worked, and continues to work, internationally in all these areas. One of his specialities is the presentation of briefs to parliamentary committees in Canada, Europe, and the USA. His research has influenced, directly, the amendment of Canadian federal law, as in the case of The Parks Act being revised to require lead-free fishing weights in all National Parks, and the introduction of mandatory ballast water exchange regulations for shipping under the National Transportation Act. He has worked with industry on the development and toxicological evaluation of the lead shot substitutes Tungsten Matrix and Tungsten Bronze, both of which received unconditional approval for use in waterfowl hunting in the USA and Canada.

Dr. Thomas has published many papers concerning lead ammunition, policy reform, and availability of nonlead alternatives including:

Thomas, V.G. 2013. Lead-free hunting rifle ammunition: product availability, price, effectiveness, and role in global wildlife conservation. *AMBIO*. 42: 737-745.

Thomas, V.G. and Guitart, R. 2013. Transition to non-toxic gunshot use in Olympic shooting: policy implications for IOC and UNEP in resolving an environmental problem. *AMBIO*. 42: 746-754.

Thomas, V.G. and Guitart, R. 2010. Limitations of European Union policy and law for regulating use of lead shot and sinkers: comparisons with North American regulation. *Environmental Policy and Governance* 20: 57-72.

Thomas, V.G., Roberts, M.J. and Harrison, P.T.C. 2009. Assessment of the environmental toxicity and carcinogenicity of tungsten-based shot. *Ecotoxicology and Environmental Safety* 72: 1031-1037.

Thomas, V.G. and McGill, I. R. 2008. Dissolution of copper, tin, and iron from sintered tungsten-bronze spheres in a simulated avian gizzard, and an assessment of their potential toxicity to birds. *Science of the Total Environment* 394: 283-289.

Thomas, V.G. and Guitart, R. 2003. Evaluating non-toxic substitutes for lead shot and fishing weights: criteria and regulations. *Environmental Policy and Law* 33: 150-154.

Executive Summary

The enactment of Assembly Bill 711 (“AB 711”) in 2013 created a prohibition on the use of lead ammunition to take wildlife in California by no later than July 2019. Finding (i) of AB 711 states: “[g]iven the deleterious impacts of lead ammunition, regulations for the use of nonlead ammunition should be implemented as soon as practicable in California. The Fish and Game Commission (“the Commission”) should implement the requirement for the use of nonlead ammunition incrementally, if practicable, to provide for increasing protection from lead exposure until full compliance with the nonlead ammunition requirement is achieved.” AB 711 formally amended Fish and Game Code Section 3004.5 to add subsection (i), which reads: “The commission shall promulgate regulations by July 1, 2015, that phase in the requirements of this section. The requirements of this section shall be fully implemented statewide by no later than July 1, 2019. If any of the requirements of this section can be implemented practicably, in whole or in part, in advance of July 1, 2019, the commission shall implement those requirements. The commission shall not reduce or eliminate any existing regulatory restrictions on the use of lead ammunition in California condor range unless or until the additional requirements for use of nonlead ammunition as required by this section are implemented.”

Governor Brown’s signing message for AB 711 additionally asked the Commission “to consider and act on any and all options for facilitating the least disruptive phase-in.” At the January 2014 meeting of the Fish and Game Commission’s Wildlife Resources Committee, the California Department of Fish and Wildlife (“the Department”) proposed a draft implementation schedule, and as part of that indicated uncertainty around the availability of nonlead ammunition in California.

This report was prepared at the request of the sponsors of AB 711 (Audubon California, Defenders of Wildlife and The Humane Society of the United States), who commissioned me to conduct research on the availability of nonlead ammunition in California as relates to the wildlife species taken in the state. This report also offers my expert opinion, based on my research, about the ability of the Commission to adopt a non-disruptive implementation schedule that is consistent with AB 711’s emphasis on protecting against the adverse impacts of ongoing dispersal of lead from ammunition as soon as practicable.

The term “availability” has several relevant components. Market availability refers to whether a given product is made and distributed. Retail availability refers to whether a given product is able to be purchased in a given location, whether online, or over-the-counter in a retail store. Economic availability refers to whether a given product is available to the public at a competitive price, in this case, relative to that of comparable lead shot cartridges.

1. Nontoxic shot cartridges are already being used to hunt upland game species in 34 US states, including California.
2. Four types of federally-approved nontoxic shot cartridges are commercially available for hunting upland game and non-game species. Steel shot cartridges are widely available and are stocked in many small retail stores. They cost about the same as their lead shot cartridge equivalent. The more expensive Tungsten-Matrix, HEVI-Shot, and RST Nice Shot cartridges are readily available online, but less available in retail stores.
3. Precedents exist for the complete adoption of nontoxic shot cartridges for hunting upland game at the international (Denmark and The Netherlands) and state levels (South Dakota).
4. Given the above, and the extent of existing nontoxic shot regulations in California, there is no reasonable barrier to the state extending these regulations to upland game hunting on all state and private lands in 2015-2016.

5. Five major US companies already produce nonlead rifle ammunition in more than 48 different calibers that are readily available online and in major sporting/hunting goods stores in California. These calibers include those suitable for hunting all species of California big game.
6. Given the current product availability, retail availability, and economic availability of nonlead rifle ammunition, there is no reasonable barrier to California regulating the use of such ammunition for big game hunting on all state and private lands in 2015-2016.
7. The availability of shotgun and rifle ammunition at the local retail level is heavily influenced by the date of entry of a regulation. It is not good economic sense for store owners to stock different lines of nontoxic ammunition in addition to lead ammunition lines years before they are required by law. Similarly, ammunition makers will ramp up production and distribution only in time to meet the date of entry of a law. A 1.5-2 year transition period is adequate to allow industries to increase production and for their products to become more widely available. It is also a reasonable time interval for hunters to adjust to the widening of a new regulation requiring use of nonlead ammunition.

Preface. Definitions used in report.

The term “availability” has several relevant components. Market availability refers to whether a given product is made and distributed. Retail availability refers to whether a given product is able to be purchased in a given location, whether online, or over-the-counter in a retail store. Economic availability refers to whether a given product is available to the public at a competitive price, in this case, relative to that of comparable lead ammunition.

The term “nontoxic” is used in reference to shotgun ammunition, as defined by the U.S. Fish and Wildlife Service, and the term “nonlead” is used in reference to rifle ammunition and ammunition in general, as defined by California law, AB 711.

I. Availability of Nontoxic Shot and Nonlead Bullet Ammunition

A. Nontoxic shot cartridges are readily available.

The four types of nontoxic shot listed in Tables 1 and 2 are manufactured in the USA by American companies, and so are able to be distributed to California dealers and residents.

Table 3 indicates that the four types of nontoxic shot are readily available online to California residents and throughout the USA. Steel shot has been required for hunting waterfowl in California since 1991, and so is readily available to residents from the usual gun/hunting/sporting stores. This would apply to cartridges in both 12 and 20 gauge, and in shot loadings and shot sizes appropriate for hunting all species of mammals and upland bird species in California. Steel shot cartridges are now sold at a price comparable with equivalent lead shot cartridges, so there is no economic penalty associated with steel shot adoption for hunting mammals and upland birds. Furthermore, hunters’ experiences with using steel shot cartridges for hunting waterfowl, should predispose them to using the same type of nontoxic shot for hunting mammals and upland bird species.

The cartridges containing Tungsten-Matrix shot, HEVI-Shot, and Nice Shot do not have the same market share as steel shot. Moreover, the much higher cost of tungsten compared to steel means that the retail cost of such cartridges is higher. There is thus an economic factor reducing the availability of these three brands of nontoxic ammunition. However, for those hunters prepared to pay for these brands, there is ready retail availability via online purchases. There would be a reduced retail availability of these products (compared to steel shot cartridges) in small-scale hunting/gun stores, especially in the absence of regulated demand.

Hand-loading of shotshells is a common practice in the USA. Table 3 indicates that bulk steel shot is widely available in the USA, both online and in retail stores, and in shot sizes that hunters would use to hunt different species of mammals and upland birds. Bulk quantities of HEVI-Shot and Tungsten-Iron shot are readily available online from at least one US dealer. Tungsten-Matrix shot is not sold as bulk shot for hand-loaders.

Cartridges in 16, 28, and .410 are used by a much smaller number of hunters, and this much lower potential demand greatly influences the availability of these cartridge sizes, especially in over-the-counter retail situations. However, they are readily available online from either the makers or the principal dealers.

Hunters who use shotguns in 16, 28, gauge and .410 bore comprise a very small proportion of the hunting public, and so the retail demand, even for lead shot cartridges, is low, and retail prices reflect this economic reality. Tables 1 and 2 indicates that HEVI-Shot is made for 16, 28, gauge and .410 bore guns, and that RST Nice shot is produced for 16 and 28 gauge guns. Thus, nontoxic shot cartridges for these gauge guns are readily available online, but only through a small number of large-scale stores specialized in guns, hunting, and shooting in California. Many hunters who prefer these less common gauge guns also hand-load to reduce cost. Two brands of nontoxic shot are readily available online for such shooters. There is a substantial pressure problem encountered when steel shot is fired from 28 gauge and .410 shotshells, so there is virtually no steel shot cartridge brands available in these gauges. It is possible to use steel shot safely in 16 gauge shotshells, but the market for such a gauge is small, and so it is not economical for the industries to market steel shot cartridges in this gauge.

Table 1. A list of nontoxic shot cartridges available for hunting upland game species of birds and mammals in California. A + indicates that the type of nontoxic shot is appropriate for that species.

Shotshell gauge/caliber manufactured	Types of nontoxic shot			
	Steel shot ¹	Tungsten-Matrix ²	HEVI-Shot ³	RST Nice Shot ⁴
	10, 12, 20 ga	10,12, 20 ga	10,12,16, 20, 28, .410	10,12, 16, 20, 28
GAME SPECIES				
Ring-necked Pheasant <i>Phasianus colchicus</i>	+	+	+	+
Quail <i>Callipepla californica</i> <i>C. gambelii</i> <i>Oreortyx pictus</i>	+	+	+	+
Chukar Partridge <i>Alectoris chukar</i>	+	+	+	+
Sage Grouse <i>Centrocercus urophasianus</i>	+	+	+	+
Ruffed Grouse <i>Bonasa umbellus</i>	+	+	+	+
Blue Grouse <i>Dendragopus obscurus</i>	+	+	+	+
White-tailed Ptarmigan <i>Lagopus leucurus</i>	+	+	+	+
Turkey <i>Meleagris gallopavo</i>	+	+	+	+
Mourning Dove <i>Zenaida macroura</i>	+	+	+	+
White-winged Dove <i>Zenaida asiatica</i>	+	+	+	+
Band-tailed Pigeon <i>Columba fasciata</i>	+	+	+	+
Exotic species of doves & pigeons	+	+	+	+
Snipe <i>Gallinago gallinago</i>	+	+	+	+
American Crow <i>Corvus brachyrhynchos</i>	+	+	+	+

Shotshell gauge/caliber manufactured	Types of nontoxic shot			
	Steel shot ¹	Tungsten-Matrix ²	HEVI-Shot ³	RST Nice Shot ⁴
	10, 12, 20 ga	10,12, 20 ga	10,12,16, 20, 28, .410	10,12, 16, 20, 28
GAME SPECIES				
Tree Squirrel <i>Tamiasciurus sp</i> <i>Sciurus sp</i>	+	+	+	+
Hares <i>Lepus californicus</i> <i>L. townsendii</i> <i>L. alleni</i> <i>L. americanus</i>	+	+	+	+
Rabbit <i>Sylvilagus sp</i>	+	+	+	+

Table 2. A list of nontoxic shot cartridges available for hunting non-game species of birds and mammals in California. A + indicates that the type of nontoxic shot is appropriate for that species.

Shotshell gauge/caliber manufactured	Types of nontoxic shot			
	Steel shot ¹	Tungsten-Matrix ²	HEVI-Shot ³	RST Nice Shot ⁴
	10, 12, 20 ga	10,12, 20 ga	10,12,16, 20, 28, .410	10,12, 16, 20, 28
NON-GAME SPECIES				
English Sparrow <i>Passer domesticus</i>	+	+	+	+
Starling <i>Sturnus vulgaris</i>	+	+	+	+
Weasels <i>Mustela frenata</i>	+	+	+	+
Skunks <i>Mephitis mephitis</i> <i>Spilogale gracilis</i>	+	+	+	+
Opossum <i>Didelphis virginiana</i>	+	+	+	+

¹ Principal American steel shot cartridge makers: Kent-Gamebore, Federal, Remington, and Winchester. Principal foreign imported makers are Fiocchi and Rio.

² Tungsten-Matrix (tungsten-plastic) shot made by Kent-Gamebore, West Virginia, USA. Web site: <http://kentgamebore.com>

³ Tungsten-metal alloy shot made by HEVI-Shot, Oregon, USA. Web site: <http://www.hevishot.com>

⁴ Tungsten-metal alloy shot (Envirometal) loaded into cartridges by RST Classic Shotgun Co. Ltd., Pennsylvania, USA. Web site: <http://www.rstshells.com>. This company makes nontoxic shot cartridges in 2.5 inch length in 12, 16, and 20 gauges for older, European shotguns.

Table 3. Market availability of nontoxic shot types to hunters in USA. Cartridges in 12 and 20 gauge constitute the vast majority of cartridges used by most hunters.

Type of nontoxic shot cartridge	Available online from maker/supplier	Available in retail stores
Steel shot cartridges	Readily available from many online dealers across USA, and in CA	Widely and readily available in CA retail stores
Tungsten-Matrix shot cartridges	17 online dealers across USA	Available from larger CA retail hunting/sporting goods stores
HEVI-Shot cartridges	10 online dealers, plus maker	Over 80 retail dealers across the USA; Available in 6 retail stores in CA
RST Nice Shot cartridges	Many online dealers in 22 USA states	Available from many specialized retail stores. No retail presence established yet in CA
Bulk nontoxic (Tungsten-Iron) shot for hand-loading shotgun cartridges: ITX shot density 10.0g/cc Shot sizes 2, 4, 6 ITX shot density 13.0g/cc Shot sizes 2,4, 6	Available online from Ballistic Products, Minnesota, USA http://www.ballisticproducts.com	Unclear
Bulk nontoxic HEVI-Shot (Tungsten-Nickel-Iron) for hand-loading cartridges. Shot sizes 2,4,5,6,7.5, 9	Available online from Ballistic Products	Unclear
Bulk nontoxic steel shot for hand-loading cartridges. Shot sizes 4,5,6,7,8	Available online from Ballistic Products and many other outlets	Readily available from gun/shooting stores

B. Nonlead rifle bullets and nontoxic shotgun slugs are available and comparable in price to high-quality lead-core rifle bullets.

The first lines of nonlead bullets were made in the USA to generate the most reliable and effective big game hunting ammunition, rather than to create ammunition that did not contain toxic lead cores. Consequently, they were used by hunters who required the best quality rifle ammunition for trophy hunting, but their use spread quickly, based on favorable reports from hunters and hunting magazine writers. A major endorsement of the high quality and effectiveness of copper bullets came in 2012, when the National Rifle Association gave the VOR-TX line of Barnes Bullets its best product of the year award. Further endorsement of copper bullets’ effectiveness is provided by the major US ammunition maker, Federal, loading its own lines of nonlead ammunition with Barnes copper bullets.

In California, passage of the Ridley-Tree Condor Preservation Act in 2007 created the first regulated market for nonlead rifle ammunition, when used for hunting in the habitats of California condors (*Gymnogyps californianus*). Thus, there is already an established market for this product. The product availability of nonlead rifle and shotgun slug ammunition is assured by at least five US manufacturers who sell their products throughout the continental USA, including California. The retail availability is presently assured through online sales of nonlead ammunition either via the manufacturers or their major distributors (Table 4). For example, the online US distributor/retailer Cheaperthandirt (www.cheaperthandirt.com) lists 48 different nonlead bullet rifle cartridges for sale on its website. Similarly, the US online retailer Corbon/Glaser (www.corbon.com) lists 44 different nonlead bullet rifle cartridges on its website. This large array of rifle calibers and cartridge configurations includes the most modern, most common, and less-common cartridges used by US hunters. Moreover, the listed 44-48

calibers include all of those that can be used confidently to hunt Californian big game species (Thomas 2013).

The availability of nonlead bullets to hand-loaders is assured by the large array of bullet calibers and bullet weights in each caliber available online from the major US manufacturers (especially Barnes Bullets), as well as through major sporting/hunting retail stores such as Cabela's Inc. (Thomas 2013). The same statement applies equally to copper bullets for muzzle loading rifles and copper slugs used by shotgun hunters pursuing wild pigs and/or bears.

The economic availability of nonlead rifle ammunition is about the same as high quality lead-core bullet ammunition. This was shown in detail by Thomas (2013) who compared the prices of comparable lead-core and nonlead rifle ammunition made by major US companies and retailed online by Cabela's Inc. Where higher prices for nonlead products existed, they were not of such magnitude as to prohibit purchase of nonlead ammunition by hunters. As Table 2 in Thomas (2013) showed, for many products there were no price differences in the products offered online. Thus, there is no economic barrier to the use of nonlead rifle ammunition in California, especially when purchased online.

Over the counter retail availability is determined, largely, by local demand and this responds to regulations requiring use of nonlead products. However, given the existing requirement for nonlead rifle ammunition in California, and the ability of hunters to back-order products from specialized retail stores, nonlead ammunition is reasonably available to hunters who do not use online purchasing.

Table 4. Market availability of nonlead rifle bullets and shotgun slugs to hunters in continental USA.

Type of nontoxic projectile	Available online from maker/supplier	Available in retail stores
Center-fire rifle cartridges with nonlead bullets	Readily available in at least 48 different rifle calibers and cartridge designations	Common rifle calibers available from large retail hunting/gun stores
Bulk sales of nonlead bullets for hand-loaders	Readily available in all regular rifle calibers, from makers (e.g., Barnes Bullets) and their distributors	Available from specialized hunting and gun stores, especially through back orders from US makers
Muzzle-loading rifle nonlead bullets	Readily available from leading US makers (e.g., Remington Arms and Barnes Bullets) and their distributors	Available from specialized hunting and gun stores, especially through back orders from US makers
Shotgun copper slug cartridges in 12, 16, & 20 gauge	Readily available from leading US makers and their distributors	Available from specialized hunting/gun stores, especially through back orders from manufacturers

II. Use of Nonlead Ammunition for Hunting in California

A. Nontoxic Shot is Available and Appropriate for Hunting Upland Game and Non-game Species in California.

It is possible for all species of upland birds and mammals to be hunted successfully with different types of nontoxic shot ammunition. California's upland game birds range in size from turkeys to quail and snipe. There are suitable types of nontoxic shot in different gauges of cartridges for hunting this entire range of game (Tables 1 and 2). While most of the types of nontoxic shot cartridges have been developed for the

hunting of waterfowl, some parties in the industry have recently developed lines of cartridges more suited to the hunting of upland game (Thomas 2009). Most of the upland game species tend to be shot at closer ranges than many waterfowl species, so shot type's ballistic performance at ranges over 40 yards tends not to be an issue, especially for steel shot. Tungsten-Matrix, HEVI-shot, and RST Nice Shot have a shot density approximating that of commercial lead shot, so ballistic performances are not a realistic issue.

Nontoxic types of cartridges developed for waterfowl hunting have to perform successfully against the heavy feather coverings and fat-laden thick skins of geese and ducks. Most of the upland game species have thinner skins and are not as fat as waterfowl in the fall months, so penetrance of the shot into the vital regions of the body is facilitated.

Of particular note is the listing by RST Nice Shot that their ammunition comes in shorter 2^{1/2} inch cartridge lengths for older European guns not suited to the higher pressures of the more common 2^{3/4} inch cartridges. This could assuage the concerns of hunters who own older, lighter guns for upland game hunting that ammunition suited to their guns is not available.

Non-game species, such as starling, weasels, skunks, opossum, and rodents, are often shot as nuisance or pest animals, and often at close distances. Moreover, the non-game mammals listed in Table 2 can also be killed with small-caliber nonlead rifle ammunition, as listed in Table 5.

The four nontoxic shot types are all U.S. Fish and Wildlife Service-approved for the hunting of waterfowl and coots in the USA, and so are nontoxic to these upland game species (Table 1). A + in the table indicates that the shot type is available in the cartridge gauge, length, shot load, and shot sizes appropriate for the successful hunting of each species. Bismuth-tin and Tungsten-bronze shot cartridges are not listed in the table because these products are no longer available commercially. The Spanish company Rio, has announced that it intends (late 2013) to distribute cartridges made with bismuth-tin alloy shot in different gauges in the USA. Table 1 lists those products both made and approved in the USA. The retail availability in California varies with the shot type, steel shot being the most widely and readily available.

B. Nonlead Rifle Cartridges Are Available and Appropriate for Hunting Big Game in California.

American ammunition makers are world leaders in the development and manufacture of nonlead rifle bullets and cartridges. Five US companies (Barnes Bullets, Hornady, Nosler, Remington, and Winchester) dominate the US and international markets. The large US company, Federal, produces lines of rifle cartridges made with Barnes nonlead bullets. European, South African, and Australian companies also make nonlead bullets and export their products to the USA in the commonly-used calibers (Thomas 2013).

The species of Californian big game mammals (black bears, deer, wild pigs, elk, pronghorn antelope and bighorn sheep) can all be killed effectively with nonlead rifle bullets or shotgun slugs (Table 5). Nonlead center-fire rifle ammunition appropriate for hunting these species is made in a wide range of calibers, bullet weights and types, and cartridge designations (e.g., .270 Winchester and .270 Weatherby). Nonlead bullets made by the above companies are also sold in bulk for the benefit of hand-loaders. Hunters who use muzzle-loading rifles can use pure copper bullets made in all of the common rifle calibers and bullet weights. Pure copper slugs are made by the leading US ammunition makers for use in 12, 16, and 20 gauge shotguns (Thomas 2013). Such projectiles may be used when hunting deer, bears and wild pigs at

short distances, but are not appropriate for hunting elk, pronghorn antelope, bighorn sheep, and any other species at long ranges.

The acceptance of the effectiveness of copper bullets in killing game has been addressed in Thomas (2013). As an example of the quality and effectiveness of copper bullets, the US National Rifle Association awarded Barnes Bullets of Utah the 2012 American Hunter Ammunition Product of the Year Golden Bullseye Award for its VOR-TX line of nonlead ammunition (Thomas 2013).

The non-game species coyotes and feral goats can be hunted effectively with a range of nonlead bullet cartridges in both center-fire and muzzle-loading calibers. The other small mammal non-game species listed in Table 5 are often controlled as nuisance animals at short distances. Nonlead ammunition is readily available as rim-fire .22 caliber bullets for such purpose, as is nonlead center-fire ammunition in the calibers .17, .22 Hornet, and .222/.223.

The furbearing species, badger, gray fox, muskrat, mink, beaver, and raccoon are normally taken by licensed trappers with approved humane traps. However, such animals may also be dispatched with bullets, and nontoxic non-expanding (solid) bullets in small calibers are made in the USA for this purpose, so as not to damage the pelt of the trapped animal. This category of nonlead ammunition is not made for other types of game hunting involving “fair chase.” Because of the restricted market for this category of ammunition, its availability is, understandably, less than types of expanding nonlead rifle ammunition devised for game hunting.

Table 5. Market availability of nonlead rifle ammunition and nontoxic shotgun slugs for effective use on species of California big game, non-game, and furbearing species. A + indicates that nonlead rifle bullets are made in calibers, bullet weights, and cartridge designations suitable for taking each species. The term “Inappropriate” means that the bullet/slug is not suited to longer range shooting for the species, or that it is too large and destructive for that species.

GAME SPECIES	Center-fire rifle ammunition	Muzzle-loading rifle ammunition	Shotgun slugs in 12, 16 & 20 gauge
Black Bear <i>Ursus americanus</i>	+	+	+
Wild Pig <i>Sus scrofa</i>	+	+	+
Deer species	+	+	+
Desert Bighorn Sheep <i>Ovis canadensis</i>	+	+	Inappropriate
Elk <i>Cervus elaphus</i>	+	+	Inappropriate
Pronghorn Antelope <i>Antilocapra americana</i>	+	+	Inappropriate

NON-GAME SPECIES	Center-fire rifle ammunition	Muzzle-loading rifle ammunition	Shotgun slugs in 12, 16 & 20 gauge
Bobcat <i>Lynx rufus</i>	+	+	+
Coyote <i>Canis latrans</i>	+	+	Inappropriate
Feral Goats <i>Capra hircus</i>	+	+	Inappropriate
Weasels <i>Mustela frenata</i> <i>Mustela ermine</i>	+	Inappropriate	Inappropriate
	.17 Cal or .22 Cal Rimfire		
Skunks <i>Mephitis mephitis</i> <i>Spilogale gracilis</i>	+	Inappropriate	Inappropriate
	.17 Cal or .22 Cal Rimfire		
Opossum <i>Didelphis virginiana</i>	+	Inappropriate	Inappropriate
	.17 Cal or .22 Cal Rimfire		
Moles and Rodents	+	Inappropriate	Inappropriate
	.17 Cal or .22 Cal Rimfire		
FURBEARERS			
Badger <i>Taxidea taxus</i>	+	Perhaps inappropriate	Inappropriate
Gray Fox <i>Urocyon cinereoargenteus</i>	+	Perhaps inappropriate	Inappropriate
Muskrat <i>Ondatra zibethicus</i>	+	Inappropriate	Inappropriate
Mink <i>Neovison vison</i>	+	Inappropriate	Inappropriate
Beaver <i>Castor canadensis</i>	+	Inappropriate	Inappropriate
Raccoon <i>Procyon lotor</i>	+	Inappropriate	Inappropriate

III. Regulatory Precedents for Use of Nontoxic Shot for Upland Hunting in Other Jurisdictions

International precedents

Denmark and The Netherlands. Both nations banned the use of lead shot for all types of wetland and upland hunting. Nontoxic shot is required by law in both countries for hunting all waterfowl species, pheasants, three species of partridge, Coturnix quail, doves, pigeons, snipe, European woodcock, and the small mammals European rabbits and European hares. The types of nontoxic shot used mainly are steel shot and Tungsten-Matrix shot.

Canada. In 2013, the Canadian Wildlife Service allowed fall hunting in the province of Ontario for mourning doves, conditional upon the use of nontoxic shot cartridges. The principal nontoxic shot used is steel shot in 12 and 20 gauge, using 1oz. and 7/8 oz. loads, respectively.

State precedents in the USA

The following information is based on Case and Associates (2006), and Hunting with Nonlead Ammunition (2014).

As of 2014, 34 US states have regulations that, to varying degrees, require by law the use of nontoxic shotgun ammunition for taking upland species of game birds and mammals. These are, by bird species:

- Pheasants – 12 states
- Quail species – 12 states
- Grouse species – 13 states
- Snipe – 22 states
- Rails – 14 states
- Doves – 15 states
- Turkeys – At least 1 state

Although doves are migratory species falling under the federal jurisdiction of the U.S. Fish and Wildlife Service, 15 of the 40 states that permit dove hunting have enacted a nontoxic shot regulation for this species.

Much of the variation in regulatory requirements among the states is attributed to whether the regulations apply to all lands in the state, or just privately-owned lands. South Dakota stands out as the US leader in nontoxic shot regulation, requiring that nonlead cartridges be used when hunting species of grouse, quail, pheasants, doves, snipe and rails *on all public lands* in the state (1998). Analysis of the nontoxic shot requirements of many states indicates that the regulations were enacted to complement the nontoxic shot requirements for waterfowl hunting, as when the habitats of upland game species and waterfowl coincided (Case and Associates 2006).

The nontoxic shot requirements enacted by South Dakota are important for several reasons. First, the US ammunition makers have made their products available for sale both online and at the retail store level within that state. The products are now available in all the gauges commonly used by hunters and in the cartridge loadings suitable for hunting the above-listed species. Thus, the product availability for California is assured. Second, there is much overlap between the upland species hunted in South Dakota and California, and the manner of hunting the same species is virtually the same in both states. California already has state regulations requiring use of nontoxic shot for hunting doves, snipe, quail, grouse, and pheasants in some regions (Case and Associates 2006), provisions that have been extended further to the habitats of California condors by the terms of the Ridley-Tree Condor Preservation Act of 2007. Thus, commercial means already exist to ensure that nontoxic shot cartridges are available to California hunters when hunting the above-listed upland species.

The collective experience of hunting in Denmark, The Netherlands, Canada, and the 34 US states indicates that nontoxic shot regulation has been a positive adjunct to wildlife conservation, in that the practice of hunting has not been diminished, and a toxic legacy has not been left in the fields to affect wildlife that ingest it. Furthermore, no jurisdiction has rescinded its nontoxic shot regulations.

IV. Conclusions

1. Nontoxic shot cartridges are already being used to hunt upland game species in 34 US states, including California.
2. Four types of federally-approved nontoxic shot cartridges are commercially available for hunting upland game and non-game species. Steel shot cartridges are widely available and are stocked in many small retail stores. They cost about the same as their lead shot cartridge equivalent. The more expensive Tungsten-Matrix, HEVI-Shot, and RST Nice Shot cartridges are readily available online, but less available in retail stores.
3. Precedents exist for the complete adoption of nontoxic shot cartridges for hunting upland game at the international (Denmark and The Netherlands) and state levels (South Dakota).
4. Given the above, and the extent of existing nontoxic shot regulations in California, there is no reasonable barrier to the state extending these regulations to upland game hunting on all state and private lands in 2015-2016.
5. Five major US companies already produce nonlead rifle ammunition in more than 48 different calibers that are readily available online and in major sporting/hunting goods stores in California. These calibers include those suitable for hunting all species of California big game.
6. Given the current product availability, retail availability, and economic availability of nonlead rifle ammunition, there is no reasonable barrier to California regulating the use of such ammunition for big game hunting on all state and private lands in 2015-2016.
7. The availability of shotgun and rifle ammunition at the local retail level is heavily influenced by the date of entry of a regulation. It is not good economic sense for store owners to stock different lines of nonlead ammunition in addition to lead ammunition lines years before they are required by law. Similarly, ammunition makers will ramp up production and distribution only in time to meet the date of entry of a law. A 1.5-2 year transition period is adequate to allow industries to increase production and for their products to become more widely available. It is also a reasonable time interval for hunters to adjust to the widening of a new regulation requiring use of nonlead ammunition.

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Survey: Availability of Nonlead Ammunition in California

Introduction

This survey was conducted for the use and benefit of the California Fish and Game Commission in its work to implement AB 711, legislation requiring the phase-in of a statewide requirement for the use of nonlead ammunition for the take of all wildlife by 2019.

Survey Objectives

The objective of this survey is to: (a) provide a snapshot of nonlead hunting ammunition available for purchase as of summer 2014 in a substantial sampling of California retail stores; and (b) document the reasons why some stores report little to no inventory of nonlead hunting ammunition.

Participants

Employees from 111 stores provided answers by phone regarding nonlead ammunition inventory.

Methodology

From April 21, 2014 to July 14, 2014, 111 stores throughout the state of California were called and asked a series of questions to determine whether certain popular nonlead hunting ammunition was currently on shelves and available for purchase. The ammunition types were the most commonly used by hunters, according to industry sources.

The results were reported directly by the retailers and were not subject to any modification after being submitted through the survey software. Therefore the results are based on the best available knowledge and the extent of cooperation of the answering retail employee.

If at the time of the call a store reported typically carrying a particular type of nonlead ammunition but was temporarily out of stock and awaiting the upcoming week's restocking shipment, the store was recorded to be without that ammunition. This was done to provide a real-time snapshot of availability and to remain authentic to the experience of a shooter looking for a particular type of ammunition at a particular time.

Stores were selected at random using Google maps and web browser and ranged from small standalone shops to large box store chains (Walmart, Sportsman's Warehouse, and Big 5 Sporting Goods). For certain Walmart locations, a knowledgeable employee was not available to take the survey and in some cases no sporting section existed. These stores were not included in the data set. In the case of certain standalone stores, retailers clarified that their businesses did not sell hunting ammunition and instead offered other services like range shooting or self defense. These stores were not included in the data set.

Responses were collected over the phone by volunteers and recorded using a customized SurveyMonkey survey. Appendix A contains the stores surveyed and Appendix B contains the complete list of questions.

Results

Of 111 stores, 77 percent (85 stores) carried at least some nonlead ammunition (bullets, shot, or both) for the purposes of hunting (Fig. 1).

When asked if nonlead rifle ammunition was available on shelf, 72 percent (80 stores) responded “yes” (Fig. 2). Availability of nonlead calibers in these stores ranged from .308 caliber (most available) to .22 long rifle rim fire (least available) of the most common hunting ammunition types (Fig. 3). More than half the stores reported selling calibers beyond the common calibers. Approximately 21 percent of the 111 stores had nonlead copper bullets for handloaders available (Fig. 4).

Nontoxic shotgun shells in size 5 or smaller were in about 55 percent of stores (Fig. 5 and Fig. 6). Nontoxic shot other than steel, such as Tungsten-Matrix or HEVI-Shot, were available in approximately 24 percent of stores (Fig. 7).

Of the 39 stores that had low inventory or no inventory of nonlead ammunition and gave reasons why, 41 percent (16 stores) said that their customers have not regularly asked for nonlead ammunition, 25 percent (10 stores) said that supply of nonlead ammunition is too limited, 15 percent (6 stores) cited AB 711 and said that they have not yet begun to increase nonlead ammunition inventory, 12 percent (5 stores) said that their stores have limited space, 12 percent (5 stores) said that nonlead ammunition is too costly, and 7 percent (3 stores) gave reasons other than those listed above (Fig. 8).

Discussion

The results of this survey demonstrate that there is a substantial amount of nonlead ammunition currently available for purchase in California retail stores. The vast majority of surveyed retailers in northern, central, and southern California have some amount of nonlead ammunition available and in a variety of calibers and shot sizes.

The variety of nonlead rifle and shotgun ammunition available throughout the state is an indication that a variety of hunting seasons and firearms can be accommodated for nonlead hunting activities. Add this to the considerable amount of nonlead ammunition available for purchase from online retailers like Cheaperthandirt.com, Cabelas.com, and Wholesalehunter.com, and from the perspective of accessibility, just about any caliber and any shot size is readily attainable for a California hunter.

While not yet widespread in stores, nonlead copper bullets for handloaders were available in approximately a fifth of retail stores. Hunters who custom-make (or re-load) rifle ammunition are likely to take advantage of online ordering, rather than rely on the immediate local availability of components.

For those few retailers that did not have nonlead ammunition stocked, the reasons given are quite consistent and can be addressed to some degree. The primary reason given for no or low nonlead inventory was that their customers are not asking for it. This is an important distinction that suggests policies to phase in the required use of nonlead ammunition should be done at a well-timed, progressive pace in order for demand to initiate supply on store shelves at a reasonable rate.

Conclusion

There is widespread market and retail availability of all popular shotgun and rifle ammunition types for the take of wildlife in California. Thus, California can speedily implement AB 711, meeting Governor Brown's direction that the phase-in be "least disruptive;" the Department's consideration for "simple and enforceable" regulations; and, California's overarching goal of reducing the discharge of lead from ammunition into the environment.

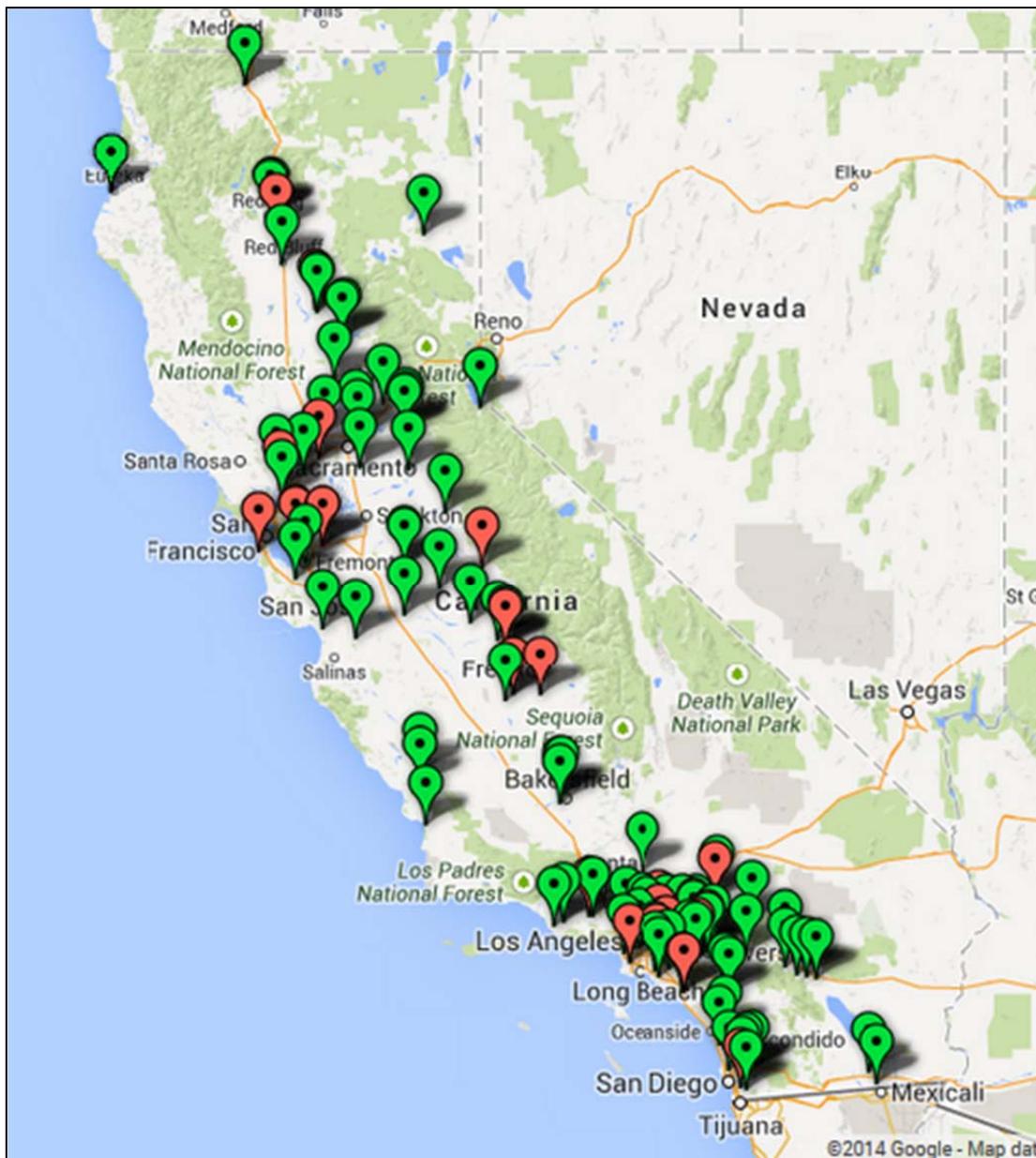


Figure 1. Nonlead Ammunition Availability. Stores represented in green (n=85) had either nontoxic shot, nonlead rifle ammunition, or both on the shelf and available for purchase; stores in red (n=26) had no nonlead hunting ammunition available at the time of the survey.

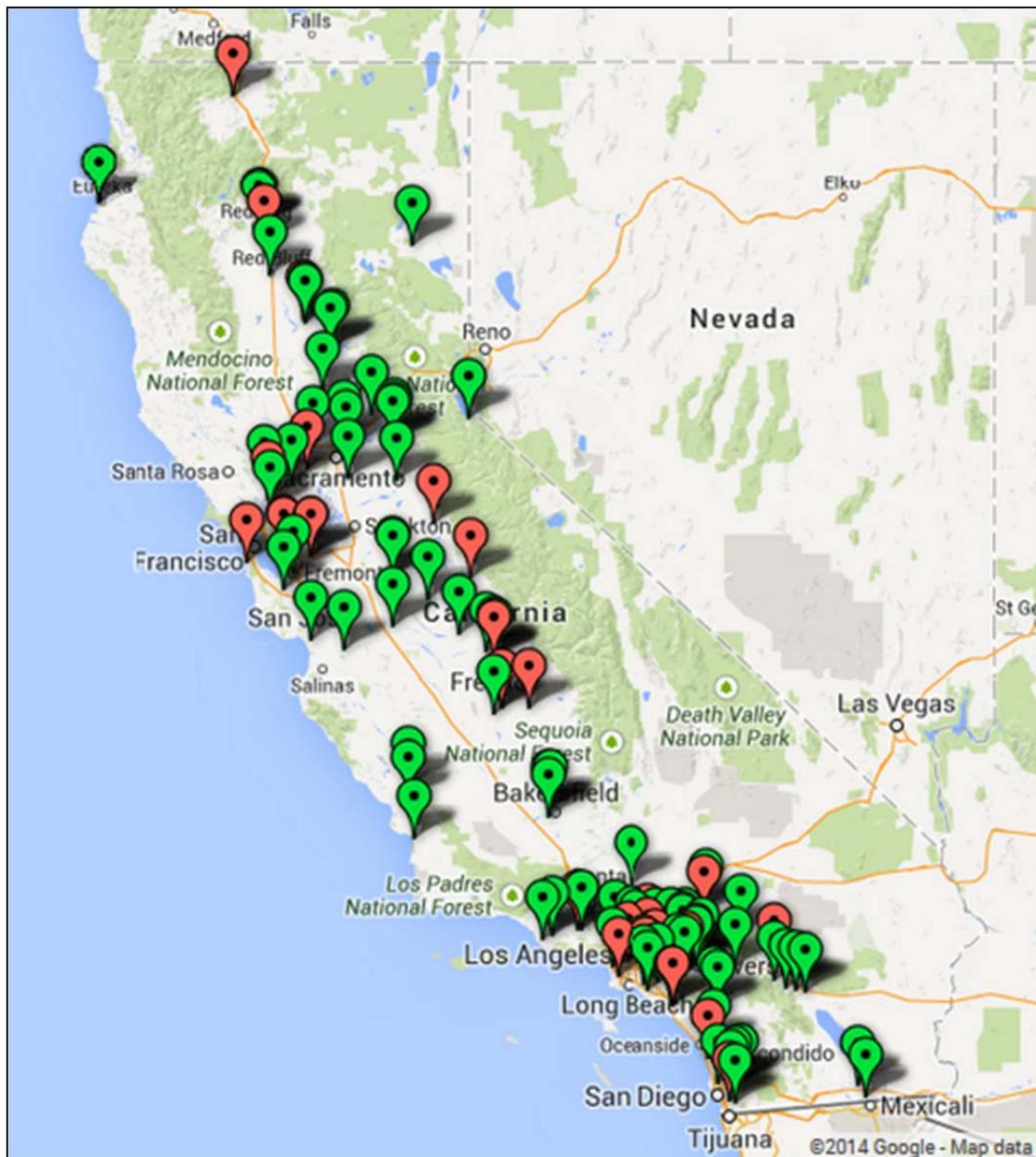


Figure 2. Nonlead Rifle Ammunition Availability. Stores represented in green (n=80) had nonlead rifle ammunition on the shelf and available for purchase; stores in red (n=31) had no nonlead rifle ammunition available at the time of the survey.

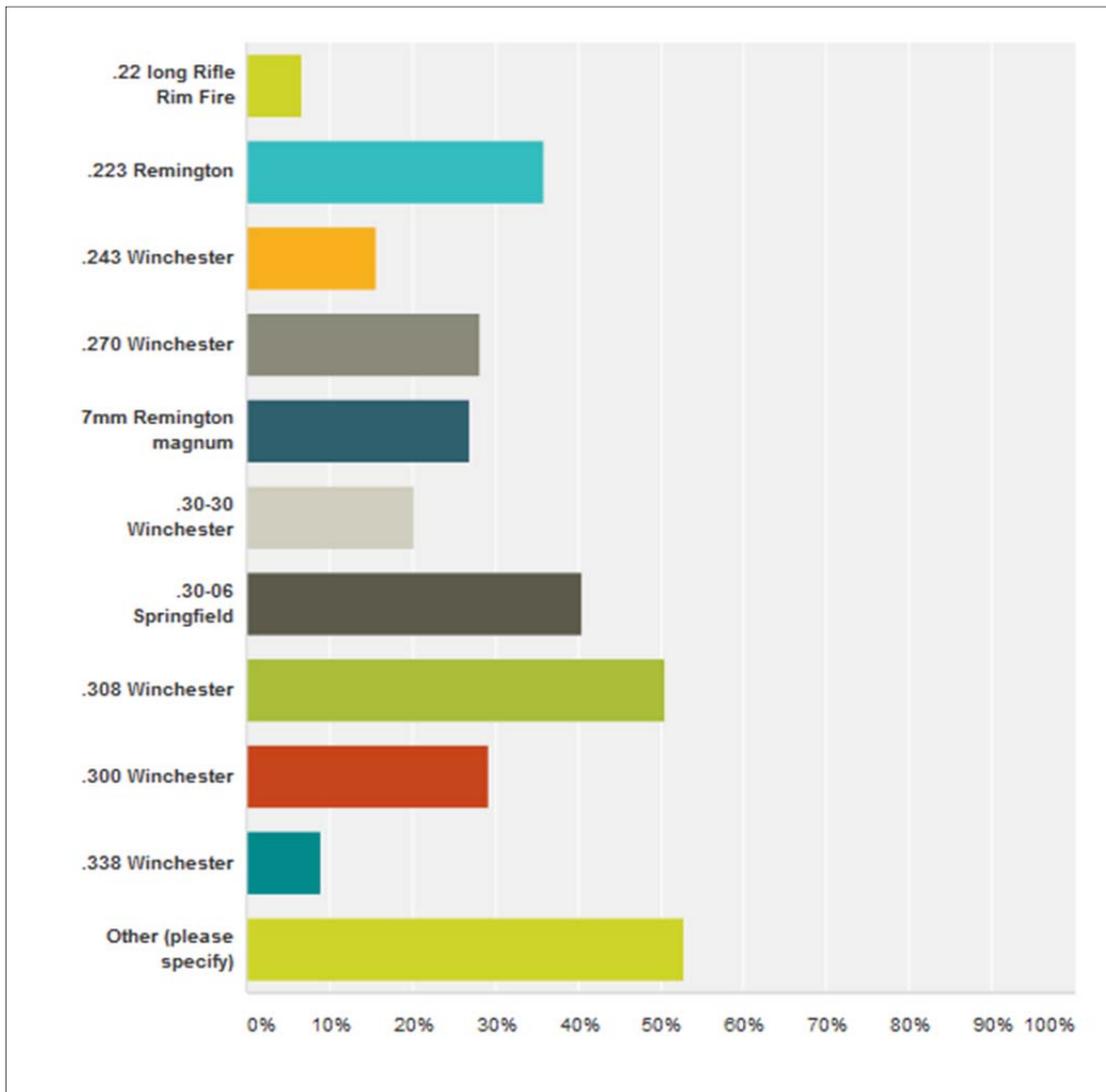


Figure 3. Breakdown by caliber of nonlead cartridges available in 80 retail stores at time of survey. Percentages refer to the proportion of stores stocking a given caliber.

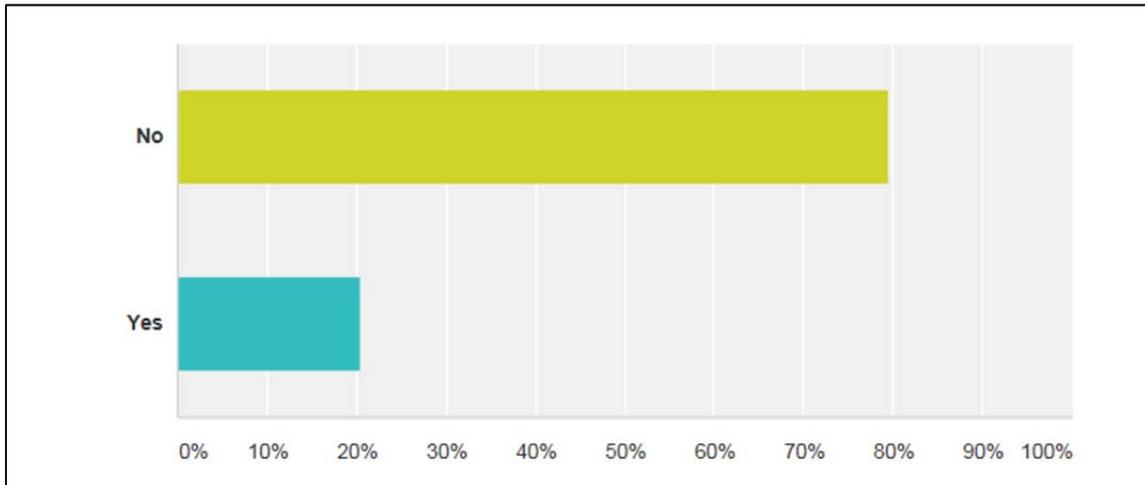


Figure 4. Percentage of 111 stores with nonlead copper bullets for handloaders on the shelf and available for purchase.

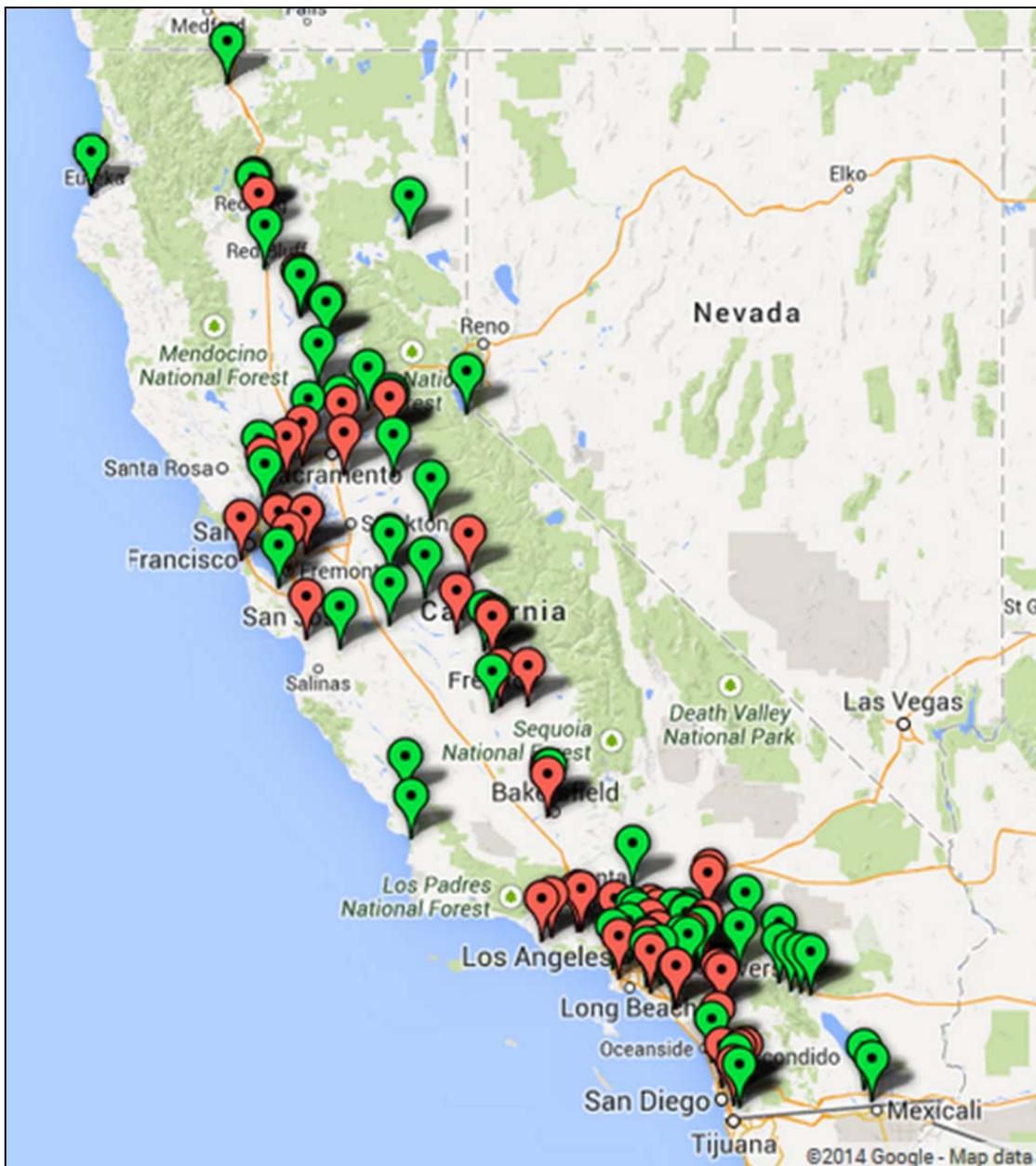


Figure 5. Nontoxic Shotgun Ammunition Availability. Stores represented in green (n=61) had nontoxic shotgun ammunition on the shelf and available for purchase; stores in red (n=50) had no nontoxic shotgun ammunition available at the time of the survey.

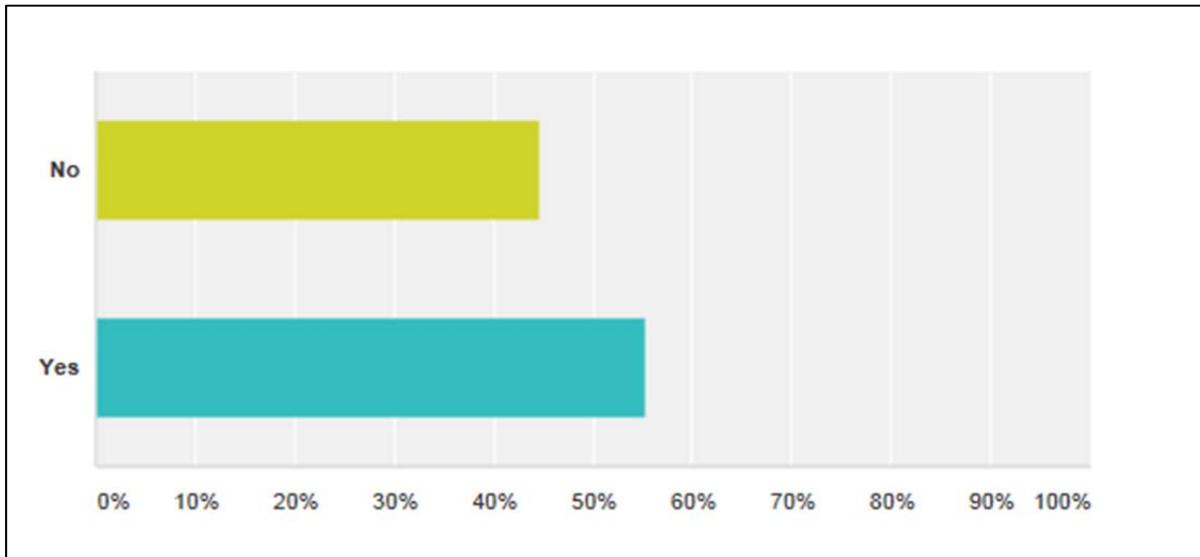


Figure 6. Percentage of 111 stores with nontoxic shotgun ammunition in shot size 5 or smaller on the shelf and available for purchase. Such shot sizes are well suited to hunting upland game birds.

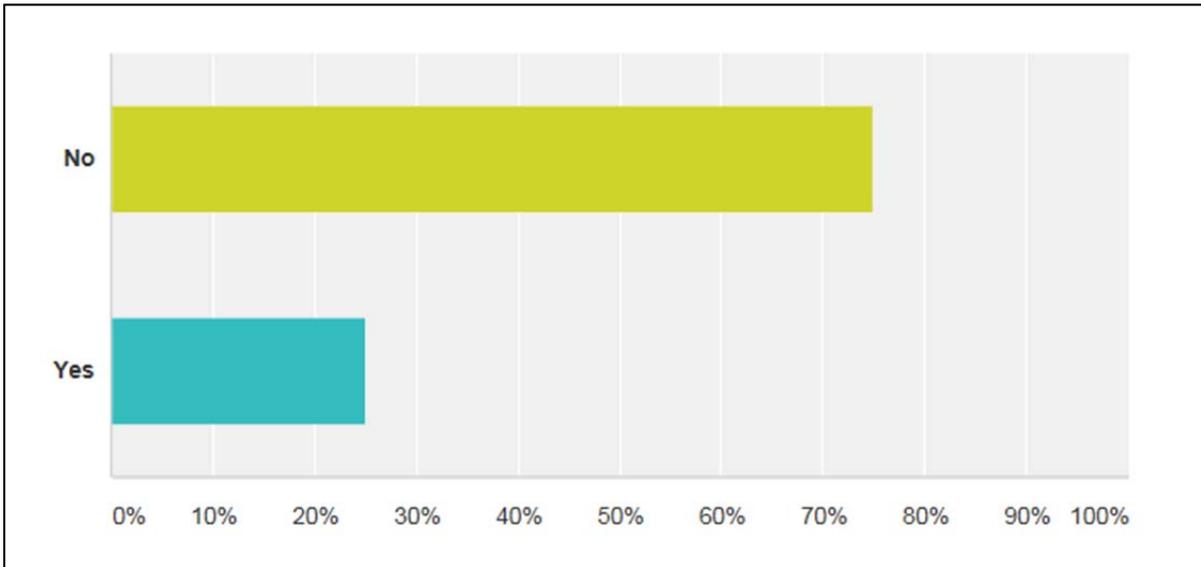


Figure 7. Percentage of 111 stores with nontoxic shotgun ammunition other than steel (i.e. Tungsten-Matrix, HEVI-Shot, or NICE shot) on the shelf and available for purchase.

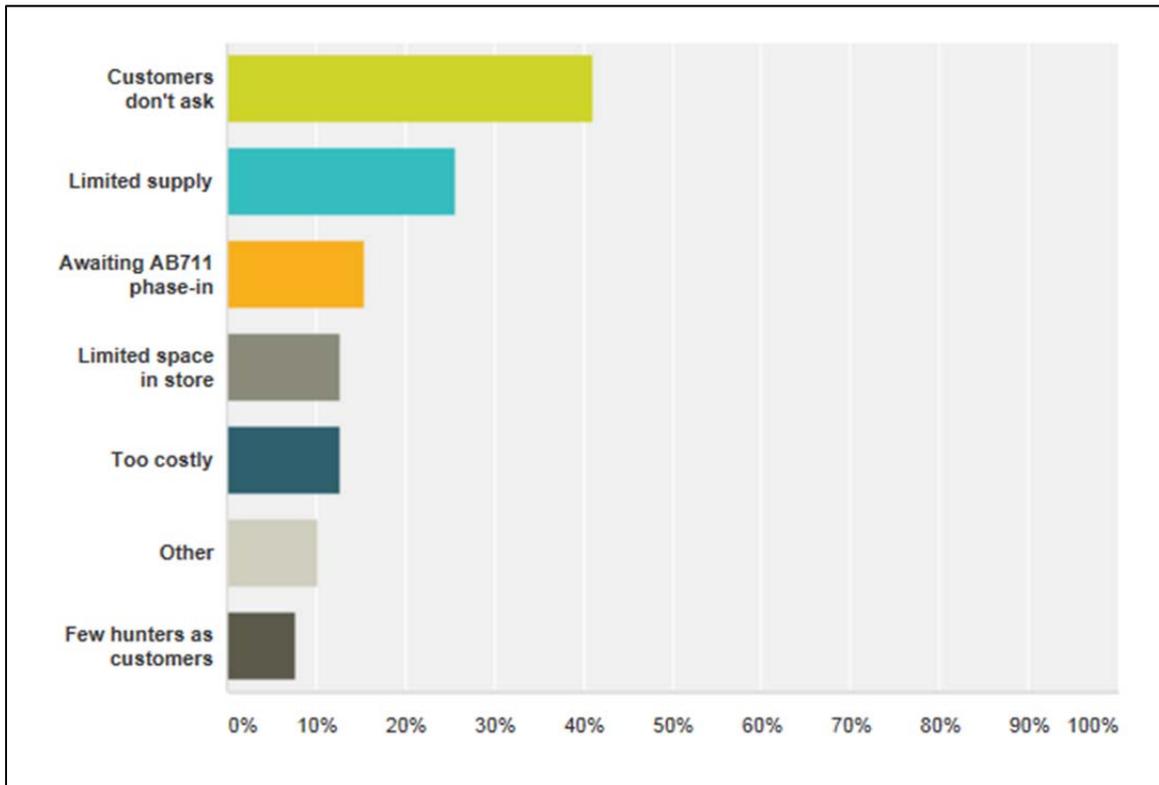


Figure 8. Reasons given by stores with low or no nonlead ammunition on shelves. Percentages refer to the proportion of stores reporting a given reason.

Appendix A. Retail stores surveyed.

	Store	Address
1	Alquist Arms	120 S. Center St Turlock, CA 95329
2	American Firearms	4089 N. Clovis Fresno, CA 93727
3	Ammo Brothers	780 S Rochester Ave, Ontario, CA 91761
4	Annie's Get Your Gun	1338 W 6th St, Corona, CA 92882
5	Annie's Guns	40927 Grimmer Blvd, Fremont, CA 94538
6	Atascadero Firearms	8850 Morro Rd, Atascadero, CA 93422
7	Bain and Davis Gun Shop	307 E Valley Blvd, San Gabriel, CA 91776
8	Bass Pro Shops	7777 Victoria Gardens Ln, Rancho Cucamonga, CA 91739
9	Bay Area Gun Vault	363 W. El Camino Real Mountain View, CA 94040
10	Big 5 Sporting Goods - Auburn	2556 Grass Valley Highway, Auburn, CA 95603
11	Big 5 Sporting Goods - Big Bear	41385 Big Bear Blvd., Big Bear, CA 92315
12	Big 5 Sporting Goods - Chico	1717 Mangrove Ave., Suite C, Chico, CA 95926
13	Big 5 Sporting Goods - Coachella	49301 Grapefruit Blvd, Coachella, CA 92236
14	Big 5 Sporting Goods - El Centro	905 N. Imperial Avenue, El Centro, CA 92243
15	Big 5 Sporting Goods - El Segundo	2515 E El Segundo Blvd, El Segundo, CA 90245
16	Big 5 Sporting Goods - Eureka	3240 Broadway, Eureka, CA 95501
17	Big 5 Sporting Goods - La Quinta	78-710 Highway 111, La Quinta, CA 92253
18	Big 5 Sporting Goods - Napa	1305 Trancas Street, Napa, CA 94558
19	Big 5 Sporting Goods - Oroville	1050 Oroville Dam Blvd., Oroville, CA 95965
20	Big 5 Sporting Goods - Palm Desert	72284 Highway 111, Palm Desert, CA 92260
21	Big 5 Sporting Goods - Palm Springs	2465 East Palm Canyon Dr., Suite 805, Palm Springs, CA 92264
22	Big 5 Sporting Goods - Placerville	284 Placerville Road, Placerville, CA 95667
23	Big 5 Sporting Goods - Red Bluff	545 South Main St, Red Bluff, CA 96080
24	Big 5 Sporting Goods - Redding	2500 Hilltop Drive, Redding, CA 96002
25	Big 5 Sporting Goods - South Lake Tahoe	2062 S. Lake Tahoe Blvd., South Lake Tahoe, CA 96150
26	Big 5 Sporting Goods - Susanville	2581 Main Street, Susanville, CA 96130
27	Big 5 Sporting Goods - Woodland	431 Pioneer Avenue, Woodland, CA 95776
28	Big 5 Sporting Goods - Yuba City	1252 Colusa Avenue, Yuba City, CA 95991
29	Big Horn Gun Shop	6271 Pleasant Valley Rd. El Dorado, CA 95623
30	Bob's Gun Shop	13971 Jackson Ave. Hanford, CA 93230
31	Boyce Firearms Sales	10681 9 1/8 Ave. Hanford, CA 93230
32	Bullet Barn Guns	923 N Central Ave, Upland, CA 91786
33	Bullseye Sport	6710 Brockton Ave, Riverside, CA 92506
34	Bulseye Castro Valley Gun Shop	22287 Redwood Rd Castro Valley, CA
35	Cal Arms	4451 Ontario Mills Pkwy, Ontario, CA 91764
36	Camarillo Shooters Supply	1808 Ventura Blvd, Camarillo, CA 93010
37	Centerfire Firearms	3696 Sunnyside Dr, Riverside, CA 92506
38	Central Valley Arms	840 6th St. Los Banos, CA 93635
39	City Arms	90 Eureka Sq Ste D Pacifica, CA 94044
40	Condor Gun Shop	64895 Pierson Blvd, Desert Hot Spgs, CA 92240
41	Dom's Outdoor Outfitters	1870 1st St, Livermore, CA 94550
42	El Cajon Gun Exchange	427 Broadway, El Cajon, CA 92021

43	Elite Armory	3636 Castro Valley Blvd #1, Castro Valley, CA 94546
44	Elite Firearms	28142 Camino Capistrano #104, Laguna Niguel, CA 92677
45	Express Gun Locker	11873 Hesperia Rd, Hesperia, CA 92345
46	Fine Firearms	8701 La Mesa Blvd, La Mesa, CA 91942
47	Fort Courage Armory	1518 E Los Angeles Ave, Simi Valley, CA 93065
48	Fowler Gun Room	358 S Tustin St, Orange, CA 92866
49	Fresno Firearms Ltd.	6573 N. Blackstone Ave. Fresno, CA 93710
50	Greta's Guns	4228 E Los Angeles Ave, Santa Susana, CA 93063
51	Gun Culture	2029 W. Ashland, Visalia, CA 93277
52	Gun Runner	2040 Yosemite Pkwy, Merced, CA 95340
53	Gun World	2412 West Magnolia Blvd, Burbank, CA 91506
54	Gunrunners	2160 E Huntington Dr, Duarte, CA 91010
55	Guns, Fishing & Other Stuff	197 Butcher Road Vacaville ca 95687
56	Gunslingers Gun Shop	1750 S Grand Ave, Glendora, CA 91740
57	High Desert Guns and Ammo	15885 Main St., Suite 220, Hesperia, CA
58	Houlding Precision Firearms	2980 Falcon Dr. Madera, CA 93637
59	Huntington Sports Store	01 Oro Dam Boulevard East Oroville, CA 95695
60	J&R Sports Supply Gun Store	2558 Old 1st St, Livermore, CA 94550
61	Just Guns	3530 Auburn Boulevard #8 Sacramento, CA 95821
62	JW Guns and Accessories	250 Iowa Ave, Riverside, CA 92507
63	Markley's Indoor Range & Gun Shop	14 Blanca Ln. Watsonville, CA 95076
64	North County Fire Arms	120 N Pacific St # C1, San Marcos, CA 92069
65	North Valley Gun Shop	544 Eaton Rd Chico, CA 95973
66	Old West Guns	129 S Hacienda Blvd, City of Industry, CA 91745
67	Petersen's Gun Sport	560 W. Stockton St Sonora, CA 95370
68	PRK Arms	5530 E. Lamona Ave. Fresno, CA 93727
69	Rifle Gear	18065 Mount Shay St., Fountain Valley, CA 92708
70	Saddleback Valley Gun Center	27601 Forbes Rd #17, Laguna Niguel, CA 92677
71	Schell's Sport Shop	2111 Geer Rd, Turlock, CA 95382
72	Schmidts Guns	30 Cernice Ct. Hollister, CA 95023
73	Second Amendment Sports	2523 Mohawk St, Bakersfield, CA 93308
74	Shooters Paradise of Oxnard	1910 Sunkist Circle, Oxnard, CA 93033
75	So. Cal. Sharpshooter	1827 W 208th St, Torrance, CA 90501
76	SoCal Gun	4891 Convoy Street, San Diego, CA 92111
77	Sportsman's Warehouse - Chico	765 East Avenue Suite 170, Chico, CA
78	Sportsman's Warehouse - Redding	1659 Hilltop Dr., Redding, CA
79	Stage Stop Gun Shop	5094 Jessie St. Mariposa, CA 95338
80	Steelwater Firearms	41750 Winchester Rd, Temecula, CA 92590
81	Stockade	8061 Westminster Blvd, Westminster, CA 92683
82	Straightline Tactical	327 S Magnolia Ave, Anaheim, CA 92804
83	TDS Guns	4370 Bonita Rd, Chula Vista, CA 91902
84	The Armory	2505 N. Fowler Ave. Fresno, CA 93727
85	The Gun Room	9221 Survey Rd, Elk Grove, CA 95624
86	The Gun Shop	44633 Sierra Hwy, Lancaster, CA 93534
87	The Shootist	24910 Washington Ave, Murrieta, CA 92562
88	Triple A Sporting Goods	1724 Springs Rd, Vallejo, CA 94591
89	Turner's Outdoorsmen	835 S Arroyo Pkwy, Pasadena, CA 91105

90	Walmart - American Canyon	7011 Main Street, American Canyon CA 94503
91	Walmart - Anderson	5000 Rhonda Road, Anderson CA 96007
92	Walmart - Antelope	7901 Watt Avenue, Antelope CA 95843
93	Walmart - Arroyo Grande	1168 West Branch St, Arroyo Grande CA 93420
94	Walmart - Bakersfield	8400 Rosedale Hwy, Bakersfield CA 93312
95	Walmart - Bakersfield	5075 Gosford Rd, Bakersfield CA 93313
96	Walmart - Beaumont	1540 E 2nd St, Beaumont CA 92223
97	Walmart - Brea	2595 E Imperial Hwy, Brea CA 92821
98	Walmart - Buena Park	8450 La Palma Ave, Buena Park CA 90620
99	Walmart - Calexico	2540 Rockwood Avenue, Calexico CA 92231
100	Walmart - Chula Vista	1360 Eastlake Pky, Chula Vista CA 91915
101	Walmart - Corona 1912	479 N Mckinley St, Corona CA 92879
102	Walmart - Corona 2842	1290 E Ontario Ave, Corona CA 92881
103	Walmart - Dixon 5139	235 E Dorset Ave, Dixon CA 95620
104	Walmart - El Cajon 2253	13487 Camino Canada, El Cajon CA 92021
105	Walmart - Encinitas 5886	1550 Leucadia Blvd, Encinitas CA 92024
106	Walmart - Martell 2054	10355 Wicklow Way, Martell CA 95654
107	Walmart - Paso Robles 2099	180 Niblick Road, Paso Robles CA 93446 805-238-1212
108	Walmart - Placerville 2418	4300 Missouri Flat Road, Placerville CA 95667
109	Walmart - Redding 2537	1515 Dana Drive, Redding CA 96003
110	Walmart - Yreka 1630	1906 Fort Jones Road, Yreka CA 96097 619-561-0828
111	Western Firearms	6621 Atlantic Ave, Bell, CA 90201

Appendix B. Survey used to collect retailer responses.

Non-lead Ammunition Availability in California

*** 1. Volunteer name:**

*** 2. Store survey # (column 3 on spreadsheet):**

3. Hi, just calling to see what non-lead hunting ammo you have on shelf today. Is there someone in particular I should speak to?

- If "No, we don't have non-lead ammo" skip to question 8.
- If "Yes" continue on to next question.

**4. Which non-lead rifle cartridges do you sell with lead-free copper bullets?
(if they ask what caliber, say "any caliber" and list brand names below)**

- .22 Long Rifle Rim Fire
- .223 Remington
- .243 Winchester
- .270 Winchester
- 7mm Remington magnum,
- .30-30 Winchester
- .30-06 Springfield
- .308 Winchester
- .300 Winchester magnum
- .338 Winchester magnum
- Other (please specify)

5. And how about lead-free copper bullets for hand-loaders of rifle ammo?

- No.
- Yes.

If yes, which ones?

6. Or steel shot shotgun cartridges in 12 gauge? (Number 5 or smaller size shot if they ask)

- No
- Yes

If yes, which ones?

7. Or how about non-toxic shotgun ammo other than steel like Tungsten-matrix or Hevi-Shot?

- No
- Yes

If yes, which ones?

8. [Q8 only for stores without non-lead ammo]: No non-lead for rifle or shotgun? Is that because of stocking issues or other reasons?

- limited space in store
- customers don't ask for it
- no waterfowl hunting in the area

Other (please specify)

9. Please use this space to share any additional notes from this store.

Done

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