



# SCWDS BRIEFS

*A Quarterly Newsletter from the*  
**Southeastern Cooperative Wildlife Disease Study**  
**College of Veterinary Medicine**  
**The University of Georgia**  
**Athens, Georgia 30602**

Phone (706) 542-1741

FAX (706) 542-5865

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## **Screwworms in USA Eradicated**

On March 23, 2017, the United States Department of Agriculture's (USDA) Animal and Plant Health Inspection Service announced the eradication of the New World screwworm (NWS) from the United States. Infestation with NWS was confirmed in Key deer on the National Key Deer Refuge on September 30, 2016, although cases likely had been occurring since July 2016. The last NWS infestation case was confirmed on January 10, 2017 (SCWDS BRIEFS Vol. 32, No. 4). Confirmed Key deer mortality associated with NWS was 135, and the only other documented wildlife infestation occurred in a single raccoon. A handful of cases were confirmed in pet dogs and cats, and two pet pigs in the Florida Keys and a stray dog on the mainland in Homestead, Florida.

Eradication of NWS is the result of cooperative efforts of the USDA, Florida Department of Agriculture and Consumer Services (FDACS), U.S. Fish and Wildlife Service (USFWS), Florida Fish and Wildlife Conservation Commission (FWC), local veterinarians, refuge volunteers, and others. Containment and eradication efforts included an animal checkpoint station on U.S. Highway 1 in Key Largo, at which nearly 17,000 pets and other domestic animals were examined for NWS infestation on their way toward the mainland from the Florida Keys. This station was closed on March 18, 2017. Twelve Key deer were immobilized and directly treated for NWS infestation, as were a few domestic animals, and remote treatment of free-ranging Key deer was accomplished through distribution of oral baits containing an anti-parasitic compound. A critical component of eradication efforts was the release of sterile screwworm flies: Approximately 3-4 million sterile flies were released twice a week in the affected keys beginning in early October, and releases occurred in the area of the affected stray

dog on the mainland. More than 160 million flies were released with the last release scheduled for April 25, 2017. Passive surveillance for NWS will be continued by the cooperating agencies.

This NWS incursion into the Florida Keys hit the endangered Key deer population hard. In the summer of 2016, the entire population was estimated at nearly 1000 individuals; 135 confirmed NWS-associated mortalities plus an unknown number of undetected mortalities suggest that approximately 20% of the population was lost to NWS. When added to 171 mortalities due to other causes, nearly 1/3 of the entire population may have been lost in 2016. However, the population is expected to recover without any long term impacts because few female deer were affected by NWS. More than 90% of documented cases occurred in male deer in which more than 90% of NWS-associated lesions occurred on the head, neck, and forelimbs. This likely is associated with fighting and antler rubbing during the rut.

It is gratifying to report a success story such as this one, particularly because of the extensive interagency cooperation that was employed to contain the screwworms before they could cause major damage to livestock and wildlife on the mainland and to eradicate this severe threat to an endangered wildlife species. More information on NWS can be found at the websites of FDACS (<http://www.freshfromflorida.com/screwworm>), FWC, USDA, and USFWS ([https://www.fws.gov/refuge/National\\_Key\\_Deer\\_Refuge/](https://www.fws.gov/refuge/National_Key_Deer_Refuge/)).  
(Prepared by John Fischer)

## **Avian Influenza Update, May 2017**

Highly pathogenic avian influenza virus (HPAIV) was detected in early March 2017 in two commercial chicken flocks in close proximity in

Continued...

Tennessee. Within a few weeks, low pathogenicity avian influenza virus (LPAIV) was confirmed in three backyard and three commercial chicken flocks in Alabama, two commercial chicken flocks in Kentucky, and a commercial chicken flock in Georgia. Genetic evaluation determined that the virus from each event was a subtype H7N9 influenza virus of North American wild bird origin. All farms were depopulated, carcasses were destroyed, and surveillance/control zones were established surrounding affected sites. Restrictions were placed on activities that involved poultry assembly, such as exhibitions, shows, sales, and swap meets. Surveillance zones and restricted activities have since been rescinded by the state veterinarians in the four affected states, because no additional avian influenza virus infections have been detected.

Low pathogenicity influenza viruses occur naturally in North America's wild waterfowl. Infection rates are highest in late summer when populations of immunologically naive juveniles congregate to begin their southern migration. However, LPAIV can be found at a low prevalence (<2%) in waterfowl throughout the year. The H7 viruses can be isolated from waterfowl at any time of year, but are detected consistently during spring migration in some species (blue-winged teal) in the southern United States. This influenza subtype, like H5, occasionally is transmitted as a LPAIV to domestic poultry where it has the potential to evolve to the highly pathogenic phenotype. Although wild waterfowl were implicated in disseminating Eurasian lineage H5 HPAIVs in the United States in 2014-15, there have been no instances of any North American lineage HPAI H5 or H7 viruses being isolated from or maintained in waterfowl populations. As in the case of the recent Tennessee outbreak, all HPAIV outbreaks in the United States to date have been successfully controlled and eradicated through the culling of infected poultry, movement restrictions, and other measures.

The Tennessee outbreak appears to be mirroring an outbreak that occurred in Indiana in January 2016. At that time, H7N8 HPAIV was detected in a commercial turkey flock and this was followed by LPAIV detections in several nearby facilities. The outbreak was contained quickly and no other

HPAIV cases were detected in poultry in the United States until the Tennessee event. While the direct costs of the Tennessee and Indiana outbreaks may be relatively limited, their occurrence is significant. Prior to 2014, HPAIV outbreaks in United States poultry had occurred only three times (1924, 1983, and 2004). The United States has experienced HPAI outbreaks in each of the last three years. It is unclear if these recent outbreaks represent isolated events or a burgeoning trend. Regardless, research and surveillance aimed at gaining a better understanding of influenza infection dynamics in wild birds must be a top priority if we wish to fully address these concerns.

Meanwhile, new human cases of avian influenza H7N9 in China continue to be reported, raising concern for public health officials. This Eurasian-lineage virus circulating in Chinese poultry is unrelated to North American lineage viruses. Over 1,400 human cases have been reported since early 2013 with more than 640 (48%) in just the past seven months. Most infections have been associated with contact with infected poultry or poultry markets. A limited number of human-to-human transmissions have been reported, but the virus currently lacks the ability to be easily transmitted between people. Although transmissibility appears low, disease severity is a concern. Human infections with this virus typically result in severe respiratory disease and death in approximately one in three cases. The continually changing genetic nature of influenza viruses means that the virus could gain the ability to spread easily from person to person. This could have catastrophic, pandemic consequences.

In response to the current wave of infections, the Chinese government has increased surveillance and response efforts within the public health realm, and worked to enhance control measures associated with sanitation in live poultry markets. The World Health Organization and United States Centers for Disease Control and Prevention recommend that people traveling to China avoid contact with live poultry, areas where poultry may be slaughtered, or areas that may be contaminated with poultry feces. In the meantime, public health officials around the globe continue to monitor the situation for any indication that this smoldering H7N9 virus has reached a flash point. (Prepared by Charlie Bahnson)

## Raccoon Roundworm and Wildlife Rehabilitators

SCWDS has been conducting surveillance and research on the raccoon roundworm (*Baylisascaris procyonis*) for many years. This parasite is most common in raccoons from northern and western regions of the United States and Canada, but it has been detected increasingly in southeastern states such as Florida and Georgia. Although interest centers on the severe disease and death this parasite causes in people, *B. procyonis* also is an important pathogen of native wildlife and exotic hosts.

To date, approximately 50 human neural larva migrans (NLM) and ocular larva migrans (OLM) cases have been reported. Most cases have been in the USA, but a few human infections have occurred in Europe and Asia where raccoons (and *B. procyonis*) have been introduced. About half of the reported cases have involved meningoencephalitis, and historically, most of these cases were fatal. Currently, more diagnosed individuals are surviving, possibly due to increased awareness and more aggressive treatment, but surviving patients often have permanent neurological complications. There also is some evidence that subclinical *B. procyonis* infection occurs as has been reported in human infections with the canine roundworm (*Toxocara canis*). A review of these most recently diagnosed cases can be accessed at <https://www.cdc.gov/mmwr/volumes/65/wr/mm6535a2.htm>.

We partnered with collaborators at the Parasitic Diseases Branch at the U.S. Centers for Disease Control and Prevention (CDC) to conduct a cross sectional serosurvey of wildlife rehabilitators to assess the occurrence of subclinical *Baylisascaris* infections. We chose to concentrate on wildlife rehabilitators because of interest among this community in the raccoon roundworm and the possible elevated risk for their exposure to zoonotic agents, including *B. procyonis*, due to frequent and prolonged contact with wildlife.

We tested serum from 347 adult wildlife rehabilitators from 35 states and Canadian provinces. All were in good health and did not report any recent clinical signs suggestive of *Baylisascaris* infection. Twenty-four (24/347; 7%) were positive for antibodies to *Baylisascaris* using the diagnostic immunoblot assay originally

developed and validated by the CDC. Among positive individuals, 22 (92%) reported that they had actively rehabilitated wildlife and the other two reported occasional contact with wildlife, including raccoons, through veterinary activities. Raccoon contact was reported by all but two of the positive individuals. Interestingly, two seropositive individuals who rehabilitated animals were members of the same household. Nineteen (79%) of the 24 positive participants resided in a state or province with a high prevalence of roundworms in raccoons (for example, California and northeastern states where more than 90% of juvenile raccoons harbor *B. procyonis*). Importantly, many of these seropositive rehabilitators reported inconsistent hand washing after activities involving raccoon contact including handling live animals and potential exposure to feces when cleaning animal enclosures.

This finding provides additional evidence that *B. procyonis* infections can occur without overt neurological disease in humans. Most cases of NLM in children are severe or fatal, and likely occur following accidental ingestion of large numbers of infectious eggs in raccoon feces while playing outdoors; however, adults are more likely to become infected with lower numbers of eggs through more indirect means. With rehabilitators, this likely occurs during cage-cleaning activities where proper personal protective equipment (PPE) and hand washing are not practiced, as our study suggests. Even though contact with live raccoons should not present an exposure risk *per se*, because larvae in eggs must develop in the environment for weeks prior to becoming infectious, the reported inconsistencies in PPE and hand hygiene may indicate an overall lack of caution. Alternately, live raccoons could contaminate their fur with eggs that become infectious if their environment is not properly decontaminated. Few rehabilitators reported sanitizing enclosures with a heat-based treatment, which is the sole method known to inactivate environmentally hardy *B. procyonis* eggs.

While the implications of these asymptomatic individuals having antibodies against *B. procyonis* are not completely understood, rehabilitators should take extra precautions to avoid transmission. Simple things, such as washing hands and use of proper PPE, when handling animals or their bodily fluids/feces can greatly minimize risk of infection with *B. procyonis* as well as other possible zoonotic pathogens. In addition,

use of enclosures made of materials that are easily heat-sanitized will reduce the risk of exposure to *B. procyonis*. Finally, Bauer and Gey reported in 1995 that some anthelmintics not approved for use in raccoons can kill adult worms and prevent egg shedding while the animals are held for treatment. Details of the SCWDS study can be found at [https://wwwnc.cdc.gov/eid/article/22/12/16-0467\\_article](https://wwwnc.cdc.gov/eid/article/22/12/16-0467_article). (Prepared by Sarah Sapp and Michael Yabsley)

## Oral Mass in a Deer

During late November 2016, a 5 1/2 year-old buck was harvested by a hunter in Winn Parish, Louisiana. The hunter reported that the animal was well-muscled and appeared to be in good health with adequate fat stores. However, the hunter noticed a large mass on the deer's lower jaw, as well as several broken antler tines, and contacted the Louisiana Department of Wildlife and Fisheries (LDWF). A biologist with LDWF examined the head and submitted it to SCWDS for diagnostic evaluation.

Gross examination revealed a 6-cm diameter, round, hard mass protruding through the gums adjacent to the incisors of the lower jaw (Figures 1 and 2). The mass destroyed the normal architecture of the front end of the lower jaw and most incisors were absent, with only remnants of two incisors embedded in the hard mass. The primary rule-outs for the mass included cancer, chronic infection, and previous trauma.

On cut section, the mass was dense throughout and appeared to be continuous with the mandibles. Microscopic examination revealed granulation tissue and mature woven bone separated by fibrous connective tissue, consistent with excessive healing of a fracture. There was no evidence of infection, inflammation, or cancer.

These findings suggest that the mass on the jaw of this buck was a bony callus that formed following fracture of the front end of the lower jaw at the midline where the left and right mandibles fuse. When a bone is fractured, one of the body's primary objectives is to stabilize the fracture and stop motion across the injured bone through formation of a callus. When treating humans and domestic animals, this motion across the fracture is minimized through casts or surgery involving pins, plates, and screws, and the size of the callus is often negligible. The instability and motion of

the fracture of this deer's jaw likely resulted in excessive callus formation by the body.

A cancerous growth was a primary rule-out in this case. In particular, osteochondromas on the mandibles, and other bones of the head, can have a very similar gross appearance. However, microscopic examination is critical to reach a diagnosis in these cases.



Figure 1.



Figure 2.

This case illustrates how resilient wild animals can be. This mass disrupted conformation of the jaw and undoubtedly impacted normal feeding behavior. However, based on the reported body condition and evidence of rutting behavior, this buck pushed through the setback and was in good condition at the time it was harvested. (Prepared by Mark Ruder)



## PPR Threatens Endangered Saiga Antelope

In January 2017, the United Nation's Food and Agriculture Organization (FAO) and the World Organisation for Animal Health (OIE) reported that approximately 900 Mongolian saiga (*Saiga tartarica* ssp. *mongolica*) were found dead in the Khovd Province of Mongolia in an outbreak of peste des petits ruminants (PPR). This outbreak, which is the first report of PPR in free-ranging antelope, has involved one tenth of the population of this saiga subspecies.

The saiga (*Saiga tartarica*) is a nomadic species that has inhabited the steppe grasslands of central Asia since the last Ice Age. Saiga once numbered in the millions, but the species has been listed as critically endangered since 2002. Threats to the saiga population include habitat loss and poaching for their horns, which are used for traditional medicines. However, disease outbreaks are a growing concern: In 2015 in Kazakhstan, hemorrhagic septicemia due to *Pasteurella multocida* infection killed approximately 200,000 saiga of the Kazakh subspecies (*S. tartarica* ssp. *tartarica*) representing more than half of the global population at the time (SCWDS BRIEFS Vol. 31, No. 1).

Peste des petits ruminants virus (PPRV) is a morbillivirus that primarily affects sheep and goats. The virus damages lymphoid and epithelial tissue leading to immunosuppression and lesions in the respiratory and gastrointestinal tracts. Affected animals may have discharge from the eyes and nose, mucosal ulcerations in the oral cavity, respiratory dysfunction, and diarrhea. Clinical disease typically is severe with a fatal outcome in approximately 90% of affected sheep and goats. The virus is transmitted by direct contact and indirectly via exposure to ocular and nasal discharge, aerosols, or feces of infected animals. Affected animals often are in poor body condition, and hemorrhagic lesions can be found in the respiratory and gastrointestinal tracts.

Affected saiga in the current outbreak displayed clinical signs and post mortem lesions consistent with severe PPR in sheep and goats, and PPRV was detected by laboratory testing. The outbreak in antelope appears to be the result of spillover from affected domestic ruminants in areas where

the saiga graze. In August 2016, PPR was reported for the first time in Mongolia in domestic sheep and goats in the Khovd Province and is believed to have spread from neighboring China. Since last August, ten more outbreaks have occurred in Mongolia and more than 11 million sheep and goats have been vaccinated. The outbreak in domestic animals was reported to be resolved on November 15, 2016.

Peste des petits ruminants virus first was reported in 1942 in Côte d'Ivoire when a rinderpest-like disease was seen in small ruminants, but cattle in close contact with diseased sheep and goats were unaffected. The virus had spread from west to east Africa, with some cases in the United Arab Emirates and India, by the late 1980s. In the past fifteen years, the distribution of PPRV has rapidly expanded into Asia and north and south in Africa. Peste des petits ruminants never has been documented in the United States and is considered a reportable foreign animal disease by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service.

With 80% of the world's estimated two billion domestic small ruminants living in areas affected by PPR, and many people living in developing nations depending on small ruminants for food and livelihood, PPR has been targeted for eradication. In 2016, the OIE and FAO launched the PPR Global Eradication Program (PPR GEP) with the goal of eliminating PPR by 2030. The PPR GEP draws upon the structure and lessons learned from the recent (2011) eradication of rinderpest, a similar morbilliviral disease of domestic and wild ruminants. The first phase of the PPR GEP will run from 2017 to 2021 with an estimated cost of US \$996 million.

The PPR GEP focuses on the 76 OIE member countries that have reported PPR or have unknown PPR status. These countries are divided into nine regions that will hold regional meetings throughout the program, share vaccine banks, and coordinate laboratory and epidemiological networks. Each country will go through up to four stages: assessment, control, eradication, and post-eradication monitoring to document continued absence of disease. Control and eradication efforts focus mainly on vaccination of domestic small ruminants, and the first phase of the program aims to vaccinate 1.5 billion sheep and goats by 2021. Other control activities include

strict biosecurity measures, quarantine of clinically affected animals, and movement restrictions on susceptible domestic species.

As for the Mongolian saiga, the current response involves additional surveillance and vaccination of domestic small ruminants in the province, separation of domestic and wild species, and monitoring of saiga morbidity and mortality. Education of sheep and goat herders regarding the risk of PPR spillover from livestock to saiga also is a critical component. Saiga congregate in the spring for calving, and this could provide an opportunity for increased disease transmission. Increased morbidity and mortality is expected and will be monitored by several organizations. (Prepared by Grace Vahey of the University of Georgia College of Veterinary Medicine and Heather Fenton)

## Indiana TB Update

The Indiana Department of Natural Resources (IN DNR) continues to look for bovine tuberculosis (bTB) in wildlife since it was confirmed last August in a free-ranging white-tailed deer on an affected Franklin County cattle farm (SCWDS BRIEFS Vol. 32, No. 3). Samples were collected from hunter-harvested animals during the 2016-17 deer season and targeted deer (killed by sharpshooters in July 2016) within surveillance zones in Franklin and adjacent Fayette Counties and in Dearborn County where bTB was found in cattle in 2011. *Mycobacterium bovis*, the zoonotic bacterium that causes bTB, was not found in any of the 1,996 samples submitted to the Animal Disease Diagnostic Laboratory at Purdue University and the USDA Animal and Plant Health Inspection Service's National Veterinary Services Laboratories (NVSL).

The recent history of bTB in Indiana began in 2008 when the disease was detected in a cow on a Franklin County farm. Bovine TB had been eradicated in Indiana since 1984. In 2009, *M. bovis* was confirmed in a captive deer from a Franklin County captive cervid operation, and bTB was found in elk, fallow deer, and red deer when the facility was depopulated. Surveillance for bTB in wildlife was initiated at that point. In 2011, *M. bovis* was found in cattle in adjacent Dearborn County, and wildlife surveillance for bTB was expanded. Bovine TB was detected in a second cattle herd in Franklin County in April 2016 and in a third herd in December 2016. The *M. bovis*

isolates from all affected cattle, captive cervids, and the wild deer confirmed with bTB last August were genetically similar, and this strain has been associated with captive cervids and cattle for decades. The same strain was found in 2010 in cattle on a farm in nearby Fleming County, Kentucky. These findings suggest that this strain of *M. bovis* has been circulating in this region at least since 2008. It should be noted that this strain differs from the *M. bovis* strains found in wild deer in the northeastern portion of Michigan's Lower Peninsula, where endemic bTB has been recognized since the mid-1990s, and in Minnesota, where it was found in 27 wild deer from 2005-2009.

Wildlife surveillance has occurred in neighboring states as well. The Kentucky Department of Fish and Wildlife Resources conducted bTB surveillance in hunter-harvested wild deer in 2016-17 in response to the bTB detection in a wild deer in Indiana in 2016. Surveillance for bTB also occurred in Fleming County, Kentucky, where *M. bovis* was detected in cattle in 2010, although some wildlife surveillance had been conducted at the time. Neither bTB lesions nor acid-fast bacteria were found in lymph nodes from 102 deer in Boone County bordering the affected area in Indiana and 121 deer in Fleming and adjacent Bath and Nicholas Counties. Results of mycobacterial cultures are pending. The Ohio Division of Wildlife collected samples for bTB testing from 178 wild deer in Butler and Hamilton Counties near the affected area in Indiana; results are pending.

Wildlife surveillance for bTB is becoming increasingly common in the United States following detection of the disease in cattle. Historically, bTB had been found in wild deer on a handful of occasions after it had spilled over from affected livestock, but the disease was not maintained in wildlife. That changed when bTB came to be regarded as endemic in wild deer in a portion of Michigan in the mid-1990s, and *M. bovis* has been confirmed in 70 cattle herds, five feedlots, and four captive cervid herds since 1998. Surveillance of wildlife in the vicinity of affected cattle herds in northwestern Minnesota resulted in detection of bTB in white-tailed deer in the area. Fortunately, an aggressive disease management program appears to have eradicated or reduced bTB to an undetectable level in cattle and deer in that area since 2009. Most recently, wildlife surveillance began in late March in South

Dakota in response to *M. bovis* detection in cattle in Harding County.

The IN DNR will continue monitoring deer for bTB in the affected area in southeastern Indiana and will ask hunters to submit deer for testing in the future. Agriculture officials are continuing to investigate the epidemiology of bTB in Indiana cattle and announced in late April that bTB had been found in a cow in a small beef herd in Lake County in western Michigan. The animal had been imported from the affected Franklin County, Indiana herd prior to the detection of *M. bovis* in December 2016. (Prepared by John Fischer)

### SCWDS Folks Honored

We are excited to share details on awards that several SCWDS-affiliated students, staff, and faculty have received in recent months. Shannon Curry, a PhD student who works on the project investigating the role of human activity in pathogen dynamics in white ibises, won a University of Georgia (UGA) Graduate School Outstanding Teaching Assistant Award. These awards are provided to a small number of graduate students who have demonstrated excellent teaching skills. Sebastian Ortiz, a PhD student studying impacts of food supplementation on wildlife and their pathogens, and Anjelika Kidd, a master's student also working on the white ibis project, each received UGA Young Alumni Scholarship for Leadership and Training awards that will be used to support their travel to professional conferences and other leadership opportunities.

SCWDS has been represented well at scientific conferences by our staff and students with several individuals receiving speaking awards. Stacey Vigil, a research professional who is an international expert on *Culicoides* spp. identification, won the O.I. Snapp Award for the Best Regular Member Presentation at the 81<sup>st</sup> Annual Meeting of the Georgia Entomological Society held on Jekyll Island, Georgia. Chris Cleveland, a PhD student and research professional at SCWDS working on a guinea worm (*Dracunculus* spp.) project, won first

place for short presentations at the annual UGA Student Chapter of The Wildlife Disease Association symposium.

Sarah Sapp is a PhD student working on a One Health project related to the raccoon roundworm (*Baylisascaris procyonis*) that spans wildlife, domestic dogs, and people (see Page 3 for a research update on this project). She recently won the Willis A. Reid Research Grant from the American Society of Parasitologists. This grant is given to one graduate student to add an additional study to their dissertation research.

This year was a big year for recognition of SCWDS faculty for excellence in teaching and research. Dr. Sonia Hernandez was one of three UGA faculty members who received a Russell Award for Excellence in Undergraduate Teaching, the university's highest early career teaching honor. As noted in the UGA press release (<http://news.uga.edu/releases/article/russell-awards-17/>), Dr. Hernandez's "*classes, including an experiential learning course taught in Costa Rica, incorporate meaningful real-world experiences alongside lectures and more traditional approaches, and she is dedicated to mentoring students and acting as an advocate for students who are underrepresented in her fields.*" This award represents the continuing recognition of Dr. Hernandez as an influential teacher: She is a previous recipient of the Warnell School of Forestry and Natural Resources (WSFNR) Faculty Award for Excellence in Teaching and the Western Veterinary Conference Educator of the Year. Dr. Hernandez previously chaired WSNFR's Teaching Effectiveness Committee and participated in UGA's Teaching Academy Fellows and Writing Fellows programs.

Dr. Michael Yabsley received two awards from WSNFR this year: the Herrick Superior Teaching Award and the Alumni Association Faculty Award for Research. These awards highlight the dedication of SCWDS faculty to training future generations of wildlife professionals and conducting research to benefit our fellow wildlife professionals. (Prepared by Michael Yabsley)

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College of Veterinary Medicine  
The University of Georgia  
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