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THE MAYFLIES (EPHEMEROPTERA) OF TENNESSEE,
WITH A REVIEW OF THE POSSIBLY THREATENED SPECIES
OCCURRING WITHIN THE STATEL. S. Long¹ and B. C. Kondratieff²

ABSTRACT

One hundred and forty-three species of mayflies are reported from the state of Tennessee. Sixteen species (*Ameletus cryptostimulus*, *Choroterpes basalis*, *Baetis virile*, *Ephemera blanda*, *E. simulans*, *Ephemerella berneri*, *Heterocloeon curiosum*, *H. petersi*, *Labiobaetis ephippiatus*, *Leptophlebia bradleyi*, *Macdunnoa brunnea*, *Paraleptophlebia assimilis*, *P. debilis*, *P. mollis*, *Rhithrogenia pellucida* and *Siphonurus mirus*) are reported for the first time. Rare and vulnerable species occurring in the state are also discussed. This represents the first comprehensive statewide list of mayflies for Tennessee.

Wright and Berner (1949) provided the first extensive record of mayflies for Tennessee, listing 39 species in eight counties of East Tennessee. Berner (1977) listed 90 species from 44 counties in Tennessee, and Kondratieff and Foster (1977) added records for 25 species in seven counties of Middle and East Tennessee. Baker (1984) recorded 17 species from two counties in upper Middle Tennessee, and Long (1996) recorded 30 species from two counties in Middle Tennessee. Various taxonomic works also included individual collection records for the state (Allen and Edmunds 1962, Allen and Edmunds 1963a, 1963b, Allen and Edmunds 1965, Bae and McCafferty 1991, Bednarik and McCafferty 1979, Berner 1975, Burks 1953, Check 1982, Funk and Sweeny 1994, Kondratieff and Durfee 1994, Kondratieff and Voshell 1984, Lewis 1974, McCafferty 1975, McCafferty 1994, Morihara and McCafferty 1979, Pescador and Berner 1981, Provonsha 1990).

The checklist presented herein follows the classification of McCafferty (1996) and includes previous collection records, as well as unpublished records of the senior author or material deposited in the C. P. Gillette Museum of Arthropod Diversity, Colorado State University. A total of 144 species in 43 genera and 15 families is listed, including 16 new state records.

Type localities of six species of mayflies (*Habrophlebiodes celestria* Berner, *Paraleptophlebia kirchneri* Kondratieff and Durfee, *Serratella spiculosa* (Berner and Allen), *Isonychia diversa* Traver, *I. tusculanensis* Berner, and *Stenonema sinclari* Lewis) are in Tennessee. Of the six species, four are also found outside the state; *S. spiculosa* from North Carolina (Berner and Allen 1961), *H. celestria* and *I. tusculanensis* from Virginia (Kondratieff and Voshell 1984) and *S. sinclari* from West Virginia (Fisher and Tarter 1988).

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Nineteen species known from Tennessee are considered threatened or vulnerable to extirpation in surrounding states and therefore could be considered threatened in Tennessee due to limited distribution and disappearing habitat (Harris 1990, Kondratieff and Kirchner 1991, Morse et al. 1993, Peters 1994). Using Natural Heritage Global Rarity Ranks, the majority of these species can be categorized as "critically imperiled globally because of extreme rarity" or "imperiled globally because of rarity." Much of this rarity is being caused by anthropogenic stress to crenal and rhithral habitats by urban land development, forestry practices and chemical disturbances throughout Tennessee. Additional information on these species can be found following the county records.

Tennessee, with its varied physiographic provinces and its juxtaposition between major ecoregions of Eastern North America, may contain additional and possibly new species that have yet to be collected. Comparison with the mayfly fauna of surrounding states indicate that additional species are likely to occur in Tennessee, but have not yet been collected.

Although this list includes 143 species for Tennessee, 30 counties (31%) have yet to be sampled. Of the portion of the state that has been sampled for mayflies, 38 counties (40%) have 5 or less species listed, 10 counties (11%) have between 6 and 10 species listed, and only 17 (18%) counties have more than 10 species listed. West Tennessee (approximately 21 counties) has been virtually ignored, with only 17 records. In contrast, Sevier and Greene Counties in East Tennessee have been extensively collected over the years, each with 52 and 53 species records, respectively. With a majority of the state lacking adequate surveys, further research is necessary to determine which species are truly rare and which have been overlooked due to insufficient collecting.

Species list of Tennessee mayflies. The numbers following a species corresponds to the counties listed in Fig. 1, with the life stage in which it was collected (N—nymph, A—adult). An asterisk (*) indicates a new state record.

Superfamily Leptophleboidea
Family Leptophlebiidae
Genus Choroterpes Eaton

**Choroterpes basalis* (Banks)—89A. With Burian's (1995) recent review, only one variable eastern species is recognized.

Genus Habrophlebia Eaton

Habrophlebia vibrans Needham—89NA.

Genus Habrophlebiodes Ulmer

Habrophlebiodes americana (Banks)—18A, 71A, 87A, 88A, 89A, 90A.

Habrophlebiodes celeteria Berner—77A, 93NA.

Genus Leptophlebia Westwood

**Leptophlebia bradleyi* (Needham)—78A. This widespread species is probably much more common than records indicate. Adults can be found from

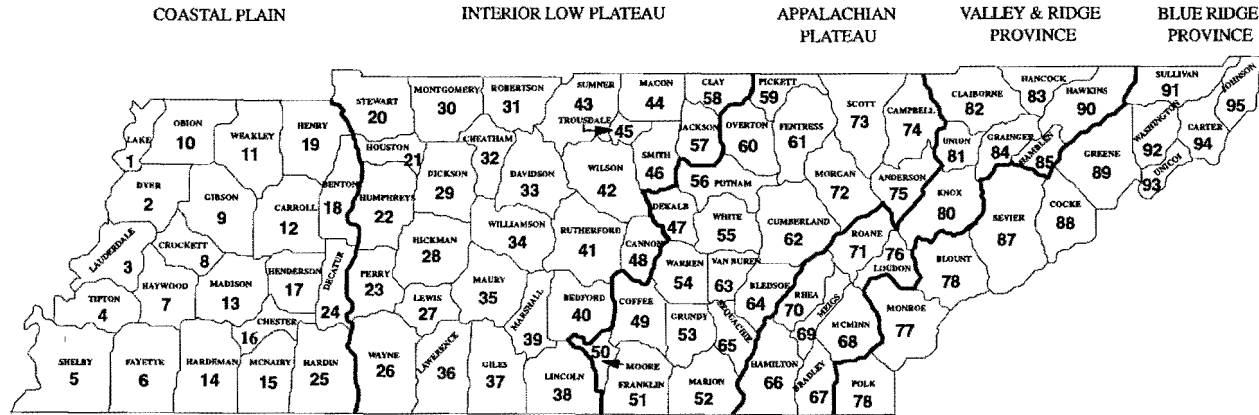


Figure 1. Map of Tennessee indicating counties and physiographic provinces.

January to March, a time when little adult collecting is done. Nuptial flights occur throughout the day.

Leptophlebia cupida (Say)—38NA, 41N, 48N, 71A, 78NA, 80N, 89N, 90A.

Genus *Paraleptophlebia* Lestage

**Paraleptophlebia assimilis* (Banks)—62A, 88A, 89A.

**Paraleptophlebia debilis* (Walker)—88A, 89A.

Paraleptophlebia guttata (McDunnough)—21NA, 26NA, 28NA, 29N, 33A, 34N, 41N, 48N, 82A, 87A, 89A, 90A, 91A, 92A, 93A, 94A, 95A.

Paraleptophlebia jeanae Berner—60A. This species is listed as threatened in Alabama (Harris, 1990) and known from only one site in Virginia, where it is considered a species of "special concern" (Kondratieff and Kirchner 1991). The nymph of this species was recently described by Randolph and McCafferty (1996) from Indiana populations.

Paraleptophlebia kirchneri Kondratieff & Durfee—34A, 45A. Previously known only from the type locality in Trousdale County, Tennessee (Kondratieff and Durfee, 1995), additional material has been collected by the senior author from Holt Creek in Williamson County.

Paraleptophlebia moerens (McDunnough)—82A.

**Paraleptophlebia mollis* (Eaton)—87A.

Superfamily Ephemeroidea

Family Potamanthidae

Genus *Anthopotamus* McCafferty & Bae

Anthopotamus distinctus (Traver)—23N, 35A, 81N, 87NA.

Anthopotamus myops (Walsh)—33A, 41N, 66A, 87A.

Anthopotamus neglectus disjunctus Bae & McCafferty—32A, 38A, 39A, 66A.

Anthopotamus verticis (Say)—27N, 32A, 33A, 35NA, 38A, 39NA, 80A, 90N.

Family Polymitarcidae

Genus *Ephoron* Williamson

Ephoron leukon Williamson—23N, 31NA, 32A, 37N, 38A, 41N, 48N, 52A, 61A, 87A, 88N, 89A, 90N, 93A.

Genus *Tortopus* Needham & Murphy

Tortopus puella (Pictet)—No locality data given by Burks (1953; as *T. primus*) or McCafferty (1994). This species prefers streams and rivers with vertical clay banks; may represent a record from the Mississippi or Tennessee River (McCafferty, personal communication).

Family Ephemeridae

Genus *Ephemera* Linnaeus

**Ephemera blanda* Traver—88A, 89A.

Ephemera guttulata Pictet—62N, 72N, 78A, 87N, 89NA, 93NA.

**Ephemera simulans* Walker—6A, 56A.

Ephemera varia Eaton—26N, 29N, 41N, 48N, 60N, 61N, 62N, 87N, 89NA, 93A.

Genus *Hexagenia* Walsh

Hexagenia atrocaudata McDunnough—88A, 89A, 91A, 93A.

Hexagenia bilineata (Say)—18A, 22A, 25A, 33A, 38A, 41A, 61A, 66A, 71A, 85A, 89A, 91A.

Hexagenia limbata Serville—22A, 31N, 32A, 33A, 38A, 41NA, 43N, 47A, 48N, 66A, 78A, 85A, 89A.

Hexagenia rigida McDunnough—33A, 66A, 85A.

Genus *Litobrancha* McCafferty

Litobrancha recurvata (Morgan)—89N. Considered rare in the Southeast; found in small, swift cold-water streams with a silt and marl substrate (Morse et al. 1994). McCafferty (1994) listed this species as occurring in both Tennessee and North Carolina.

Genus *Pentagenia* Walsh

Pentagenia vittigera (Walsh)—5A, 52A.

Superfamily Prosopistomatoidea

Family Baetiscidae

Genus *Baetisca* Walsh

Baetisca berneri Tarter & Kirchner—89N.

Baetisca carolina Traver—78N, 79NA, 89NA.

Baetisca gibbera Berner—35/39N.

Baetisca lacustris McDunnough—60N.

Superfamily Caenoidea

Family Neoephemeridae

Genus *Neophemera* McDunnough

Neophemera purpurea (Traver)—72N, 78N.

Family Caenidae

Genus *Amercaenis* Provonsha & McCafferty

Amercaenis ridens (McDunnough)—33A, 87NA.

Genus *Caenis* Stephens

Caenis amica Hagen—10A, 47A, 56A, 61A, 87A.

Caenis anceps Traver—41N, 66A, 74A.

Caenis diminuta diminuta Walker—10A.

Caenis hilaris (Say)—33A, 41N, 43A, 47A.

Caenis latipennis Banks—33NA, 34NA, 40N, 41N, 43A, 48N, 91A.

Caenis punctata McDunnough—29A, 34N, 48N.

Superfamily Ephemerelloidea
Family Ephemerellidae
Genus *Drunella* Needham

- Drunella allegheniensis* (Traver)—93N.
Drunella cornuta (Morgan)—87N.
Drunella cornutella (McDunnough)—78N, 79N, 87N, 89N, 90N, 91N.
Drunella lata (Morgan)—88N, 89NA.
Drunella longicornis (Traver)—87N. Also known from North Carolina (Berner, 1977) and Virginia (Kondratieff and Voshell 1983); it is considered restricted to pristine riffle habitats (Morse, et al. 1993).
Drunella tuberculata (Morgan)—87N, 89N.
Drunella wayah (Traver)—79N. This species is known from North Carolina, Georgia (Berner, 1977) and Virginia (Kondratieff and Voshell, 1983). It is found in sand-gravel substrates with moderate currents (Morse et al. 1994).

Genus *Ephemerella* Walsh

- **Ephemerella berneri* Allen & Edmunds—78N, 83A. This rare southeastern Appalachian species (Morse et al. 1994) is known only from Virginia, Georgia (Berner, 1977) and North Carolina, where it prefers clean medium-sized mountain streams (Lenat and Penrose, 1987). Kondratieff, et al. (1981) described the male imago of this species.
Ephemerella catawba Traver—52N, 62N, 87N, 88N, 89N.
Ephemerella crenula Allen & Edmunds—87N.
Ephemerella dorothea Needham—56N, 57N, 60A, 87N, 88N.
Ephemerella hispida Allen & Edmunds—87N.
Ephemerella inconstans Traver—89N.
Ephemerella invaria (Walker)—41N, 48N, 50N, 56N, 74N, 78A, 79N, 84N, 87N, 89N
Ephemerella needhami McDunnough—55A, 60A, 71A, 78N.
Ephemerella rossi Allen & Edmunds—79N, 87N.
Ephemerella rotunda Morgan—41N, 48N, 55A, 56A, 60A, 62N, 71A, 78NA, 87N, 89A. This species may be a complex of species or a widespread variable species which several other *Ephemerella* species currently recognized as synonyms.
Ephemerella septentrionalis McDunnough—78N, 56A.
Ephemerella subvaria McDunnough—56N, 57N.

Genus *Eurylophella* Tiensuu

- Eurylophella aestiva* (McDunnough)—25N, 63N.
Eurylophella bicolor (Clemens)—34N, 38N, 56N, 57N, 89N.
Eurylophella enoensis Funk—33N, 89N.
Eurylophella funeralis (McDunnough)—41N, 48N, 32N, 56N, 69N, 80N, 87N, 89N.
Eurylophella lutulenta (Clemmens)—41N, 48N, 33N, 56N, 62N.
Eurylophella macdunnoughi Funk—89N.
Eurylophella minimella (McDunnough)—32N, 69N, 84N, 89N.
Eurylophella temporalis (McDunnough)—25N, 41N, 48N, 56N, 60A, 71A, 88N.

Genus *Serratella* Edmunds

Serratella carolina (Berner & Allen)—87N. This riffle species is considered threatened in Alabama (Harris 1990) and the streams of the southern Appalachian Mountains (Morse et al. 1994).

Serratella deficiens (Morgan)—41N, 78N, 79N, 87N, 90N, 93N.

Serratella serratoides (McDunnough)—31N, 34N, 48N, 51N, 56N, 57N, 87N, 93N.

Serratella sordida (McDunnough)—62N.

Serratella spiculosa (Berner & Allen)—78N, 89N. This species is also reported from North Carolina (Berner 1977). Nymphs of this rare species collected by D. Etnier, University of Tennessee, were recently examined from Sams Creek, GSMNP, Blount County. This species is formally listed as Category 2 by United States Fish and Wildlife Service (Morse, et al. 1994).

Genus *Timpanoga* Needham

Timpanoga simplex (McDunnough)—56N, 87N.

**Family Leptohyphidae
Genus *Tricorythodes* Ulmer**

Tricorythodes allectus Needham—40A, 87A.

**Infraorder Pisciforma
Family Ameletidae
Genus *Ameletus* Eaton**

**Ameletus cryptostimulus* Carle—62A, 92A. Considered a species of "special concern" in Virginia, where it is only found in pristine spring-fed streams of the older Appalachian Mountains (Kondratieff and Kirchner 1991)

Ameletus lineatus Traver—38N, 52N, 56A, 60N, 61A, 62N, 84NA, 87A. This species may be a synonym of *A. ludens* Needham.

**Family Baetidae
Genus *Acentrella* Bengtsson**

Acentrella ampla (Traver)—52N, 62NA.

Acentrella turbida (McDunnough)—30N, 31N, 33NA, 34NA, 41N, 45A, 48N, 79N, 87N, 88N, 90N.

Genus *Acerpenna* Waltz & McCafferty

Acerpenna pygmaea (Hagen)—18A, 33NA, 34NA, 41N, 48N, 63N, 72N, 81N, 82N, 89N. *Acerpenna harti* (McDunnough) is a probable synonym.

Genus *Baetis* Leach

Baetis cinctutus McCafferty & Waltz—38A.

Baetis flavistriga McDunnough—33N, 41N, 48N, 78N, 87A, 89A.

Baetis intercalaris McDunnough—33N, 34N, 41N, 48N, 74A.

Baetis punctiventris (McDunnough)—34N, 87A.

Baetis rubrolaterale (McDunnough)—87A.

Baetis tricaudatus (McDunnough)—41N, 48N, 82NA, 86N, 87NA, 89A, 93A.

Baetis veteris (McDunnough)—60A.

**Baetis virile* (McDunnough)—41N, 48N. Known only from Canada (Needham, et al. 1934), Maine (Burian and Gibbs 1991), and recently Colorado (McCafferty, et al. 1993), this species is believed to be more widespread than collection records indicate (R. D. Waltz, pers. com.).

Genus *Callibaetis* Eaton

Callibaetis ferrugineus ferrugineus (Walsh)—No locality data given (Check 1982).

Callibaetis floridanus Banks—56A.

Callibaetis fluctuans (Walsh)—No locality data given (Check 1982).

Callibaetis pretiosus Banks—5A. Listed from Georgia and North Carolina (Berner 1977) and Virginia (Kondratieff and Voshell 1983). This species is considered threatened in the pools of mountain streams of the southern Appalachian Mountains (Morse, et al. 1994).

Genus *Centroptilum* Eaton

Centroptilum alamance (Traver)—33NA, 34NA, 41N, 48N, 62N, 87A, 89N.

Genus *Dipheter* Waltz & McCafferty

Dipheter hageni (Eaton)—34N, 41N, 48N, 62A, 82N, 89A.

Genus *Heterocloeon* McDunnough

**Heterocloeon curiosum* (McDunnough)—90A. Reported from Georgia (Berner 1977), Virginia (Kondratieff and Voshell 1983) and Alabama, where it is considered threatened (Harris 1990).

**Heterocloeon petersi* (Müller-Liebenau)—89A. Also known from Georgia (Berner, 1977), North Carolina (Lenat and Penrose, 1987) and Virginia (Kondratieff and Voshell 1983); this species prefers well oxygenated medium-sized to large streams of the southern Appalachians (Morse et al. 1994).

Genus *Labiobaetis* Novikova & Kluge

**Labiobaetis ephippiatus* (Traver)—78A.

Labiobaetis frondalis (McDunnough)—89A.

Labiobaetis propinquus (Walsh)—66A.

Family Siphonuridae Genus *Siphonurus* Eaton

**Siphonurus mirus* Eaton—95A.

Siphonurus quebecensis (Provancher)—56N, 61A, 62N, 89A.

Suborder Setisura
Family Isonychiidae
Genus *Isonychia* Eaton

Isonychia bicolor (Walker)—28A, 32A, 33N, 34NA, 41N, 48N, 60A, 80A, 86N, 87A, 88A, 89NA, 90N, 93A.

Isonychia diversa Traver—80A. This species may be extinct, with only two specimens known, both collected in 1916.

Isonychia obscura Traver—89A.

Isonychia serrata Traver—61A. Reported from Georgia, North Carolina (Berner 1977) and Virginia, where it is a species of "special concern" (Kondratieff and Kirchner 1991).

Isonychia similis Traver—87A, 89A. Also known from North Carolina, South Carolina (Berner 1977) and Virginia (Kondratieff and Voshell 1983) and is listed as threatened in Alabama (Harris 1990).

Isonychia tusculanensis Berner—79A, 89NA. Also known from Virginia, where it is considered a species of "special concern" (Kondratieff and Kirchner 1991). Few recent records are available for Tennessee. This species no longer occurs at its type locality and nearby streams.

Family Pseudironidae
Genus *Pseudiron* McDunnough

Pseudiron centralis McDunnough—5A, 93A Listed as threatened in Alabama (Harris 1990) and Florida (Peters 1994) and is considered a species of "special concern" in Virginia (Kondratieff and Kirchner 1991). It is found primarily in the shifting sand substrates in the deeper, swifter parts of rivers (Edmunds, et al. 1976, Kondratieff and Kirchner 1991, Peters 1994).

Family Heptageniidae
Genus *Cinygmula* McDunnough

Cinygmula subaequalis (Banks)—21N, 29N, 50N, 52N, 88A.

Genus *Epeorus* Eaton

Epeorus dispar (Traver)—93A.

Epeorus pleuralis (Banks)—78A, 87NA, 93A.

Epeorus rubidus (Traver)—41N, 48N, 82N, 88A, 89N, 90N, 91N.

Epeorus subpallidus (Traver)—87A. Also reported from Georgia and North Carolina (Berner, 1977). Found in moderate to fast currents and mixed substrates; a scraper of periphyton (Morse et al. 1994).

Epeorus vitreus (Walker)—78A.

Genus *Heptagenia* Walsh

Heptagenia marginalis Banks—61A.

Heptagenia townesi Traver—87A.

Genus *Leucrocuta* Flowers

Leucrocuta aphrodite (McDunnough)—29NA, 32A, 33A, 38N, 41N, 48N, 87N

Leucrocuta hebe (McDunnough)—34N, 38A, 62N, 66A, 84NA, 87A, 89A.

Leucrocuta juno (McDunnough)—31N, 87N, 90N.

Leucrocuta maculipennis (Walsh)—80A.

Leucrocuta minerva (McDunnough)—87A.

Leucrocuta thetis (Traver)—89N

Genus *Macdunnoa* Lehmkuhl

**Macdunnoa brunnea* Flowers—89A. Also known from Alabama, where it is listed as threatened (Harris, 1990).

Macdunnoa persimplex (McDunnough)—5A. Also known from Alabama, where it is listed as threatened (Harris 1990).

Genus *Raptoheptagenia* Whiting & Lehmkuhl

Raptoheptagenia cruentata (Walsh)—5A.

Genus *Rhithrogena* Eaton

Rhithrogena exilis Traver 79A.—Previously reported from Georgia and North Carolina (Berner 1977). Found in moderate to fast currents and mixed substrates; feeds on periphyton that requires an open canopy (Morse, et al. 1994).

**Rhithrogena pellucida* Daggy—41N, 48N, 90A.

Genus *Stenacron* Jensen

Stenacron carolina (Banks)—87A, 88A, 89A, 92A.

Stenacron gildersleevei (Traver)—70A.

Stenacron interpunctatum (Say)—10A, 22A, 26NA, 28A, 32A, 33NA, 34NA, 38A, 41NA, 47NA, 48N, 56N, 57N, 66N, 78NA, 79A, 80A, 81N, 87A, 88N, 89NA, 90N.

Genus *Stenonema* Traver

Stenonema carlsoni Lewis—87N. Also recorded from Georgia and South Carolina (Berner 1977) and favors high water quality (Morse et al. 1993).

Stenonema exiguum Traver—34N, 35N, 38A, 66A, 78A, 87A.

Stenonema femoratum (Say)—18NA, 22NA, 28A, 30NA, 31N, 33NA, 34N, 38NA, 41N, 45A, 48N, 49N, 50N, 56NA, 57N, 61A, 66N, 71A, 81N, 84N, 90A.

Stenonema ithaca (Clemens & Leonard)—26N, 30N, 31N, 38N, 50N, 61A, 78A, 87A, 89A, 90N, 93NA, 95N.

Stenonema mediopunctatum (McDunnough)—27N, 35A, 40N, 41N, 48N, 56N, 57N, 84N, 86N, 87N, 90N.

Stenonema meririvulatum Carle & Lewis—56N, 57N, 88A, 89A, 94A. Considered a threatened species in spring runs in Alabama (Harris 1990).

Stenonema mexicanum integrum (McDunnough)—5A, 22A, 34A, 56N, 78A, 87A.

Stenonema modestum (Banks) 21A, 28A, 38A, 41N, 56NA, 57N, 71A, 81A, 87A, 89A, 91A.

- Stenonema pudicum* (Hagen)—52N, 57N, 62N, 70N, 72N, 79A, 87N, 88A, 89NA, 93A.
Stenonema pulchellum (Walsh)—34N, 55A, 56N, 57N, 90N.
Stenonema sinclari Lewis—52N, 64N.
Stenonema terminatum terminatum (Walsh)—32A, 33NA, 34NA, 38A, 56N, 57N.
Stenonema vicarium (Walker)—48N, 56N, 57N, 62A, 71A, 88A, 89A.

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