Kaiwhekea katiki
Aristonectes quiriquinensis
Morenosaurus stocki
Styxosaurus sp
Hydrotherosaurus alexandrae
Elasmosaurus platyurus
Albertonectes vanderveldei
Thalassomedon haningtoni
Libonectes atlasense
Callawayasaurus colombiensis
Dolichorhynchops osborni
Trinacromerum bentonianum
Polycotylus latipinnis
Manemergus anguirostris
Brancasaurus brancai
Nichollssaura borealis
Colymbosaurus trochanterius
Muraenosaurus leedsii
Cryptoclidus eurymerus
Plesiopterys wildi
Microcleidus brachypterygius
Microcleidus sp
Microcleidus homalospondylus
Microcleidus tournemirensis
Seeleyosaurus guilelmiimperatori
Plesiosaurus sp
Plesiosaurus dolichodeirus
Kronosaurus boyacensis
Sachicasaurus vitae
Kronosaurus queenslandicus
Luskhan itilensis
Liopleurodon ferox
Peloneustes philarchus
Attenborosaurus conybeari
Hauffiosaurus zanoni
Hauffiosaurus tomistomimus
Hauffiosaurus longirostris
Thalassiodracon hawkinsii
Rhomaleosaurus zetlandicus
Rhomaleosaurus cramptoni
Meyerasaurus victor
Archaeonectrus rostratus
Rhomaleosaurus megacephalus
Avalonnectes arturi
Macroplata tenuiceps
Lindwurmia thiuda
Eopleiosaurus antiquior
Bobosaurus forojuliensis
Yunguisaurus liae
Wangosaurus brevirostris
Corosaurus alcovensis
Nothosaurus youngi
Lariosaurus xingyiensis
Ceresiosaurus calcagnii
Lariosaurus valceresii
Lariosaurus balsami
Nothosaurus giganteus
Nothosaurus marchicus
Diandongosaurus acutidentatus
Dianmeisaurus gracilis
Dianopachysaurus dingi
Keichousaurus hui
Panzhousaurus rotundirostris
Neusticosaurus edwardsii
Neusticosaurus peyeri
Neusticosaurus pusillus
Serpianosaurus mirigiolensis
Qianxisaurus chajiangensis
Dactylosaurus schroederi
Wumengosaurus delicatomandibularis
Psephoderma alpinum
Psephochelys polyosteoderma
Glyphoderma kangi
Henodus chelyops
Sinocyamodus xinpuensis
Cyamodus orientalis
Placodus inexpectatus
Placodus gigas
Paraplacodus broilii

Histogram of unlist(check.branches)

Frequency

8.25641025641026

0

unlist(check.branches)

Paraplacodus broilii
Placodus inexpectatus
Placodus gigas
Sinocyamodus xinpuensis
Cyamodus orientalis
Henodus chelyops
Glyphoderma kangi
Psephoderma alpinum
Psephochelys polyosteoderma
Wumengosaurus delicatomandibularis
Dactylosaurus schroederi
Qianxisaurus chajiangensis
Serpianosaurus mirigiolensis
Neusticosaurus pusillus
Neusticosaurus edwardsii
Neusticosaurus peyeri
Panzhousaurus rotundirostris
Keichousaurus hui
Dianopachysaurus dingi
Diandongosaurus acutidentatus
Dianmeisaurus gracilis
Nothosaurus marchicus
Nothosaurus giganteus
Nothosaurus youngi
Lariosaurus xingyiensis
Lariosaurus balsami
Ceresiosaurus calcagnii
Lariosaurus valceresii
Corosaurus alcovensis
Wangosaurus brevirostris
Yunguisaurus liae
Bobosaurus forojuliensis
Eopleiosaurus antiquior
Lindwurmia thiuda
Macroplata tenuiceps
Avalonnectes arturi
Rhomaleosaurus megacephalus
Archaeonectrus rostratus
Meyerasaurus victor
Rhomaleosaurus zetlandicus
Rhomaleosaurus cramptoni
Thalassiodracon hawkinsii
Hauffiosaurus longirostris
Hauffiosaurus zanoni
Hauffiosaurus tomistomimus
Attenborosaurus conybeari
Peloneustes philarchus
Liopleurodon ferox
Luskhan itilensis
Kronosaurus queenslandicus
Kronosaurus boyacensis
Sachicasaurus vitae
Plesiosaurus sp
Plesiosaurus dolichodeirus
Seeleyosaurus guilelmiimperatori
Microcleidus tournemirensis
Microcleidus homalospondylus
Microcleidus brachypterygius
Microcleidus sp
Plesiopterys wildi
Colymbosaurus trochanterius
Muraenosaurus leedsii
Cryptoclidus eurymerus
Brancasaurus brancai
Nichollssaura borealis
Manemergus anguirostris
Polycotylus latipinnis
Dolichorhynchops osborni
Trinacromerum bentonianum
Callawayasaurus colombiensis
Libonectes atlasense
Thalassomedon haningtoni
Morenosaurus stocki
Kaiwhekea katiki
Aristonectes quiriquinensis
Hydrotherosaurus alexandrae
Styxosaurus sp
Elasmosaurus platyurus
Albertonectes vanderveldei

| Permian | | | Triassic | | | | | | | Jurassic | | | | | | | | Cretaceous | | | | | | | | | | | Paleogene | | | | | | | | Neogene |

Paraplacodus broilii
Placodus inexpectatus
Placodus gigas
Sinocyamodus xinpuensis
Cyamodus orientalis
Henodus chelyops
Glyphoderma kangi
Psephoderma alpinum
Psephochelys polyosteoderma
Wumengosaurus delicatomandibularis
Dactylosaurus schroederi
Qianxisaurus chajiangensis
Serpianosaurus mirigiolensis
Neusticosaurus pusillus
Neusticosaurus edwardsii
Neusticosaurus peyeri
Panzhousaurus rotundirostris
Keichousaurus hui
Dianopachysaurus dingi
Diandongosaurus acutidentatus
Dianmeisaurus gracilis
Nothosaurus marchicus
Nothosaurus giganteus
Nothosaurus youngi
Lariosaurus xingyiensis
Lariosaurus balsami
Ceresiosaurus calcagnii
Lariosaurus valceresii
Corosaurus alcovensis
Wangosaurus brevirostris
Yunguisaurus liae
Bobosaurus forojuliensis
Eopleiosaurus antiquior
Lindwurmia thiuda
Macroplata tenuiceps
Avalonnectes arturi
Rhomaleosaurus megacephalus
Archaeonectrus rostratus
Meyerasaurus victor
Rhomaleosaurus zetlandicus
Rhomaleosaurus cramptoni
Thalassiodracon hawkinsii
Hauffiosaurus longirostris
Hauffiosaurus tomistomimus
Hauffiosaurus zanoni
Attenborosaurus conybeari
Peloneustes philarchus
Liopleurodon ferox
Luskhan itilensis
Kronosaurus queenslandicus
Kronosaurus boyacensis
Sachicasaurus vitae
Plesiosaurus sp
Plesiosaurus dolichodeirus
Seeleyosaurus guilelmiimperatori
Microcleidus tournemirensis
Microcleidus homalospondylus
Microcleidus brachypterygius
Microcleidus sp
Plesiopterys wildi
Colymbosaurus trochanterius
Muraenosaurus leedsii
Cryptoclidus eurymerus
Brancasaurus brancai
Nichollssaura borealis
Manemergus anguirostris
Polycotylus latipinnis
Dolichorhynchops osborni
Trinacromerum bentonianum
Callawayasaurus colombiensis
Libonectes atlasense
Thalassomedon haningtoni
Morenosaurus stocki
Kaiwhekea katiki
Aristonectes quiriquinensis
Albertonectes vanderveldei
Elasmosaurus platyurus
Hydrotherosaurus alexandrae
Styxosaurus sp

Permian — Guadalupian (Capitanian), Lopingian (Wuchiapingian, Changhsingian)

Triassic — Lower (Induan/Olenekian, Olenekian, Anisian, Ladinian), Middle, Upper (Carnian, Norian, Rhaetian)

Jurassic — Lower (Hettangian, Sinemurian, Pliensbachian, Toarcian), Middle (Aalenian, Bajocian, Bathonian, Callovian), Upper (Oxfordian, Kimmeridgian, Tithonian)

Cretaceous — Lower (Berriasian, Valanginian, Hauterivian, Barremian, Aptian, Albian), Upper (Cenomanian, Turonian, Coniacian, Santonian, Campanian, Maastrichtian)

Paleogene — Paleocene (Danian, Selandian, Thanetian), Eocene (Ypresian, Lutetian, Bartonian, Priabonian), Oligocene (Rupelian, Chattian)

Neogene — Miocene (Aquitanian, Burdigalian, Langhian)

260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20

Paraplacodus broilii
Placodus inexpectatus
Placodus gigas
Sinocyamodus xinpuensis
Cyamodus orientalis
Henodus chelyops
Glyphoderma kangi
Psephoderma alpinum
Psephochelys polyosteoderma
Wumengosaurus delicatomandibularis
Dactylosaurus schroederi
Qianxisaurus chajiangensis
Serpianosaurus mirigiolensis
Neusticosaurus pusillus
Neusticosaurus edwardsii
Neusticosaurus peyeri
Panzhousaurus rotundirostris
Keichousaurus hui
Dianopachysaurus dingi
Diandongosaurus acutidentatus
Dianmeisaurus gracilis
Nothosaurus marchicus
Nothosaurus giganteus
Nothosaurus youngi
Lariosaurus xingyiensis
Lariosaurus balsami
Ceresiosaurus calcagnii
Lariosaurus valceresii
Corosaurus alcovensis
Wangosaurus brevirostris
Yunguisaurus liae
Bobosaurus forojuliensis
Eopleiosaurus antiquior
Lindwurmia thiuda
Macroplata tenuiceps
Avalonnectes arturi
Rhomaleosaurus megacephalus
Archaeonectrus rostratus
Meyerasaurus victor
Rhomaleosaurus zetlandicus
Rhomaleosaurus cramptoni
Thalassiodracon hawkinsii
Hauffiosaurus zanoni
Hauffiosaurus tomistomimus
Hauffiosaurus longirostris
Attenborosaurus conybeari
Peloneustes philarchus
Liopleurodon ferox
Luskhan itilensis
Kronosaurus queenslandicus
Kronosaurus boyacensis
Sachicasaurus vitae
Plesiosaurus sp
Plesiosaurus dolichodeirus
Seelyosaurus guilelmiimperatori
Microcleidus tournemirensis
Microcleidus homalospondylus
Microcleidus brachypterygius
Microcleidus sp
Plesiopterys wildi
Colymbosaurus trochanterius
Muraenosaurus leedsii
Cryptoclidus eurymerus
Brancasaurus brancai
Nichollssaura borealis
Manemergus anguirostris
Polycotylus latipinnis
Dolichorhynchops osborni
Trinacromerum bentonianum
Callawayasaurus colombiensis
Libonectes atlasense
Thalassomedon haningtoni
Morenosaurus stocki
Kaiwhekea katiki
Aristonectes quiriquinensis
Elasmosaurus platyurus
Albertonectes vanderveldei
Styxosaurus sp
Hydrotherosaurus alexandrae

Permian — Guadalupian: Capitanian; Lopingian: Wuchiapingian, Changhsingian

Triassic — Lower: Olenekian (Induan), Anisian, Ladinian; Middle; Upper: Carnian, Norian, Rhaetian

Jurassic — Lower: Hettangian, Sinemurian, Pliensbachian, Toarcian; Middle: Aalenian, Bajocian, Bathonian, Callovian; Upper: Oxfordian, Kimmeridgian, Tithonian

Cretaceous — Lower: Berriasian, Valanginian, Hauterivian, Barremian, Aptian, Albian; Upper: Cenomanian, Turonian, Coniacian, Santonian, Campanian, Maastrichtian

Paleogene — Paleocene: Danian, Selandian, Thanetian; Eocene: Ypresian, Lutetian, Bartonian

260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40

Paraplacodus broilii
Placodus inexpectatus
Placodus gigas
Sinocyamodus xinpuensis
Cyamodus orientalis
Henodus chelyops
Glyphoderma kangi
Psephoderma alpinum
Psephochelys polyosteoderma
Wumengosaurus delicatomandibularis
Dactylosaurus schroederi
Qianxisaurus chajiangensis
Serpianosaurus mirigiolensis
Neusticosaurus pusillus
Neusticosaurus edwardsii
Neusticosaurus peyeri
Panzhousaurus rotundirostris
Keichousaurus hui
Dianopachysaurus dingi
Diandongosaurus acutidentatus
Dianmeisaurus gracilis
Nothosaurus marchicus
Nothosaurus giganteus
Nothosaurus youngi
Lariosaurus xingyiensis
Lariosaurus balsami
Ceresiosaurus calcagnii
Lariosaurus valceresii
Corosaurus alcovensis
Wangosaurus brevirostris
Yunguisaurus liae
Bobosaurus forojuliensis
Eopleiosaurus antiquior
Lindwurmia thiuda
Macroplata tenuiceps
Avalonnectes arturi
Rhomaleosaurus megacephalus
Archaeonectrus rostratus
Meyerasaurus victor
Rhomaleosaurus zetlandicus
Rhomaleosaurus cramptoni
Thalassiodracon hawkinsii
Hauffiosaurus tomistomimus
Hauffiosaurus zanoni
Hauffiosaurus longirostris
Attenborosaurus conybeari
Peloneustes philarchus
Liopleurodon ferox
Luskhan itilensis
Kronosaurus queenslandicus
Kronosaurus boyacensis
Sachicasaurus vitae
Plesiosaurus sp
Plesiosaurus dolichodeirus
Seeleyosaurus guilelmiimperatori
Microcleidus tournemirensis
Microcleidus homalospondylus
Microcleidus brachypterygius
Microcleidus sp
Plesiopterys wildi
Colymbosaurus trochanterius
Muraenosaurus leedsii
Cryptoclidus eurymerus
Brancasaurus brancai
Nichollssaura borealis
Manemergus anguirostris
Polycotylus latipinnis
Dolichorhynchops osborni
Trinacromerum bentonianum
Callawayasaurus colombiensis
Libonectes atlasense
Thalassomedon haningtoni
Morenosaurus stocki
Kaiwhekea katiki
Aristonectes quiriquinensis
Styxosaurus sp
Elasmosaurus platyurus
Albertonectes vanderveldei
Hydrotherosaurus alexandrae

Capitanian | Wuchiapingian | Changhsingian | Induan/Olenekian | Anisian | Ladinian | Carnian | Norian | Rhaetian | Hettangian | Sinemurian | Pliensbachian | Toarcian | Aalenian | Bajocian | Bathonian | Callovian | Oxfordian | Kimmeridgian | Tithonian | Berriasian | Valanginian | Hauterivian | Barremian | Aptian | Albian | Cenomanian | Turonian | Coniacian | Santonian | Campanian | Maastrichtian | Danian | Selandian | Thanetian | Ypresian | Lutetian | Bartonian | Priabonian | Rupelian | Chattian | Aquitanian | Burdigalian | Langhian

Guadalupian | Lopingian | Lower | Middle | Upper | Lower | Middle | Upper | Lower | Upper | Paleocene | Eocene | Oligocene | Miocene

Permian | Triassic | Jurassic | Cretaceous | Paleogene | Neogene

260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20