Fish & Fisheries Worldwide
SEARCH STRATEGY

Search Fields used: ((Key Words/Phrases **OR**) **AND** Author **AND** Title)

Author	: BEHNKE	86 hits
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Title	: PHYLOGENY AND CLASSIFICATION OF CUTTHROAT TROUT	1 hits
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1. **Behnke,** Robert J.; Gresswell R.E.
***PHYLOGENY** AND **CLASSIFICATION** OF **CUTTHROAT TROUT**.*
American Fisheries Society. Symposium, 4:1-7. 1988. FR 34(2) **ISSN:** 0892-2284
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Organized 1870 to Promote the Conservation, Development and Wise Utilization of the Fisheries

American Fisheries Society

November 1, 1988

Dr. Robert J. Behnke
Dept. Fishery and Wildlife Biology
Colorado State University
Fort Collins, CO 80523

Re: "Phylogeny and Classification of Cutthroat Trout"

Dear Dr. Behnke:

We do not have a Transfer of Copyright on file for the paper noted above. Would you please fill out the enclosed form and return it to the Managing Editor's office at your earliest convenience.

Thank you very much.

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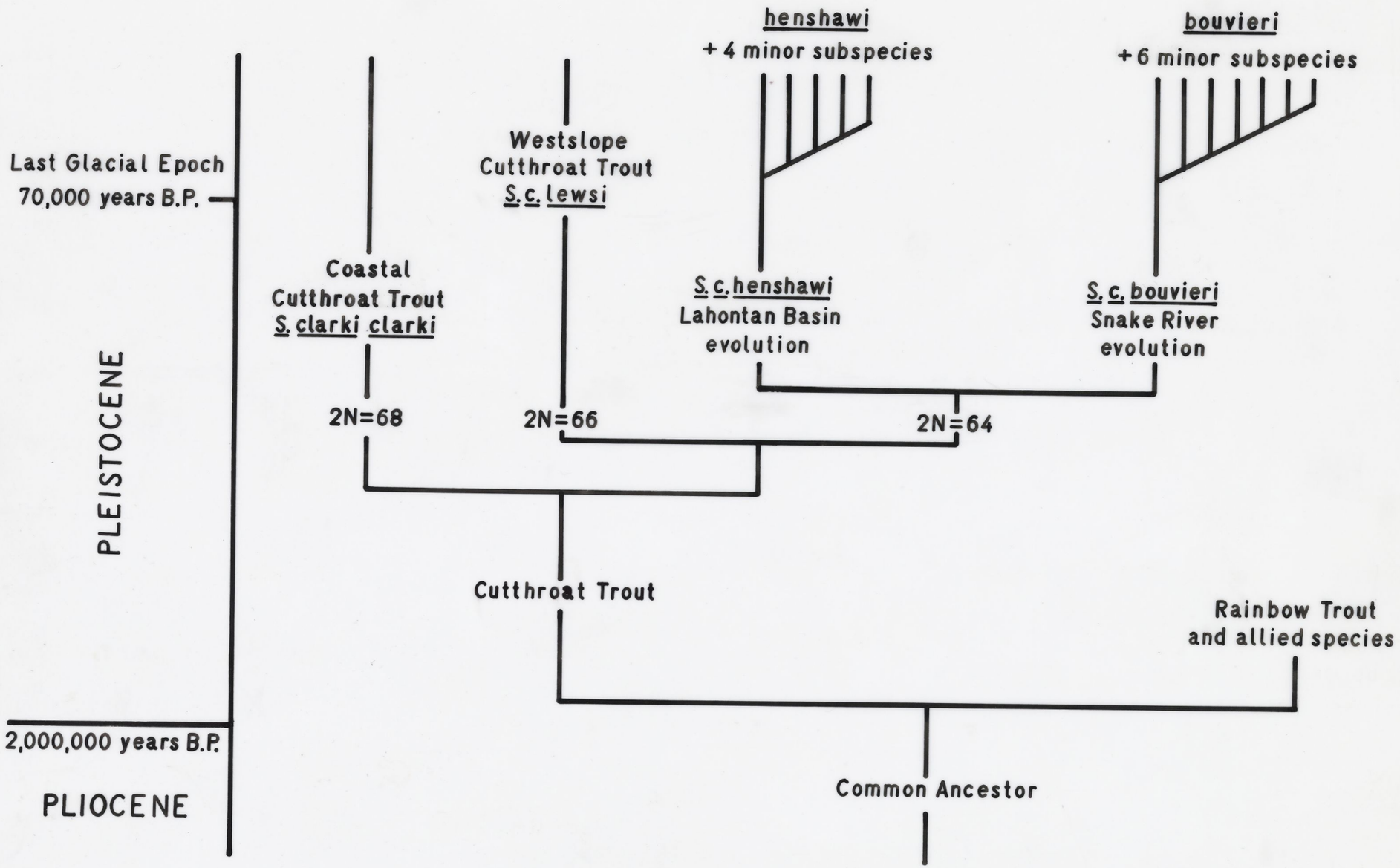
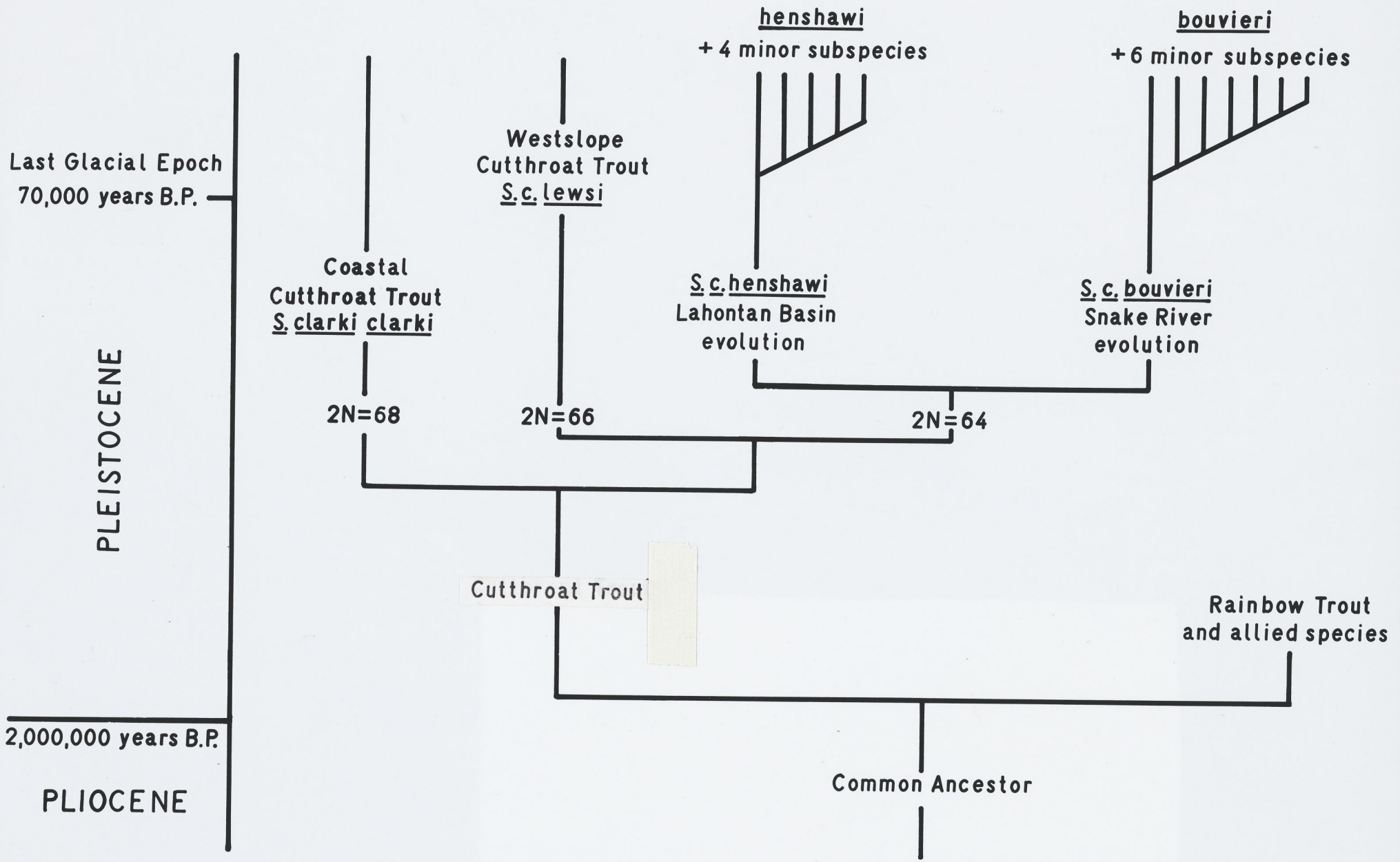

henshawi
+ 4 minor subspecies
bouvieri
+ 6 minor subspecies
Last Glacial Epoch
70,000 years B.P.
Westslope
Cutthroat Trout
S. c. lewsi
Coastal
Cutthroat Trout
S. clarki clarki
S. c. henshawi
Lahontan Basin
evolution
S. c. bouvieri
Snake River
evolution
PLEISTOCENE
2N=68
2N=66
2N=64
Cutthroat Trout
Rainbow Trout
and allied species
2,000,000 years B.P.
PLIOCENE
Common Ancestor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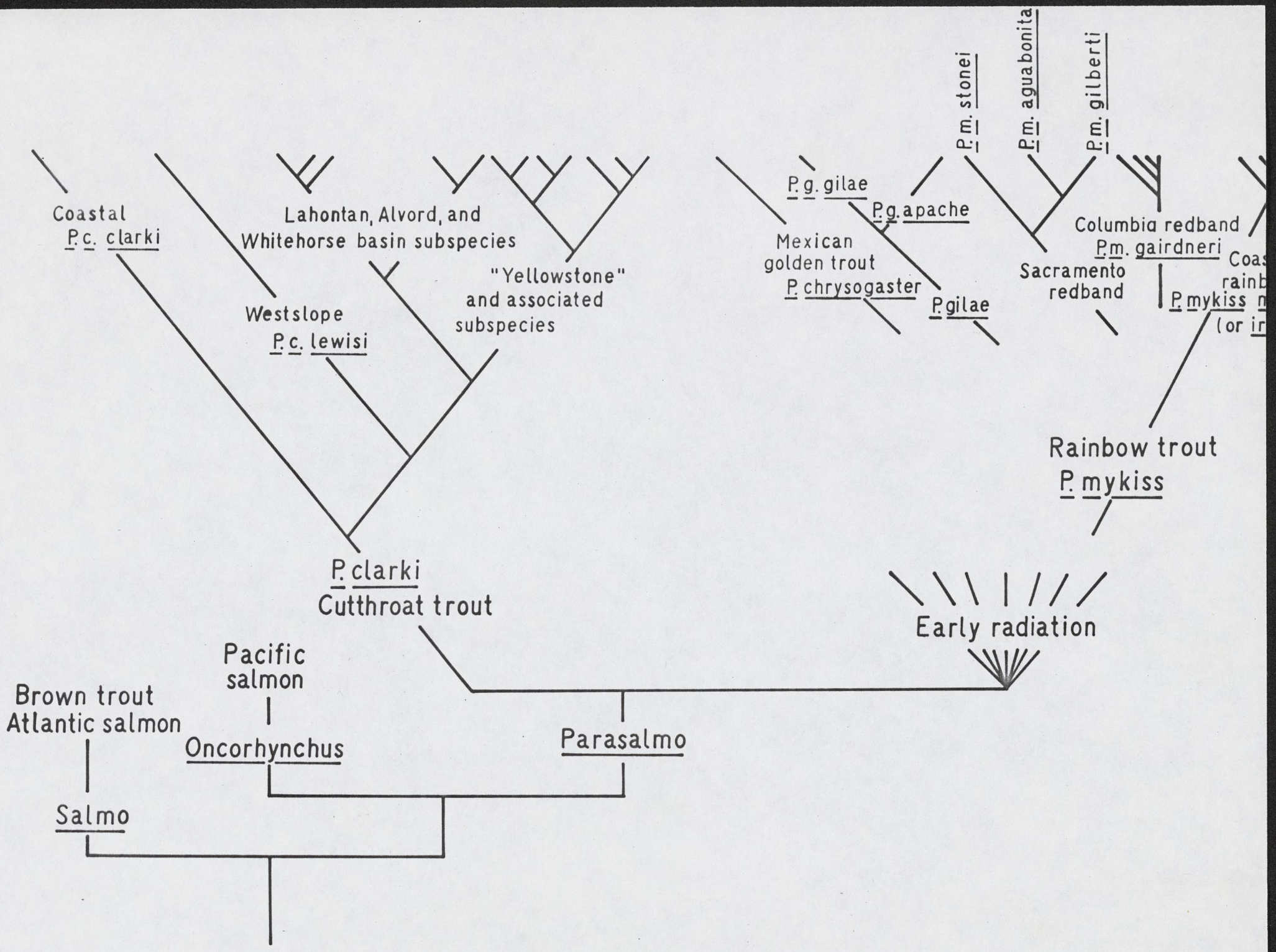
2N=68
2N=66
2N=64
Cutthroat Trout
Rainbow Trout
and allied species
2,000,000 years B.P.
PLIOCENE
Common Ancestor

JOB NAME: Cutthroat Trout	PHOTO/ART ID NUMBER: Fig. 1 Behnke Cut-1		SIZE: 52 %
DOCKET NUMBER:	☐ AA ☐ PE	PG. NO.:	
SPECIAL INSTRUCTIONS:			

PLEASE USE BLACK INK TO FILL OUT FORM

H

8.5


Coastal
P. c. clarki
Lahontan, Alvord, and
Whitehorse basin subspecies
"Yellowstone"
and associated
subspecies
Westslope
P. c. lewisi
P. g. gilae
P. g. apache
Mexican
golden trout
P. chrysogaster
P. gilae
P. m. stonei
P. m. aguabonita
P. m. gilberti
Columbia redband
P. m. gairdneri
Sacramento
redband
P. mykiss
Rainbow trout
P. mykiss
P. clarki
Cutthroat trout
Early radiation
Pacific
salmon
Brown trout
Atlantic salmon
Oncorhynchus
Parasalmo
Salmo

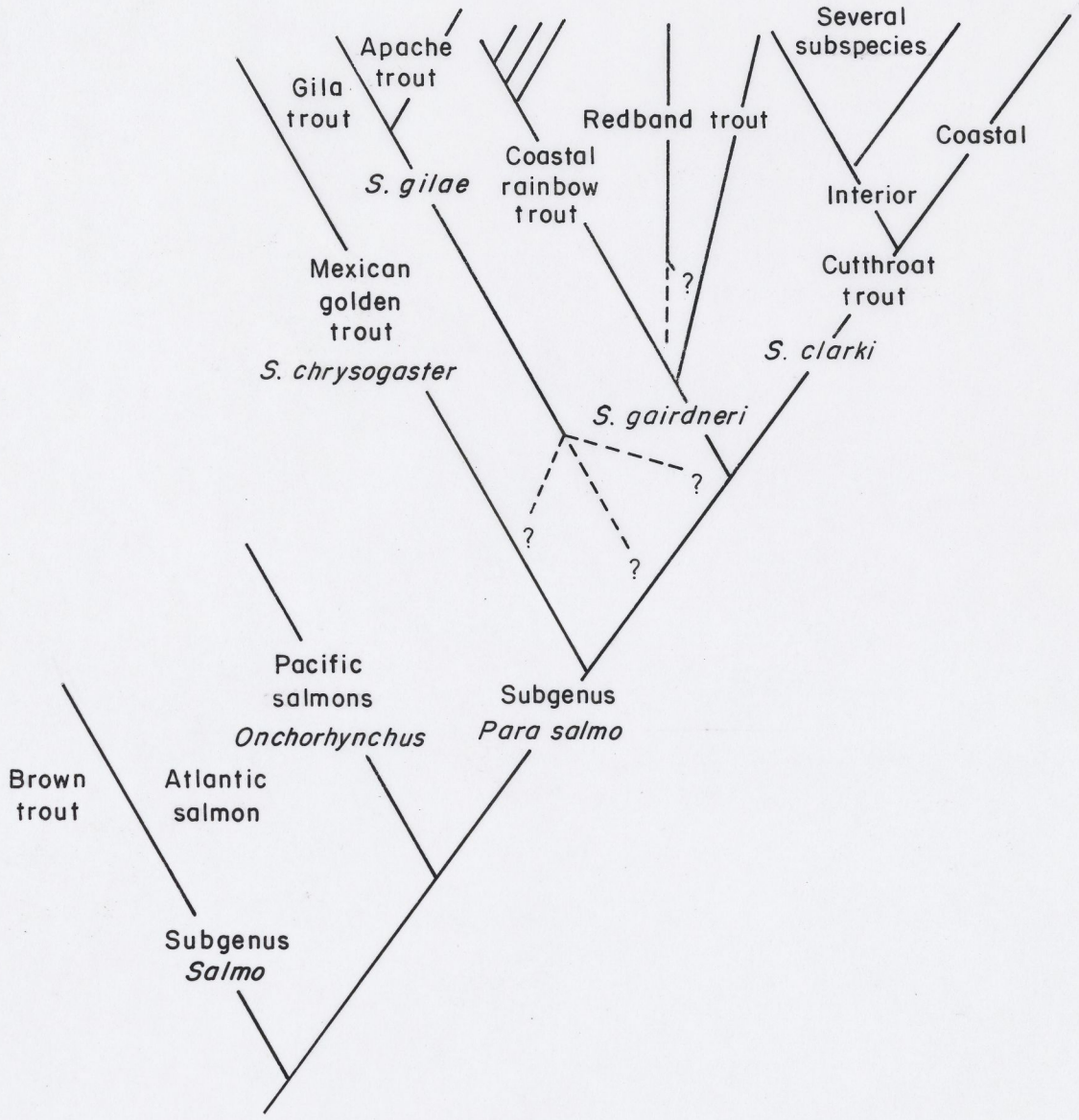

Several subspecies
Apache trout
Gila trout
Redband trout
Coastal
Coastal rainbow trout
S. gilae
Interior
Mexican golden trout
Cutthroat trout
S. chrysogaster
S. clarki
S. gairdneri
?
?
?
?
Pacific salmons
Onchorhynchus
Subgenus
Para salmo
Brown trout
Atlantic salmon
Subgenus
Salmo

Figure 1. Hypothesized phylogeny of western trouts of the subgenus Parasalmo. Dashed lines and ? denote uncertainty of connecting point.

Figure 2A, B. Distribution of the subgenus Parasalmo in North America.

Figure 3. A. Coastal cutthroat trout, Salmo clarki clarki.
B. 'Westslope' cutthroat trout; S. c. lewisi.
C. 'Yellowstone' cutthroat trout, S. c. bouvieri.

Figure 4A, B. Distribution of coastal cutthroat trout.

Figure 5. Distribution of S. c. lewisi, S. c. bouvieri, and S. c. alpestris.

Figure 6.A. Fine-spotted Snake River cutthroat trout, Salmo clarki subsp.
B. Lahontan cutthroat trout, S. c. henshawi.
C. Paiute cutthroat trout, S. c. seleniris.

Figure 7. Segments of the Great Basin known to have native trouts with an indication (shaded areas) of the approximate maximum extent of late Pleistocene lakes. Cutthroat trout are native to the Lahontan, Bonneville, and Alvord basins. The Redband trout is the native trout of the other basins.

Figure 8.A. Humboldt cutthroat trout, *Salmo clarki* subsp.
B. Alvord cutthroat trout of Virgin Creek, *S. c.* subsp.
C. Cutthroat trout of Willow and Whitehorse creeks, *S. c.* subsp.

Figure 9.A. Boneville cutthroat trout, *Salmo clarki utah*.
B. Colorado River cutthroat trout, *S. c. pleuriticus*.
C. Greenback cutthroat trout, *S. c. stomias*.

Figure 10. Distribution of Colorado River cutthroat trout, greenback cutthroat trout, and Rio Grande cutthroat trout.

Figure 11.A. Rio Grande cutthroat trout, S. c. virginalis.
B. S. c. lewisi of John Day River drainage, Oregon.
C. Yellowfin cutthroat trout, S. c. macdonaldi.

Figure 12. Range of spotting variation in the rainbow-redband-golden trout species complex.
A. Coastal rainbow trout, Salmo gairdneri irideus.
B. Interior redband trout of Columbia River basin. S. gairdneri gairdneri.
C. California golden trout, S. g. aguabonita.

Figure 13A, B. Distribution of coastal rainbow trout and redband trout.

Figure 14.A. Gila trout, Salmo gilae gilae.
B. Apache trout, S. gilae apache.
C. Mexican golden trout, Salmo chrysogaster.

Figure 15. Distribution of S. gilae gilae, S. g. apache, and S. chrysogaster.

Figure ___. Segments of the Great Basin known to have native trouts with an indication of the approximate maximum extent of the late Pleistocene lakes in each basin. A derivative of the "Yellowstone" cutthroat trout was first to invade the Great Basin. This ancestral cutthroat probably inhabited all of the present separate basins but was replaced in all basins with more recent contact to the Columbia River basin by the redband trout. Native cutthroat trout persisted only in the Lahontan, Alvord, and Bonneville basins.

1-2-3 = 9

coastal A	B	C	
clarki,	lewisi,	bouvieri	1
A	B	C	
fine-spot	henshawi	seleniris	2
A	B	C	
Humboldt	~~Alvord~~ Utah	~~willow-whitehorse~~ Alvord	3

A	B	C	
~~Bonneville~~ ~~Utah~~ willow-whitehorse	Colo. R. pleuriticus	G stomias	4

Rio Grande CT

(B)

Tail spots like #21 ... general pattern #23

(C)

virginalis macdonaldi ___ 5

pg 188 Behnke yellow fin like snake River only larger

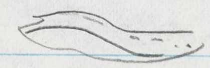
rainbow - -
coastal   interior redband   golden   6

Gila   Apache   Mexican   7

pg 5

(A)	B.	C
Lost Crk OR.	S. c. ~~pleuriticus~~ virginalis	S. c. macdonaldi

14 picture

~~Follow 1st pg B spot pattern~~ 

size of tail rear spots like 1st pg C irregular

1. Phylogeny
2. Distribution

Figure 1. A. Coastal cutthroat trout, Salmo clarki clarki.
B. 'Westslope' cutthroat trout, S. c. lewisi.
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B. Colorado River cutthroat trout, S. c. pleuriticus.
C. Greenback cutthroat trout, S. c. stomias.

Figure 5. A. Rio Grande cutthroat trout, Salmo clarki virginalis.
B. ~~Cutthroat trout native~~ to John Day River drainage, Oregon. S. c. lewisi(?).
C. ~~Yellowfin cutthroat~~ trout, S. c. macdonaldi.

Figure 6. Range of spotting variation in the rainbow-redband-golden trout species complex.
A. ~~Coastal rainbow trout~~, Salmo gairdneri irideus.
B. Interior redband trout of Columbia River basin, S. g. gairdneri.
C. California golden trout, S. aguabonita.

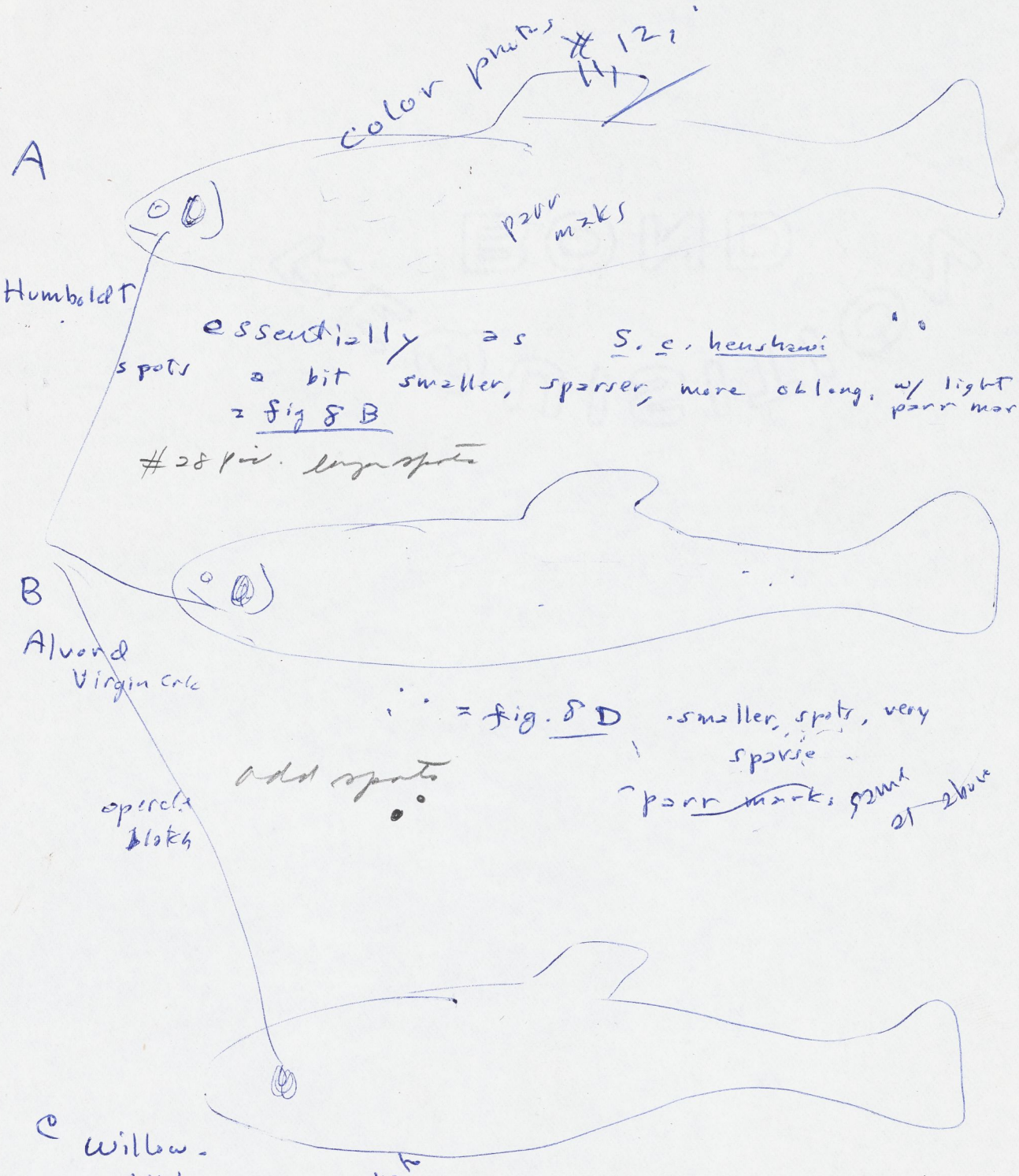
Figure 7. A. Gila trout, S. gilae gilae.
B. Apache trout, Salmo g. apache.
C. Mexican golden trout, S. chrysogaster.

#1 & #7 backgrounds
have been blotched
with Fixative —
Tried to erase —
do hope backgrounds will be
OK in final photos.

28

[Humboldt]

S. E. Utah
Smith Fork Wyo
Aug 15 1976
11 1/2"


color photo #12
A
parr marks
Humboldt
essentially as S. c. henshawi
spots a bit smaller, sparser, more oblong, w/ light parr markings
= fig 8 B
#28 pic. large spots
B
Alvord
Virgin Crk
= fig. 8 D
smaller spots, very sparse
parr marks gone
add spots
operc. black
C Willow - whitehorse
color photo #16/17
fig 8 E
parr markings
- as 8D (= B) but spots slightly larger & more numerous.

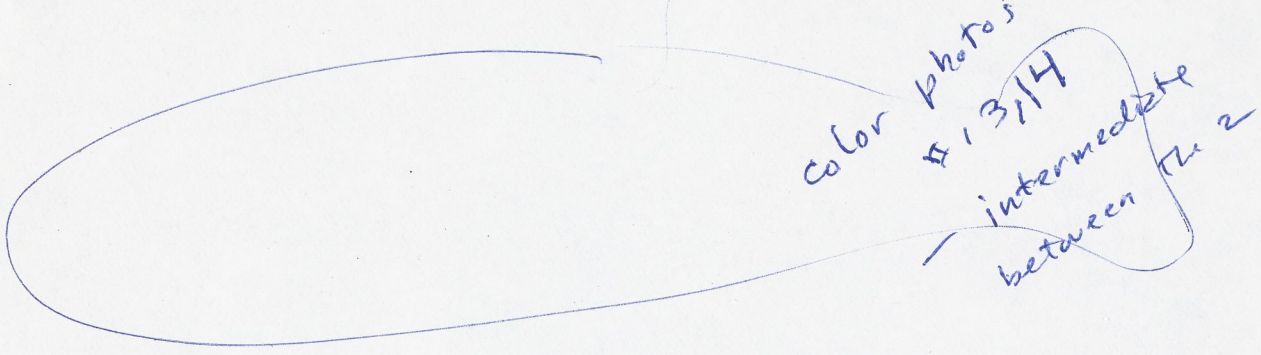
#3

33 [Bonneville]

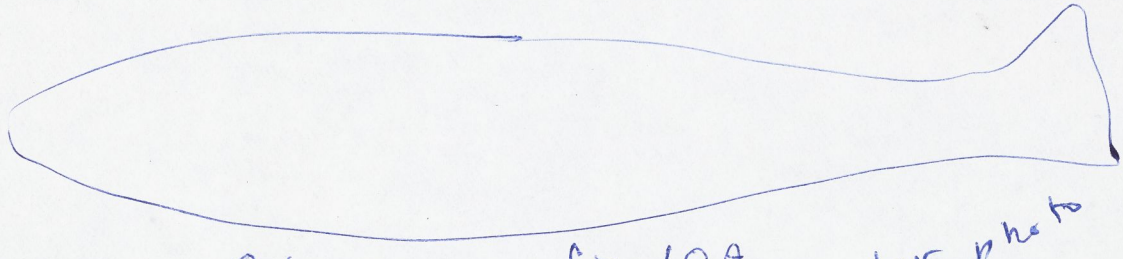
S. E. Utah
Smith Fork Wyo

10"

Aug 17, 1976



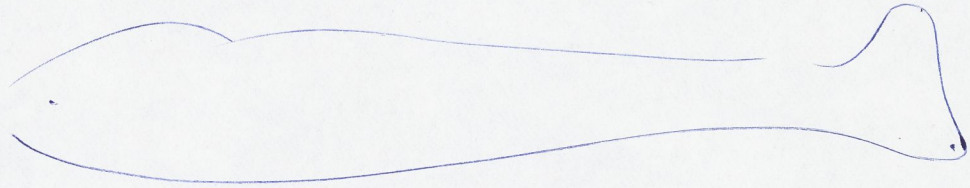
A Bonneville = fig 8 E
see color photo Thomas Pk,
#33 add more spots and as much as
pictured



B

Colo. R. = fig. 10A

Color photo
18, 19

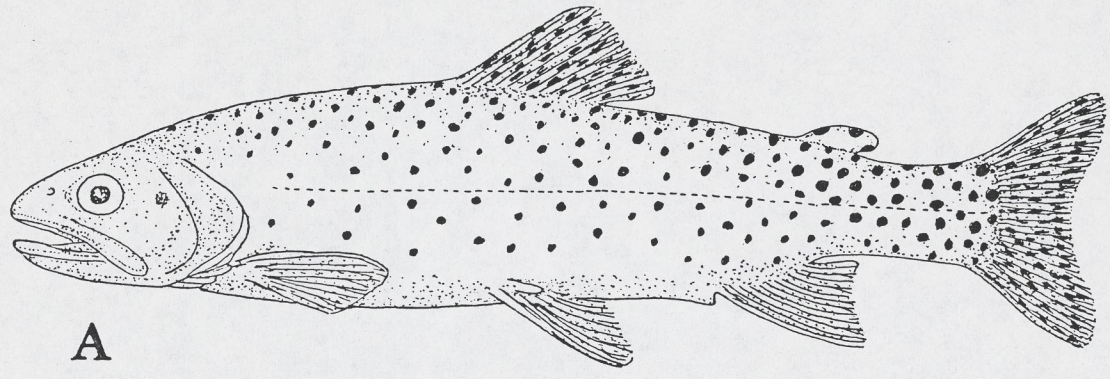


C

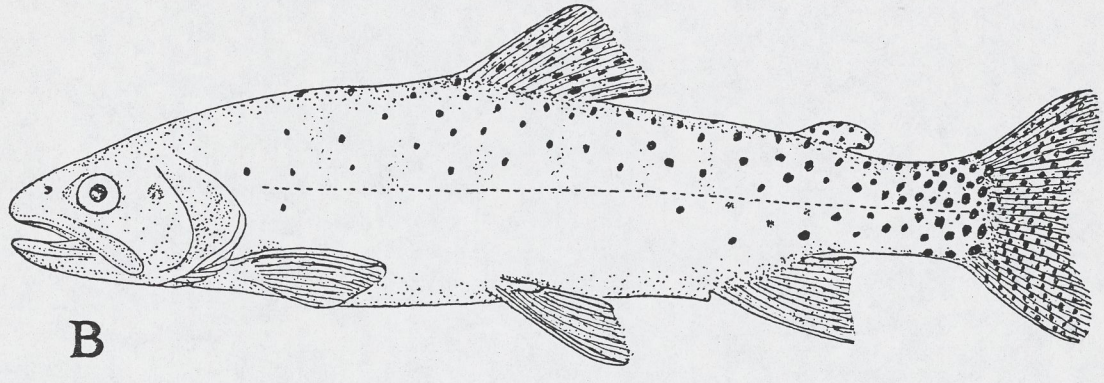
greenback fig. 10B

Color
#20 photo

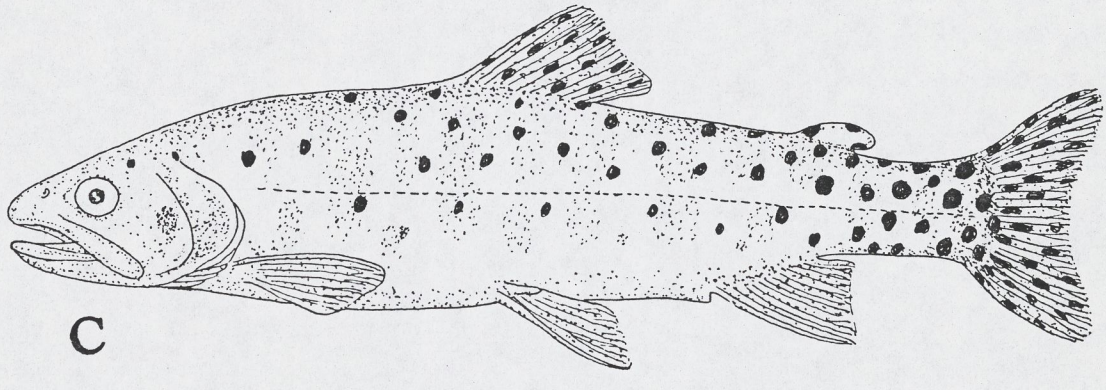
#4



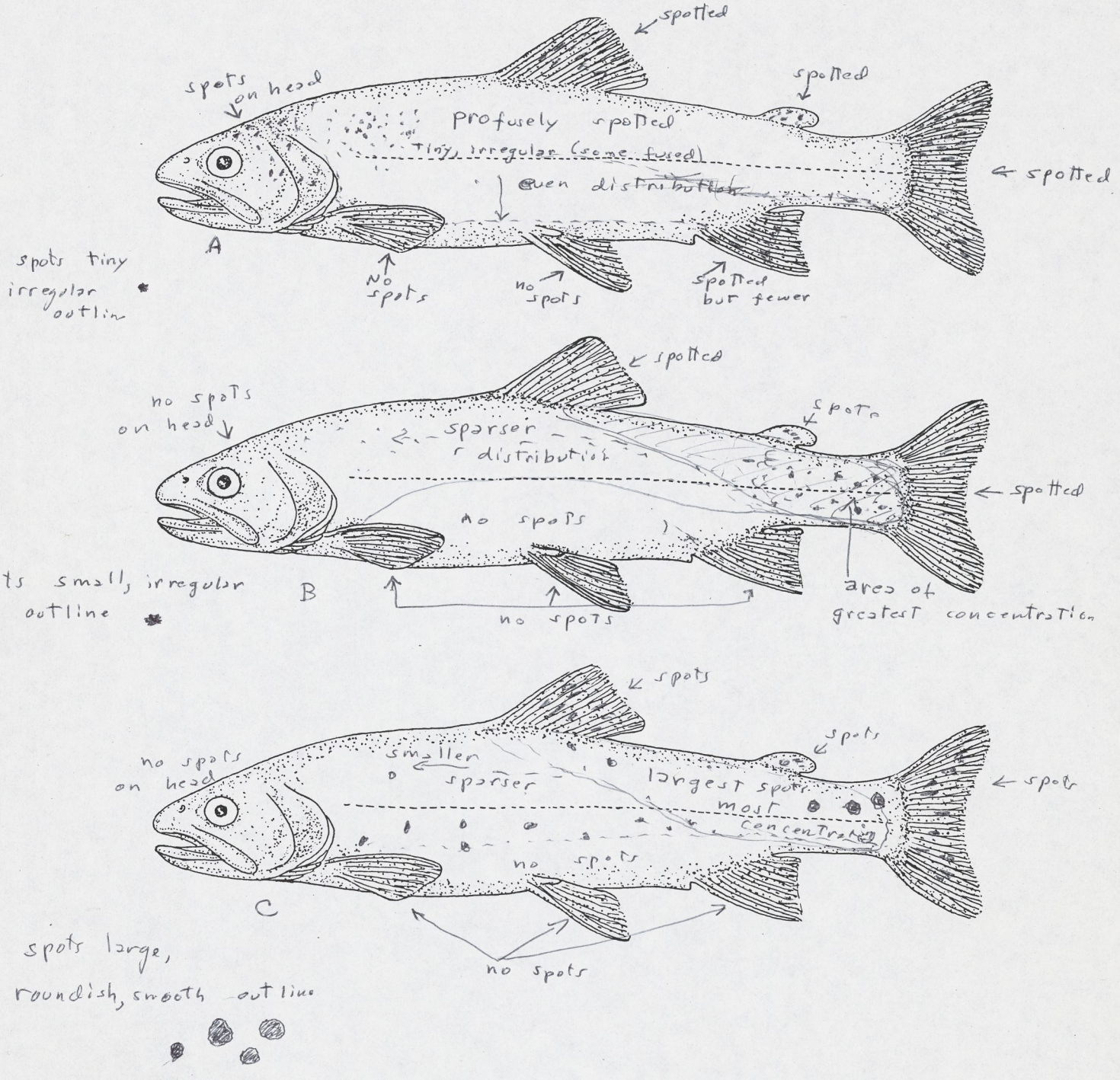
A

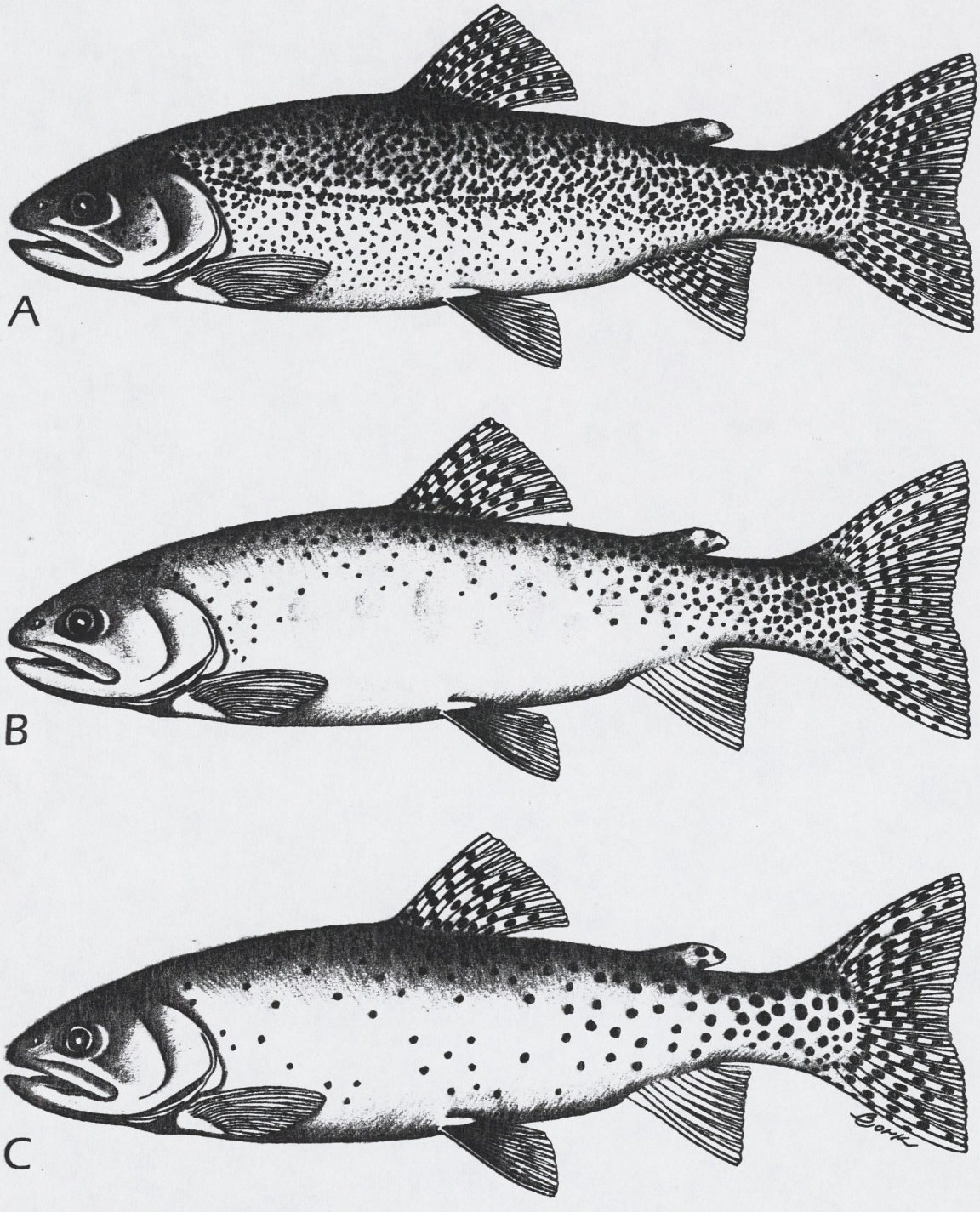


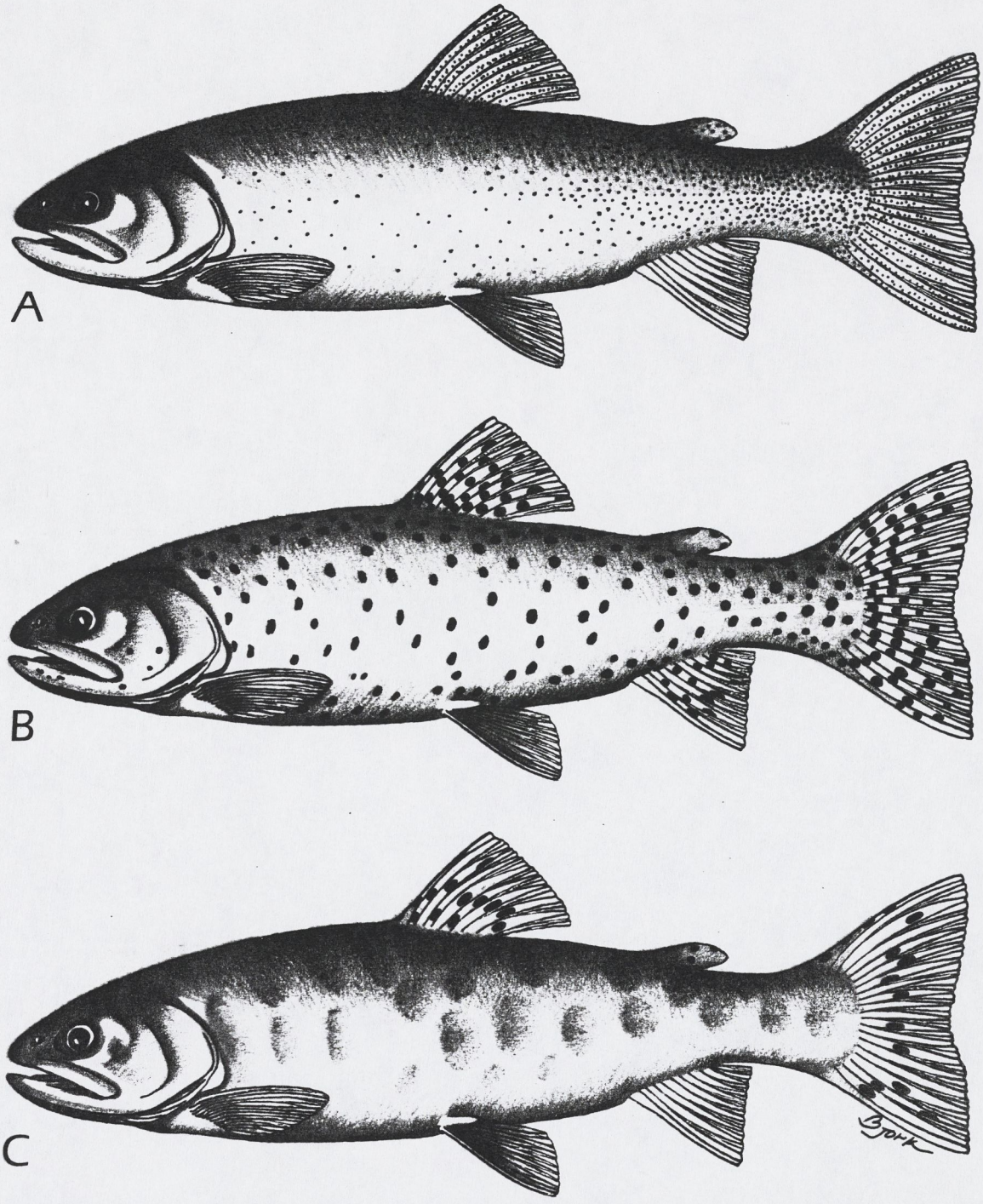
B

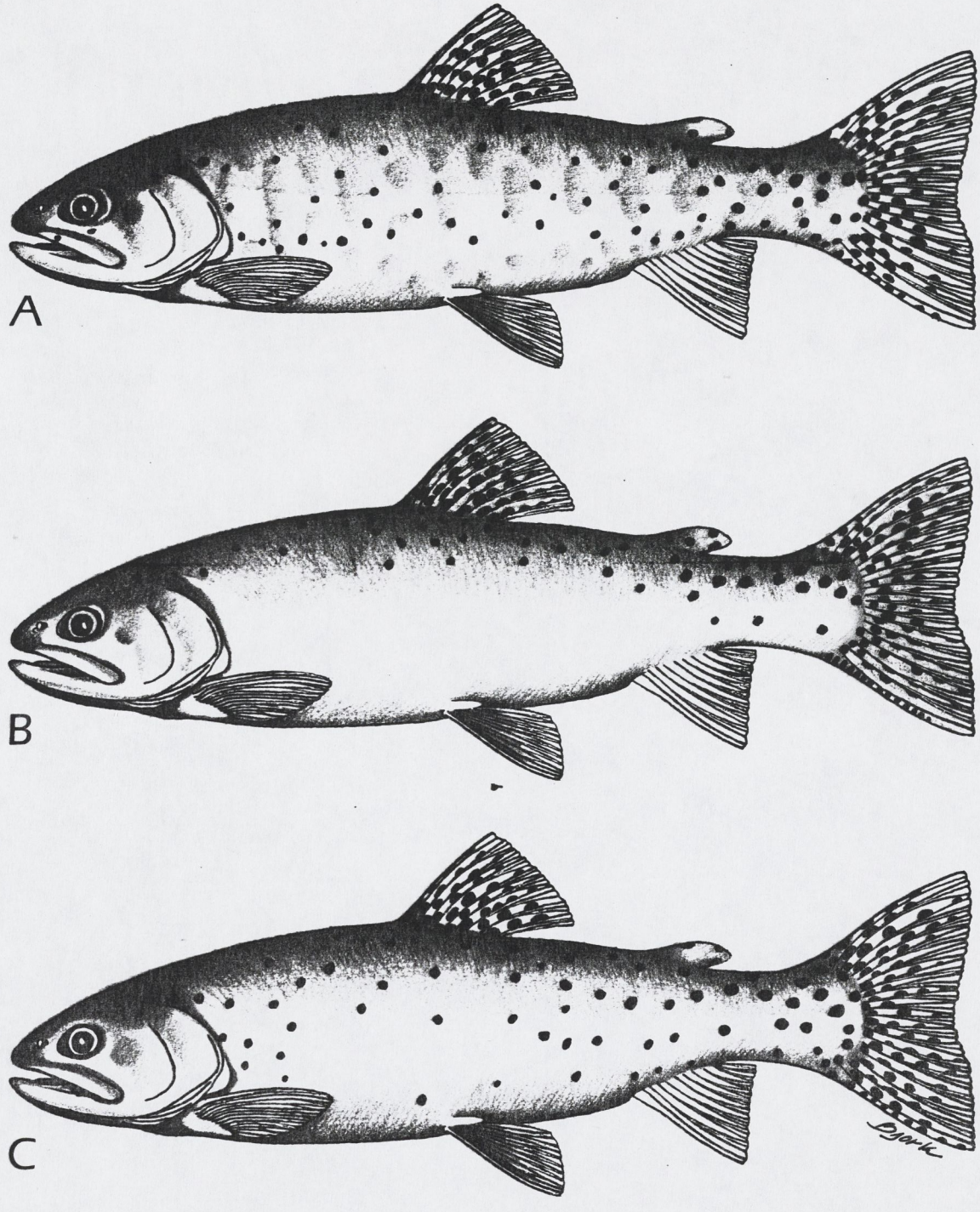


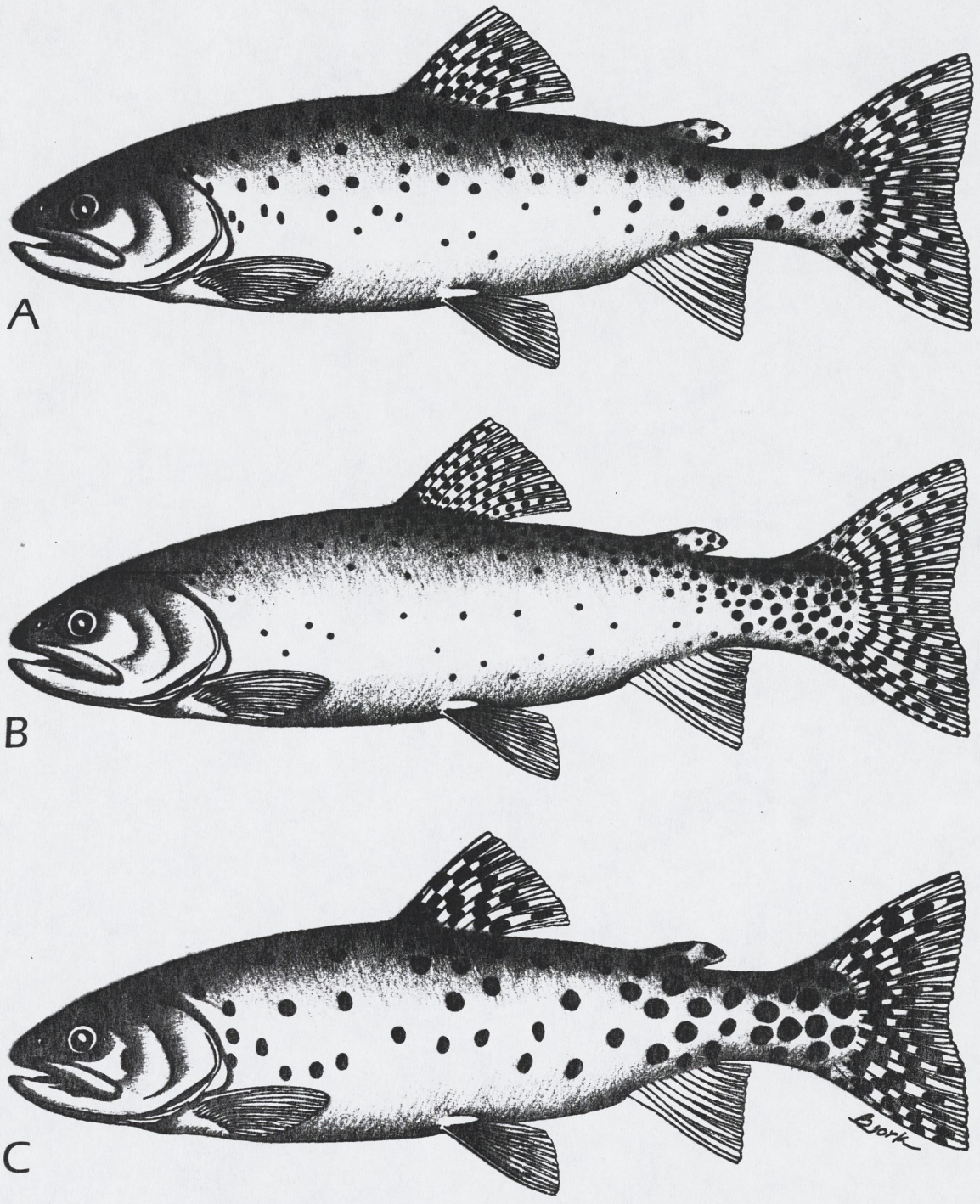
C

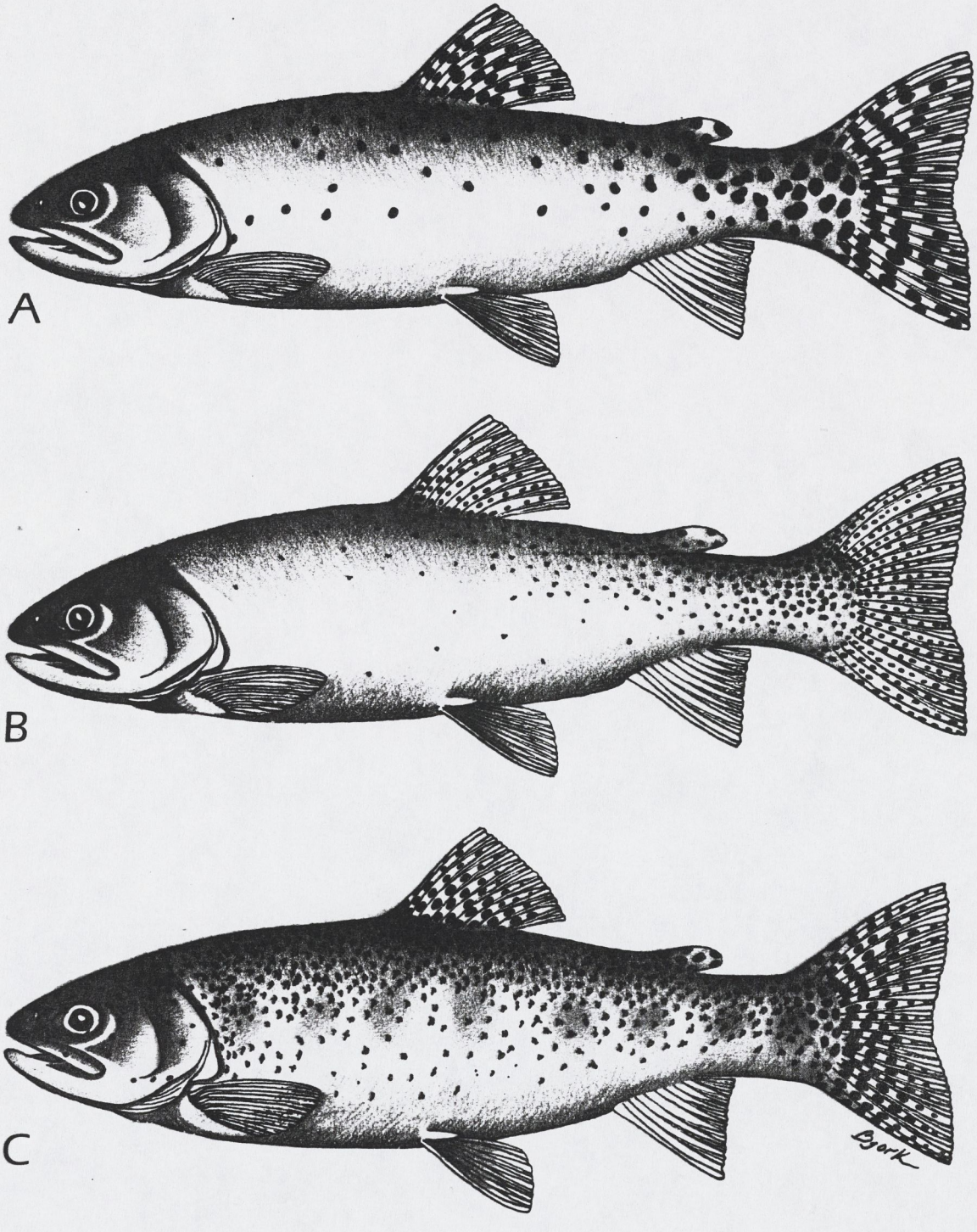

spotted
spots on head
spotted
profusely spotted
tiny, irregular (some fused)
even distribution
spotted
A
spots tiny irregular outline
no spots
no spots
spotted but fewer
spotted
no spots on head
sparser distribution
spots
spotted
no spots
spots small, irregular outline
B
area of greatest concentration
no spots
spots
spots
no spots on head
smaller
sparser
largest spots most concentrated
spots
no spots
C
spots large, roundish, smooth outline
no spots


A
B
C


A
B
C


A
B
C


A
B
C
Bjork


A
B
C
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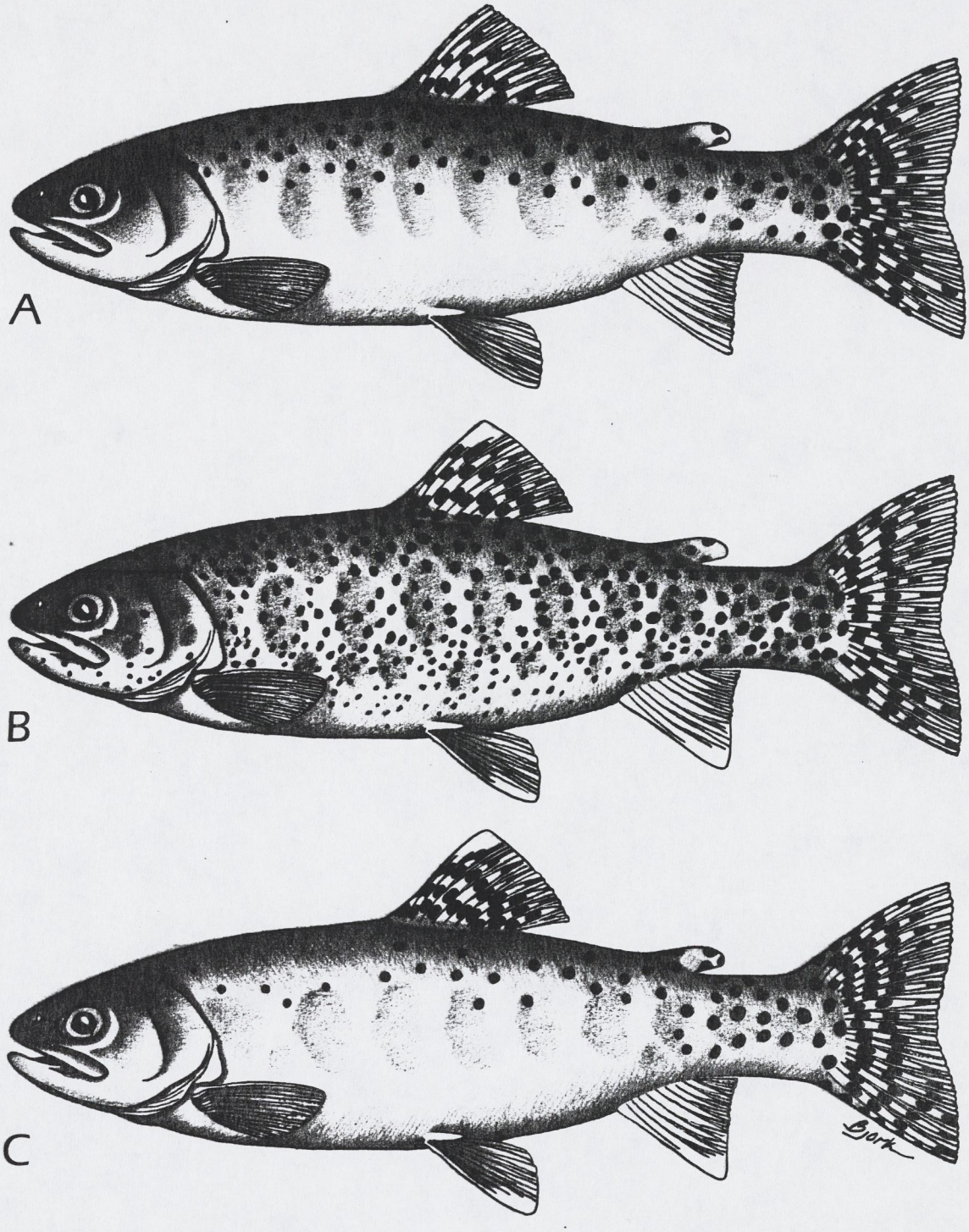
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B
C
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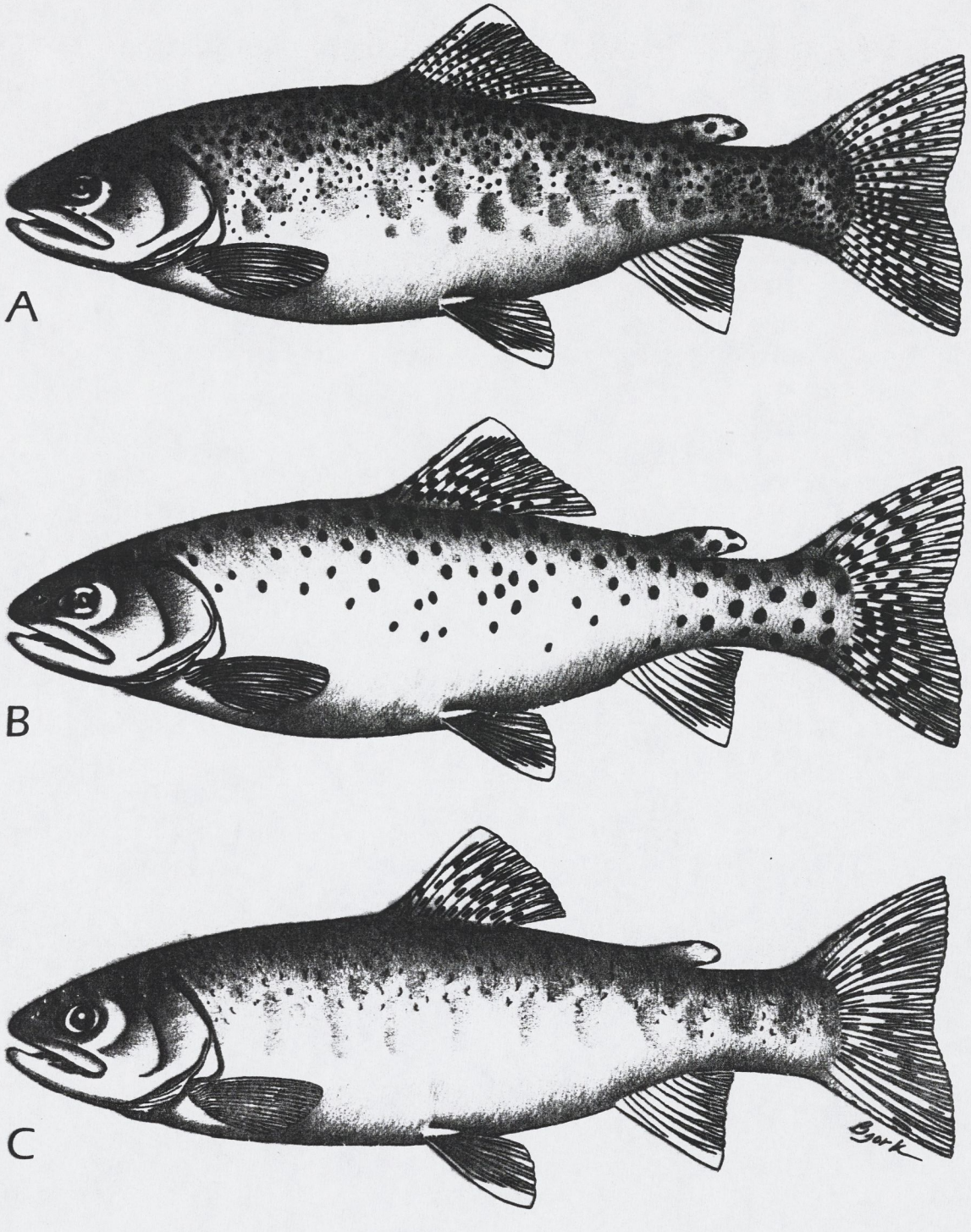
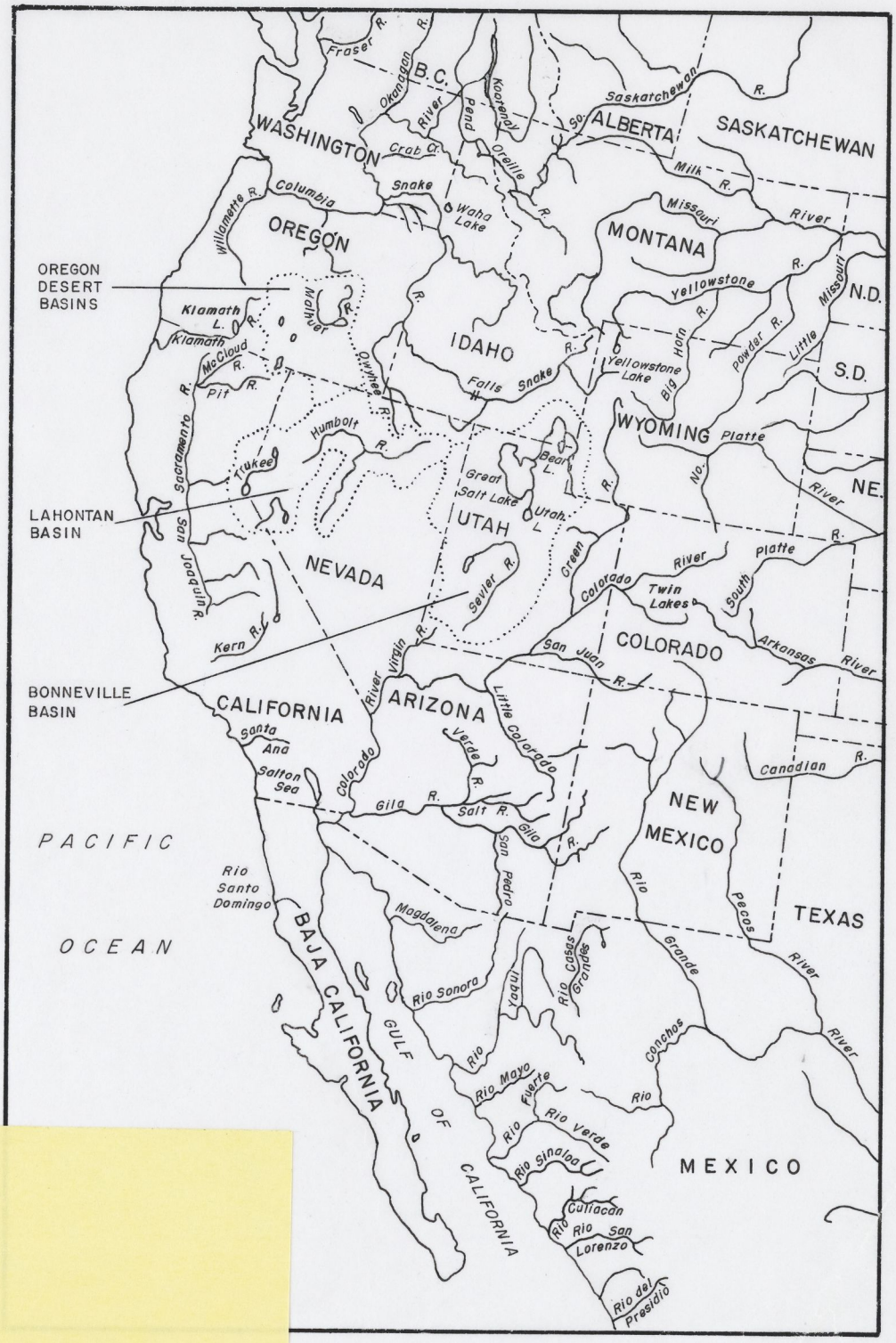
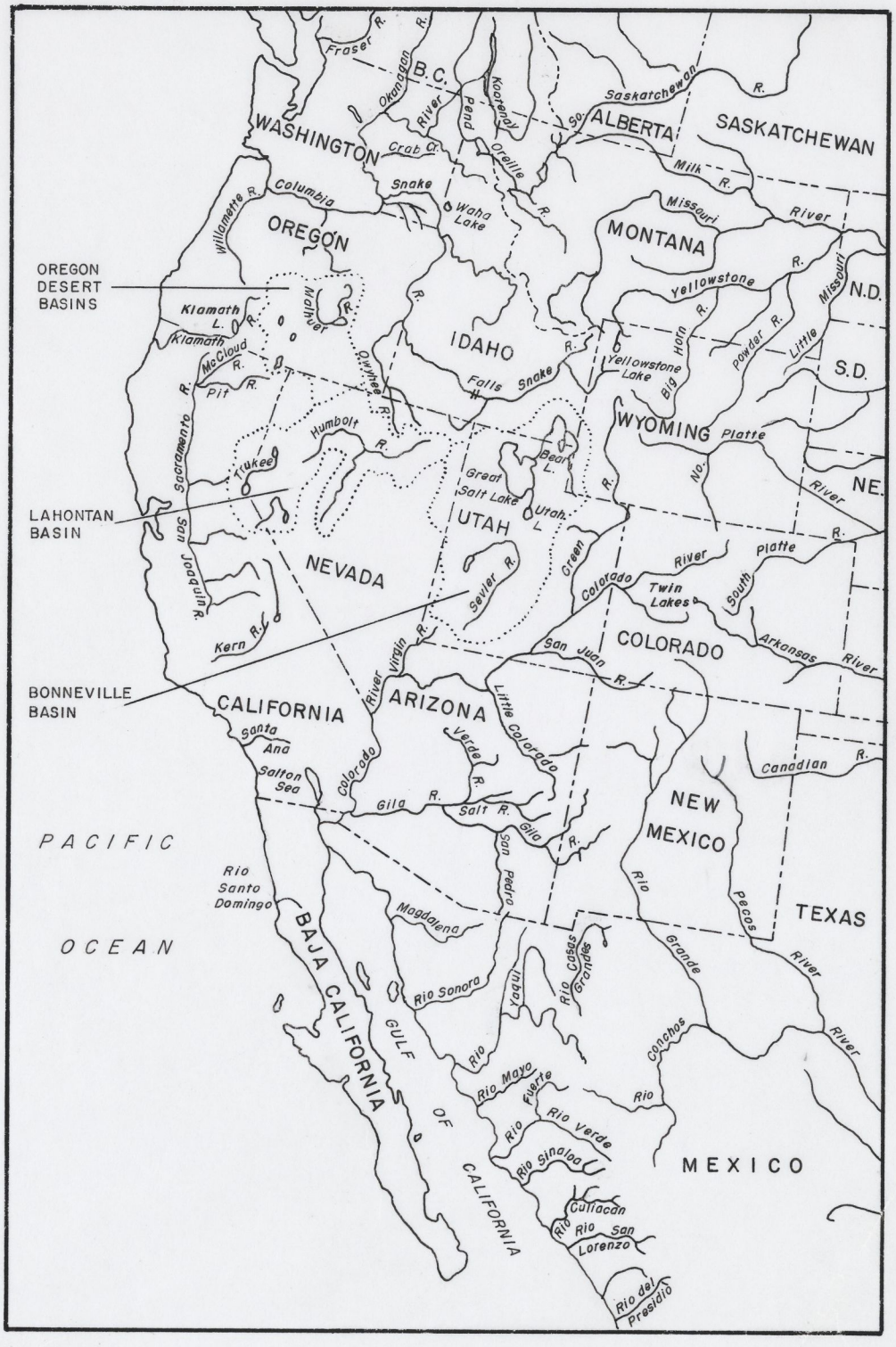
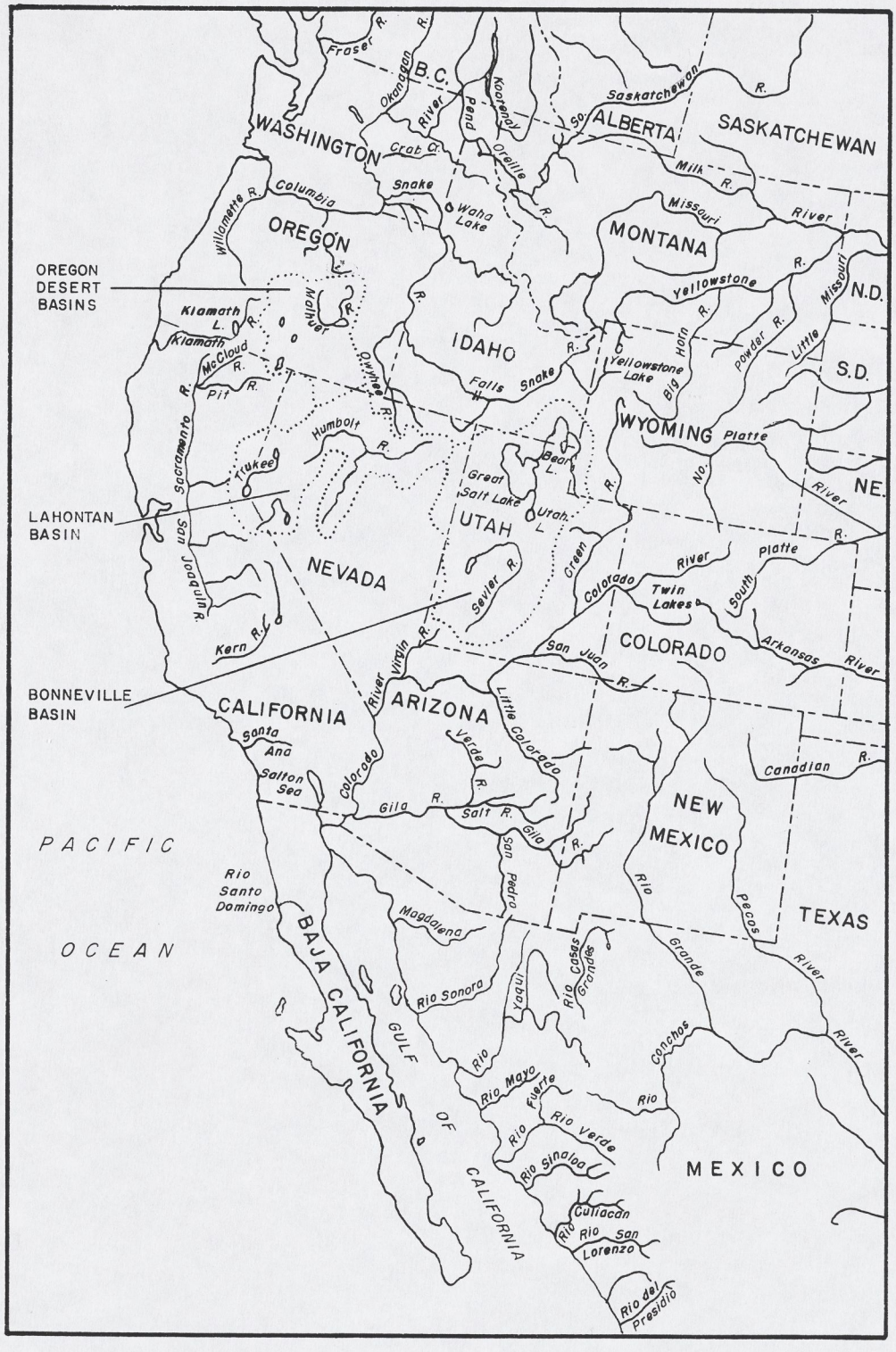

A
B
C
Bjork



original map used to make Acetates — added little Fork on N. Pecos.


OREGON DESERT BASINS
LAHONTAN BASIN
BONNEVILLE BASIN
PACIFIC OCEAN
GULF OF CALIFORNIA
BAJA CALIFORNIA
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
TEXAS
MEXICO
B.C.
ALBERTA
SASKATCHEWAN
N.D.
S.D.
NE.
Fraser R.
Okanagan R.
River
Pend Oreille
Kootenay
Sa. Saskatchewan R.
Milk R.
Crab Cr.
Columbia
Snake
Waha Lake
Willamette R.
Missouri River
Yellowstone R.
Klamath L.
Klamath R.
McCloud R.
Pit R.
Owyhee R.
Malheur R.
Falls
Snake R.
Yellowstone Lake
Big Horn R.
Powder R.
Little Missouri
Sacramento R.
Humbolt R.
Truckee
Bear L.
Great Salt Lake
Utah L.
Platte R.
No. Platte River
San Joaquin R.
Sevier R.
Green River
Colorado River
Twin Lakes
South platte R.
Kern R.
Virgin River
San Juan R.
Arkansas River
Santa Ana
Salton Sea
Colorado R.
Gila R.
Salt R.
Verde R.
Little Colorado
Canadian R.
San Pedro
Gila R.
Rio Santo Domingo
Magdalena
Rio Sonora
Yaqui
Rio Casas Grandes
Rio Grande River
Pecos River
Conchos River
Rio Mayo
Rio Fuerte
Rio Verde
Rio Sinaloa
Culiacan
Rio San Lorenzo
Rio del Presidio


OREGON DESERT BASINS
LAHONTAN BASIN
BONNEVILLE BASIN
PACIFIC OCEAN
GULF OF CALIFORNIA
BAJA CALIFORNIA
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
ARIZONA
COLORADO
NEW MEXICO
TEXAS
MEXICO
B.C.
ALBERTA
SASKATCHEWAN
N.D.
S.D.
NE.
Fraser R.
Okanagon River
Columbia R.
Snake R.
Crab Cr.
Pend Oreille R.
Kootenay R.
So. Saskatchewan R.
Milk R.
Missouri River
Yellowstone R.
Little Missouri R.
Powder R.
Big Horn R.
Yellowstone Lake
Willamette R.
Waha Lake
Klamath L.
Klamath R.
McCloud R.
Pit R.
Malheur R.
Owyhee R.
Falls R.
Snake R.
Sacramento R.
Humboldt R.
Truckee R.
Great Salt Lake
Bear L.
Utah L.
San Joaquin R.
Sevier R.
Green R.
Colorado River
Platte River
South Platte R.
Twin Lakes
Arkansas River
Kern R.
Virgin River
San Juan R.
Little Colorado R.
Santa Ana
Salton Sea
Colorado R.
Verde R.
Gila R.
Salt R.
Gila R.
San Pedro R.
Canadian R.
Rio Santo Domingo
Magdalena
Rio Sonora
Yaqui R.
Rio Casas Grandes
Rio Grande
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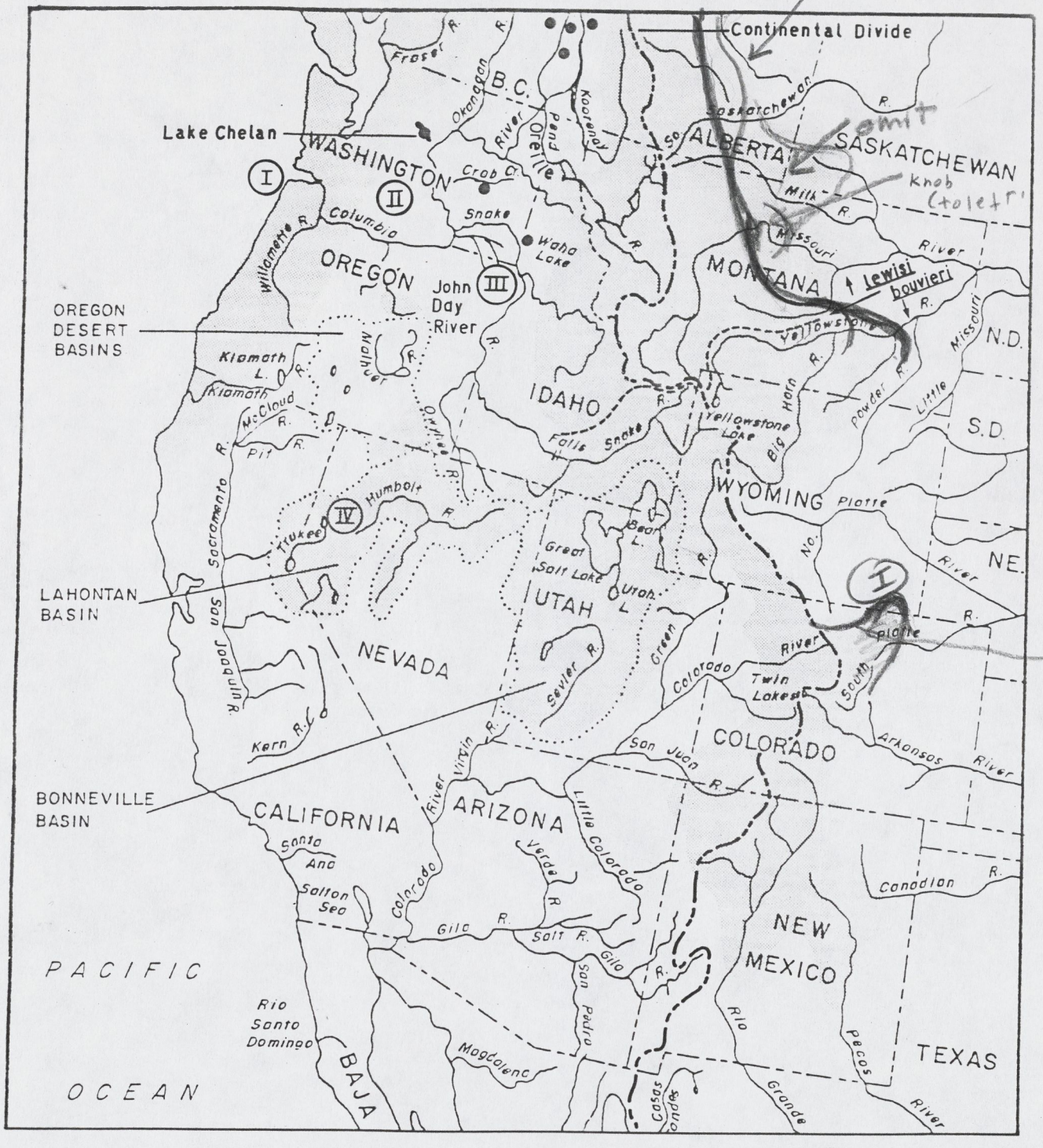
Rio Sinaloa
Conchos River
Culiacan R.
Rio San Lorenzo
Rio del Presidio



bit closer to Cont. Divide

wipe out line

remit

knob (toilet?

round off

(I) - bring up over wyo. line

greenback native to headwaters of Dale & Box Elder cks. - merely few miles above st. line S.E. of Laramie

Wait

Humboldt

Touch-up (A) & (B) dots

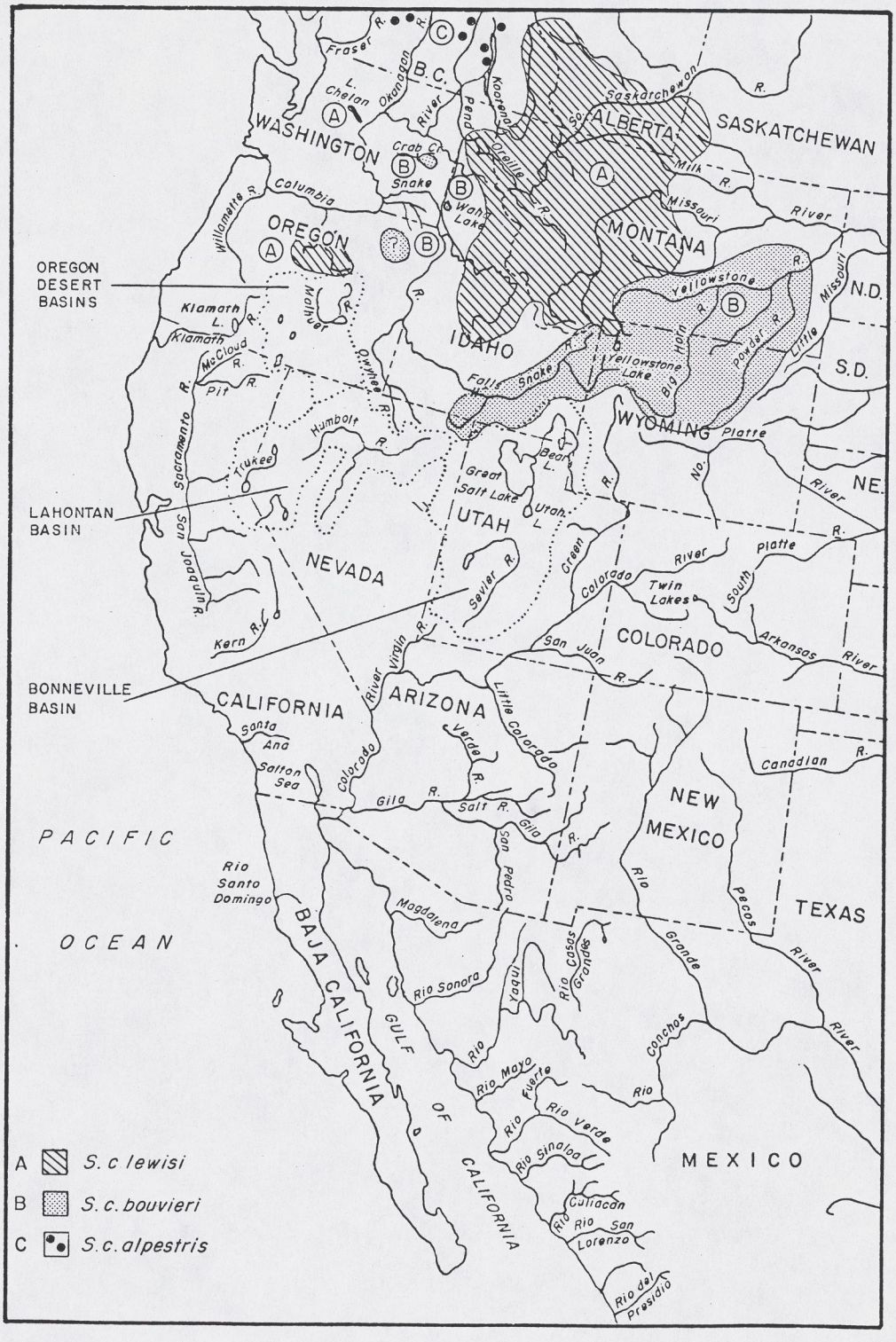
A. Westslope cutthroat

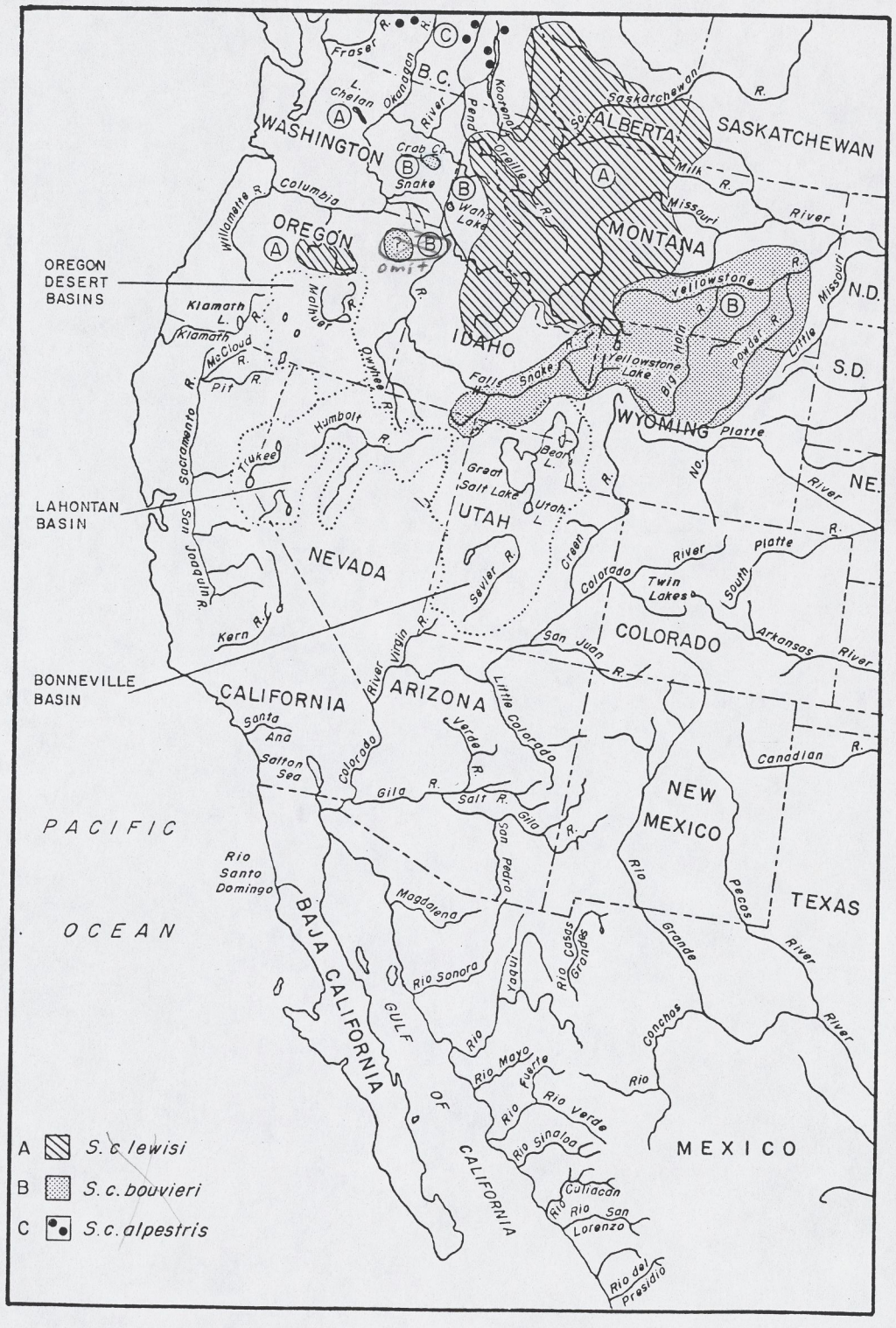
B. Yellowstone cutthroat

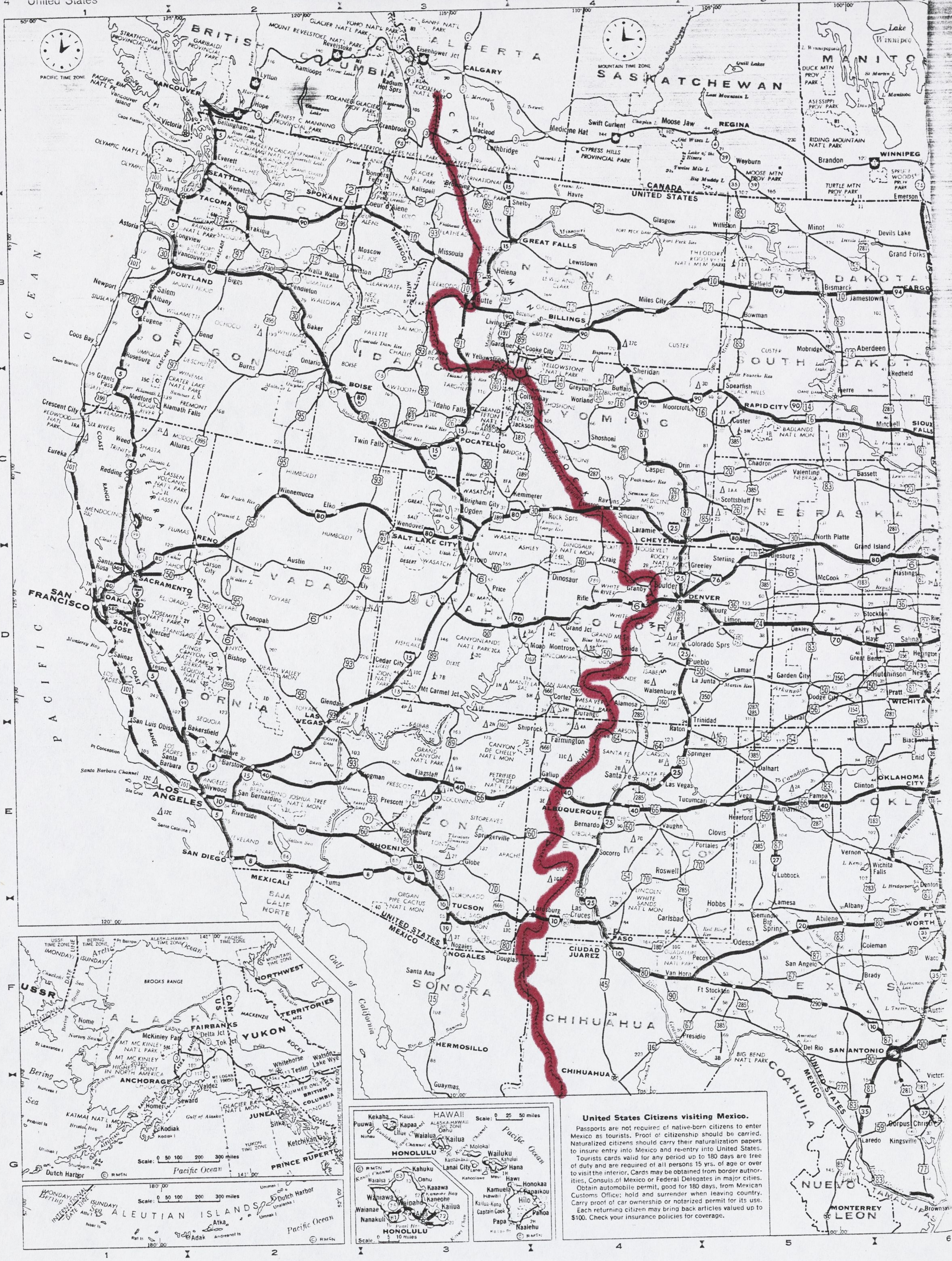
C. Disjunct populations of westslope (A) and Yellowstone (B) cutthroat

some originals that might be used

fig. 5


B.C.
WASHINGTON
OREGON
IDAHO
NEVADA
CALIFORNIA
ARIZONA
UTAH
COLORADO
NEW MEXICO
TEXAS
MONTANA
WYOMING
ALBERTA
SASKATCHEWAN
N.D.
S.D.
NE.
MEXICO
PACIFIC
OCEAN
GULF OF CALIFORNIA
BAJA CALIFORNIA
OREGON DESERT BASINS
LAHONTAN BASIN
BONNEVILLE BASIN
Fraser R.
L. Chelan
Okanagon River
Columbia
Willamette R.
Crab Cr.
Snake
Palouse
Kootenay
Pend Oreille R.
Saskatchewan
Milk R.
Missouri River
Wash. Lake
Klamath L.
Klamath R.
McCloud R.
Pit R.
Sacramento R.
Malheur R.
Owyhee R.
Humbolt R.
Truckee
Great Salt Lake
Utah L.
Bear L.
Green R.
Sevier R.
Virgin R.
Kern R.
Colorado River
Twin Lakes
South Platte
Arkansas River
San Juan R.
Little Colorado
Verde R.
Gila R.
Salt R.
Santa Ana
Salton Sea
Canadian R.
Rio Santo Domingo
Magdalena
San Pedro
Rio Pecos
Rio Grande River
Rio Sonora
Yaqui
Rio Casas Grandes
Concho River
Rio Mayo
Rio Fuerte
Rio Verde
Rio Sinaloa
Culiacan
Rio San Lorenzo
Rio del Presidio
Yellowstone R.
Yellowstone Lake
Big Horn R.
Powder R.
Little Missouri
Platte R.
Falls
Snake R.
A S.c lewisi
B S.c. bouvieri
C S.c. alpestris


OREGON DESERT BASINS
LAHONTAN BASIN
BONNEVILLE BASIN
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
ALBERTA
SASKATCHEWAN
B.C.
N.D.
S.D.
NE.
TEXAS
MEXICO
PACIFIC OCEAN
BAJA CALIFORNIA
GULF OF CALIFORNIA
Omit
A S.c. lewisi
B S.c. bouvieri
C S.c. alpestris



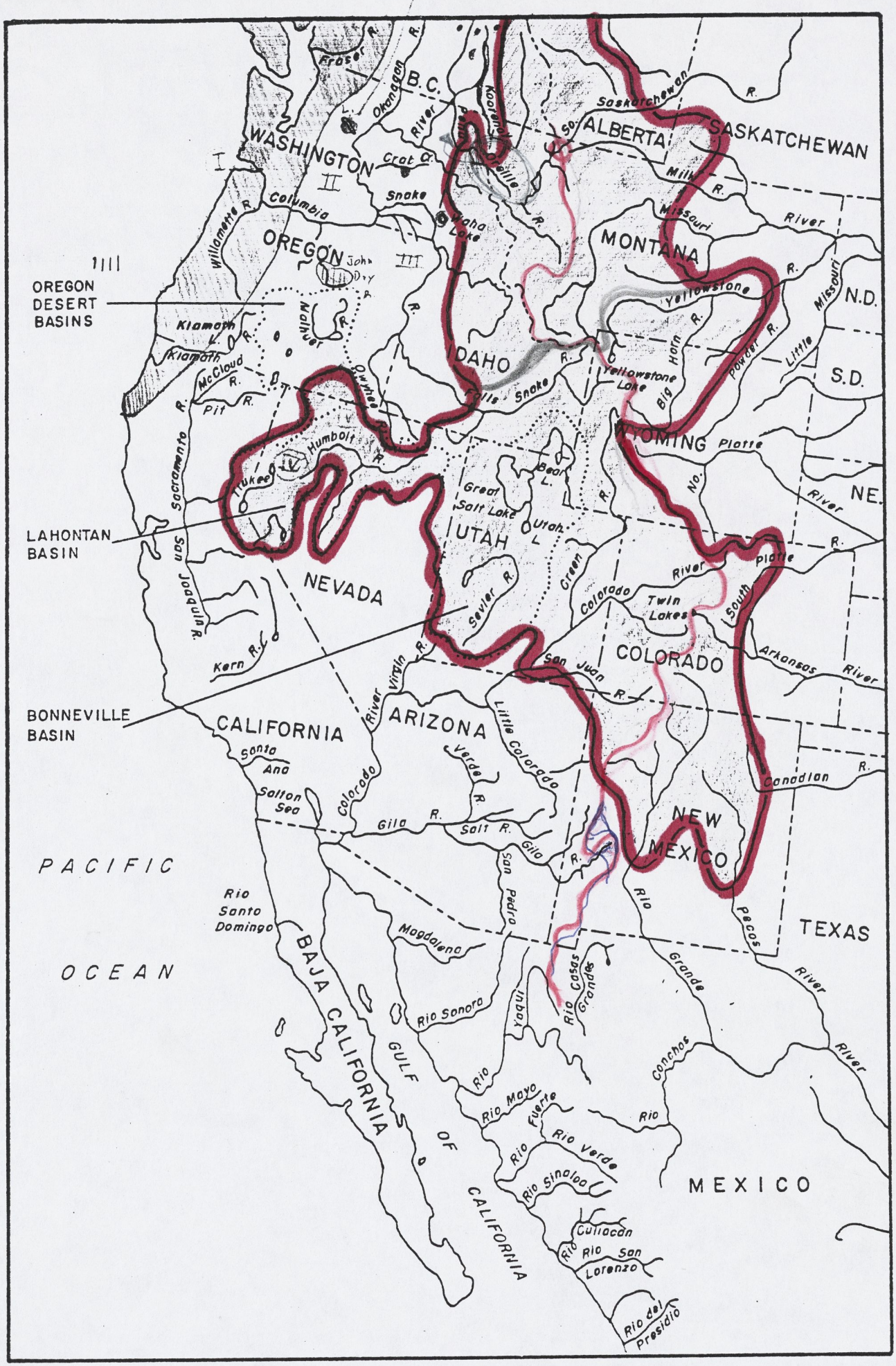
United States Citizens visiting Mexico.

Passports are not required of native-born citizens to enter Mexico as tourists. Proof of citizenship should be carried. Naturalized citizens should carry their naturalization papers to insure entry into Mexico and re-entry into United States.

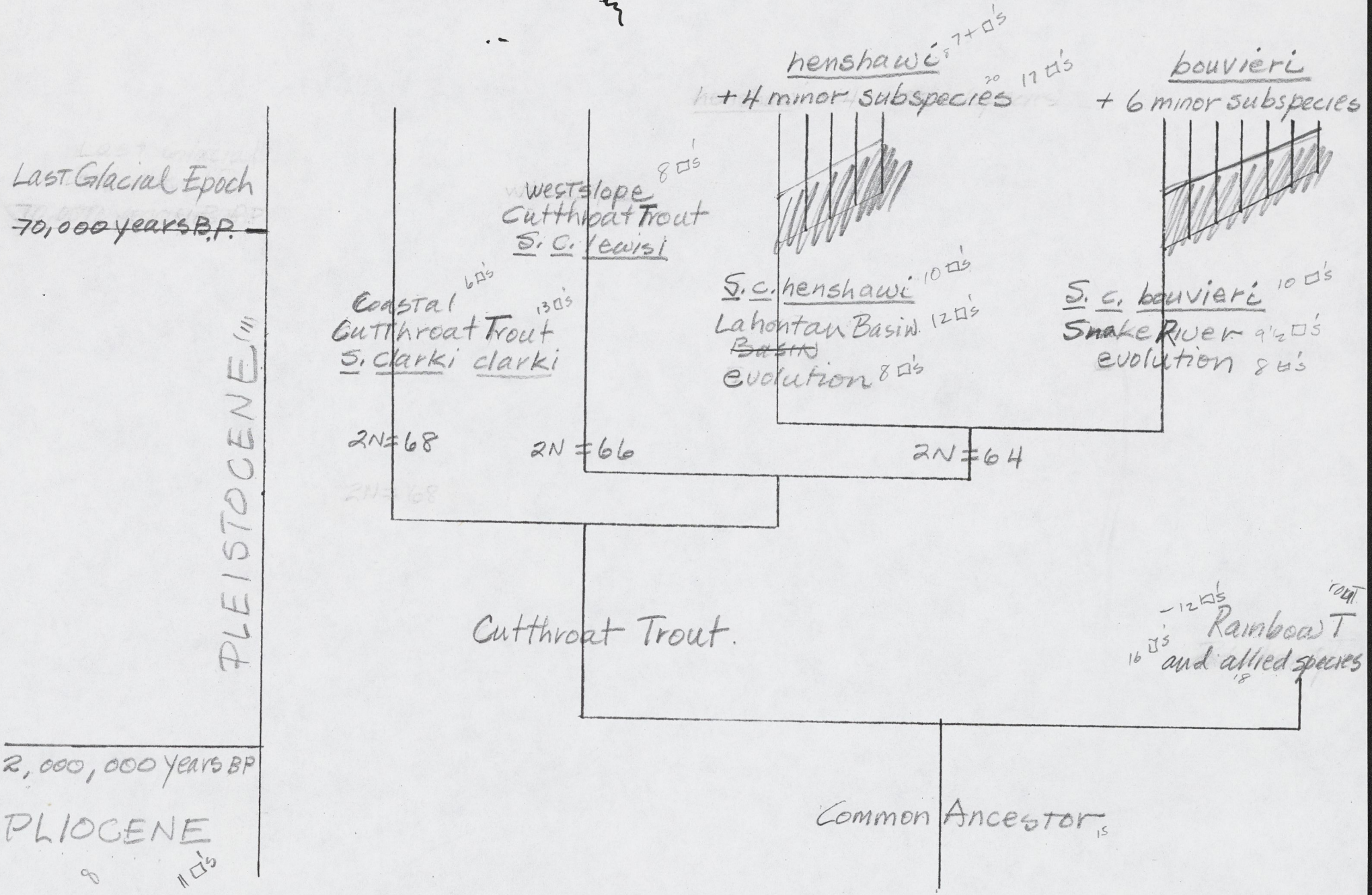
Tourists cards valid for any period up to 180 days are free of duty and are required of all persons 15 yrs. of age or over to visit the interior. Cards may be obtained from border authorities, Consuls of Mexico or Federal Delegates in major cities.

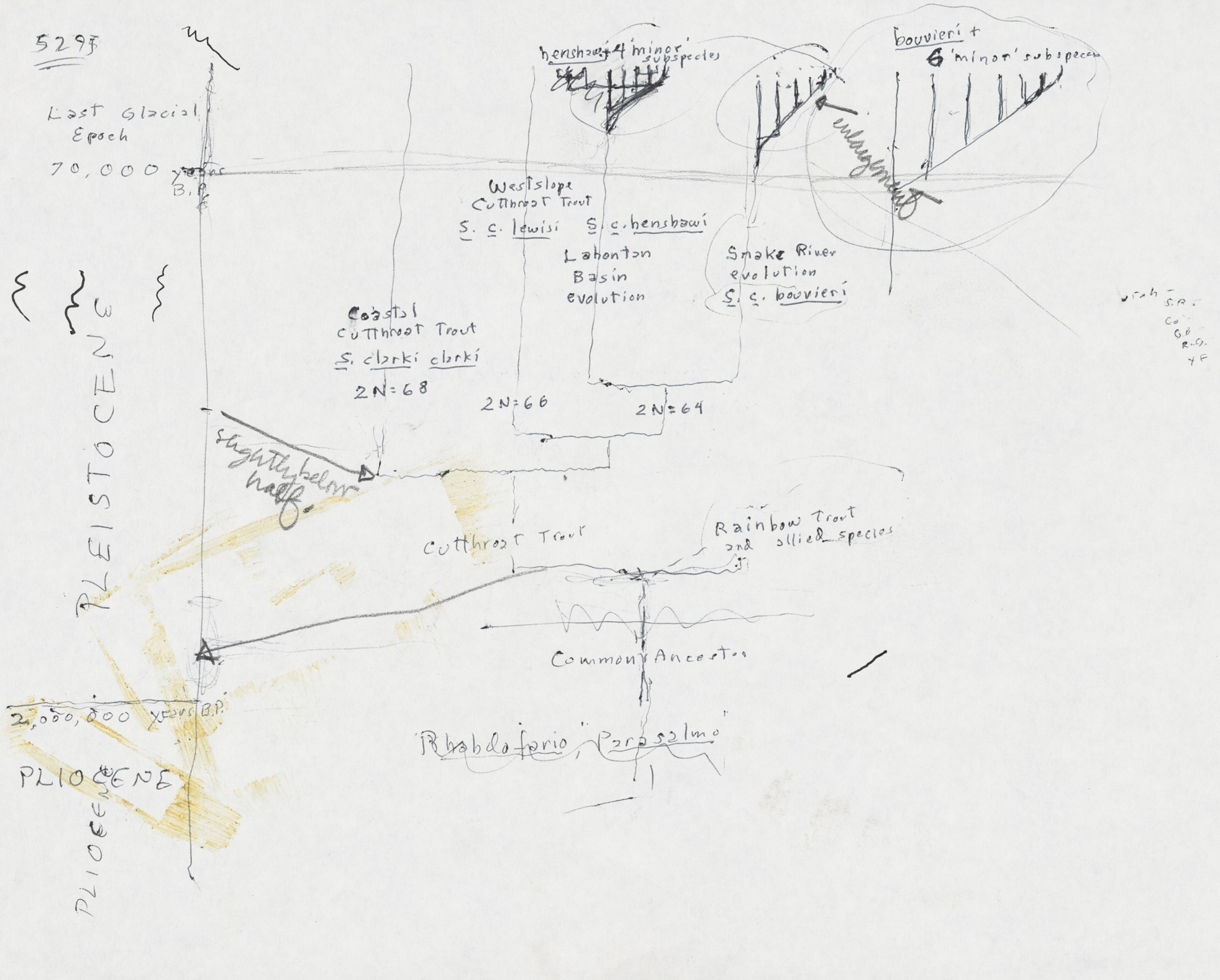
Obtain automobile permit, good for 180 days, from Mexican Customs Office; hold and surrender when leaving country. Carry proof of car ownership or notarized permit for its use.

Each returning citizen may bring back articles valued up to $100. Check your insurance policies for coverage.


Chelan
Fraser R.
Okanagon R.
B.C.
Kootenai R.
Saskatchewan R.
WASHINGTON
Crat C.
Pend Oreille
Sa. ALBERTA
SASKATCHEWAN
Columbia
Snake
Mill R.
Missouri River
Willamette R.
Wana Lake
OREGON
John Day R.
MONTANA
OREGON DESERT BASINS
Klamath
Malheur R.
Yellowstone R.
Missouri
N.D.
Klamath R.
McCloud R.
Owyhee R.
IDAHO
Yellowstone Lake
Big Horn R.
Powder R.
Little
S.D.
Pit R.
Falls
Snake
WYOMING
Platte
Humbolt R.
Sacramento R.
Truckee
Bear L.
Great Salt Lake
Utah L.
NE.
LAHONTAN BASIN
UTAH
Green R.
River
Platte R.
San Joaquin R.
NEVADA
Sevier R.
Colorado
Twin Lakes
South
Kern R.
River Virgin R.
San Juan R.
COLORADO
Arkansas River
BONNEVILLE BASIN
CALIFORNIA
ARIZONA
Little Colorado
Santa Ana
Verde R.
Canadian R.
Salton Sea
Colorado
Gila R.
Salt R.
NEW MEXICO
PACIFIC
Gila R.
San Pedro
Rio Grande
Rio Santo Domingo
Magdalena
TEXAS
Rio Casas Grandes
Pecos River
OCEAN
BAJA CALIFORNIA
Rio Sonora
Yaqui
Conchos River
GULF OF CALIFORNIA
Rio Mayo
Rio Fuerte
Rio Verde
Rio Sinaloa
MEXICO
Culiacan
Rio San Lorenzo
Rio del Presidio
Oreille

Planning and organization is an important part of the work I do.


henshawi
+4 minor subspecies
bouvieri
+6 minor subspecies
Last Glacial Epoch
70,000 years B.P.
PLEISTOCENE
Westslope Cutthroat Trout
S. c. lewisi
Coastal Cutthroat Trout
S. clarki clarki
S. c. henshawi
Lahontan Basin evolution
S. c. bouvieri
Snake River evolution
2N=68
2N=66
2N=64
Cutthroat Trout.
Rainbow T and allied species
2,000,000 years BP
PLIOCENE
Common Ancestor


5295
henshawi + 4 'minor' subspecies
bouvieri +
6 'minor' subspecies
Last Glacial Epoch
70,000 years B.P.
Westslope Cutthroat Trout
S. c. lewisi S. c. henshawi
Lahontan Basin evolution
Snake River evolution
S. c. bouvieri
Coastal cutthroat Trout
S. clarki clarki
2N=68
2N=66
2N=64
slightly below half
Cutthroat Trout
Rainbow Trout and allied species
Common Ancestor
Rhabdofario, Parasalmo
2,000,000 years B.P.
PLIOCENE
PLEISTOCENE
PLIOCENE

~~Cutthroat Trout - Rainbow~~

~~Common~~

common Ancestor

Co-1

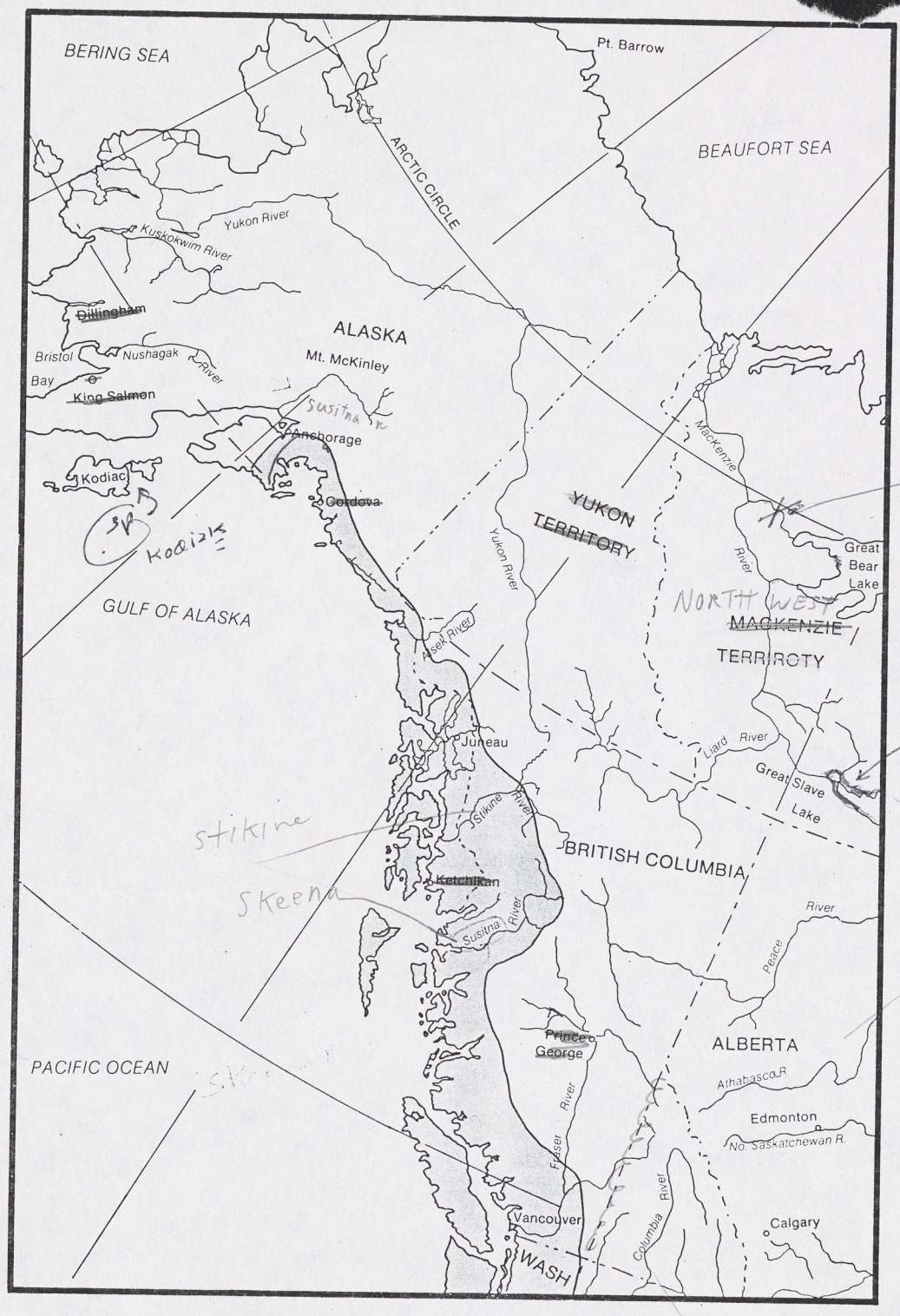


Figure 4A. Distribution of coastal cutthroat trout.

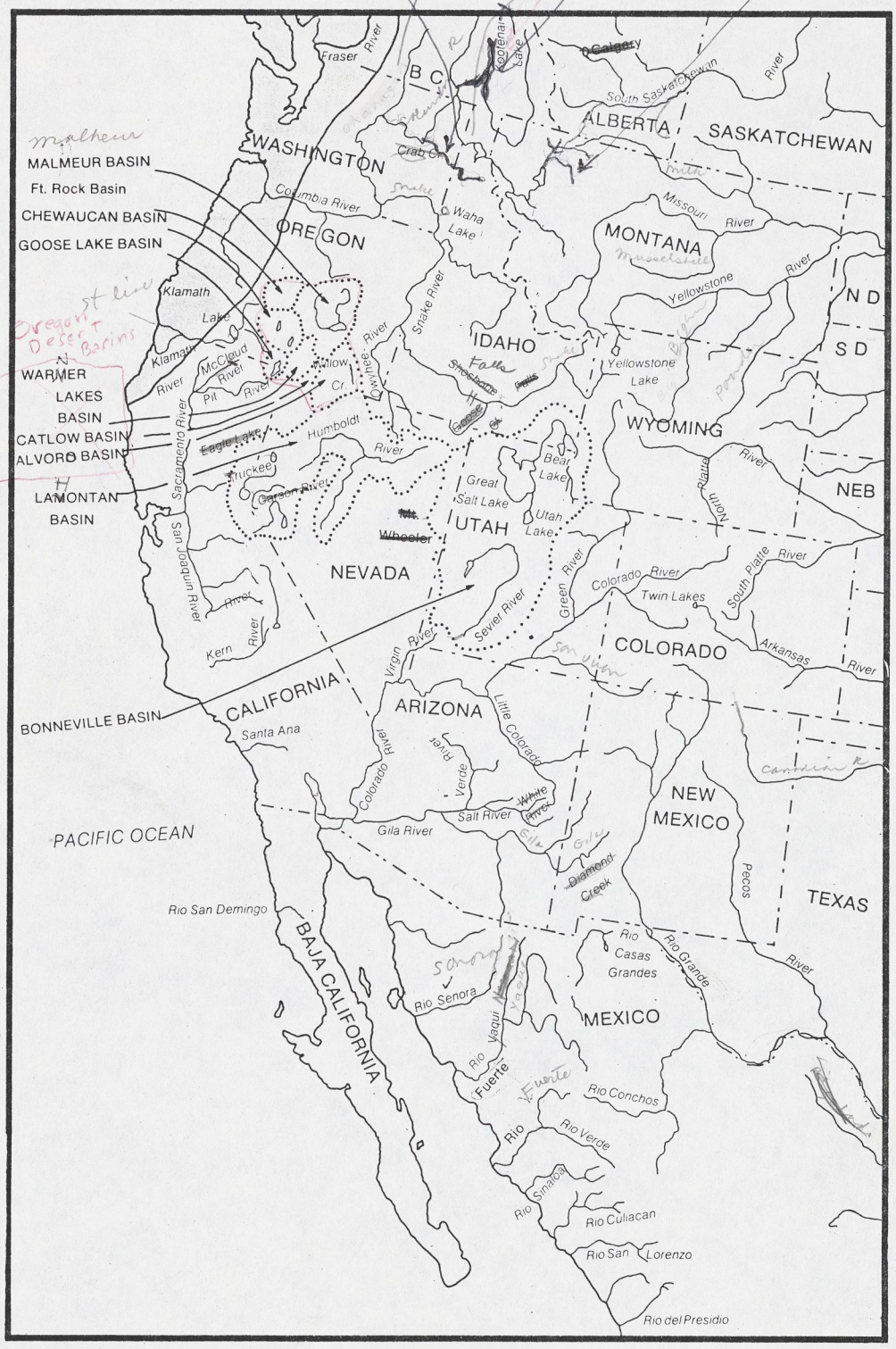
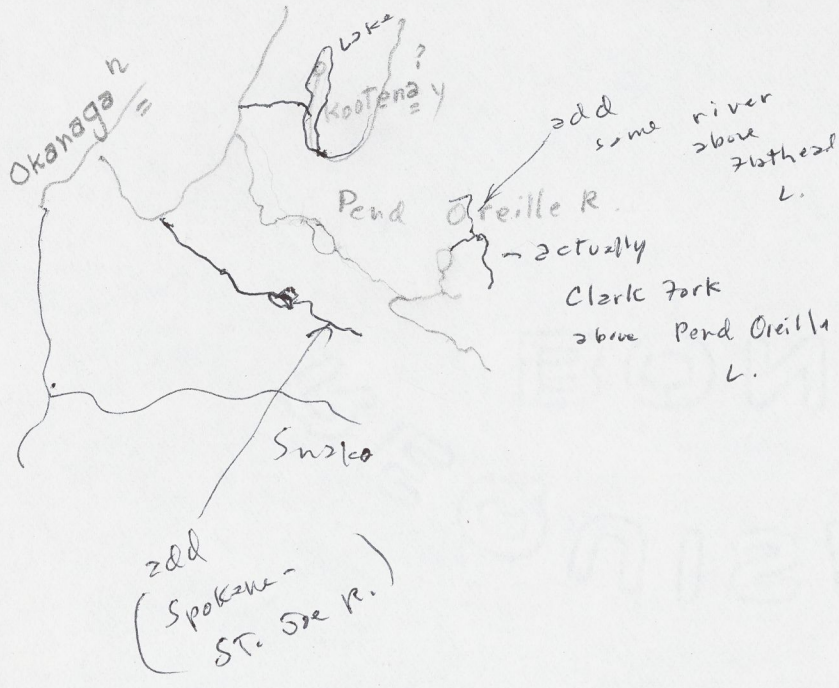
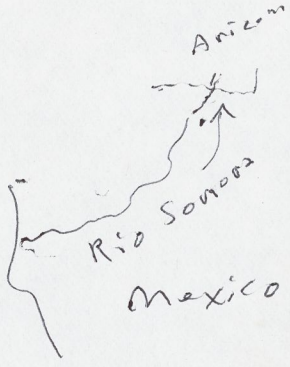


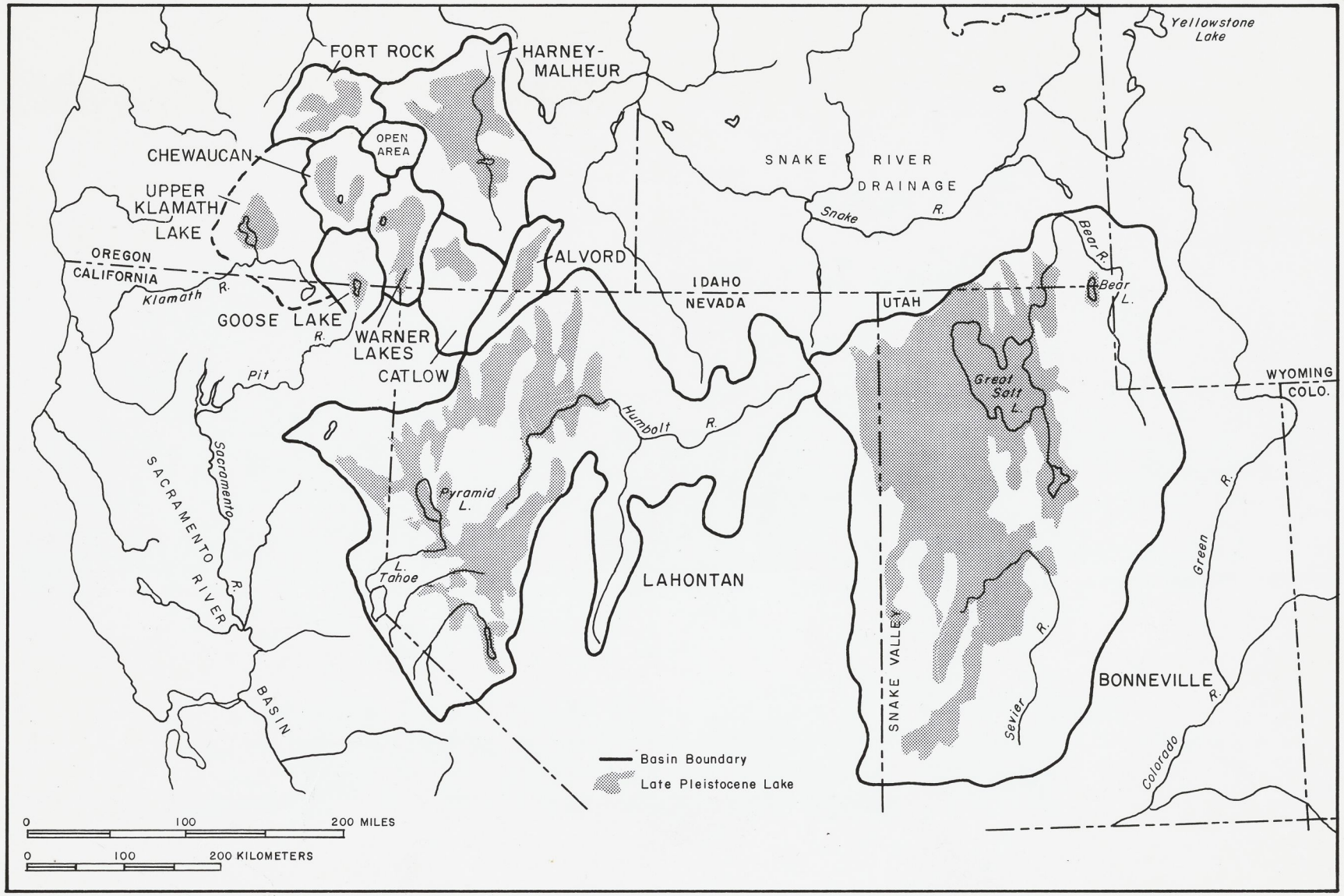
Figure 4B. Distribution of coastal cutthroat trout.

Apr 58

Smith & Miller
1981 Mus. Zool.
#696 U Mich
Occ. Pap.







P.97

FINE LINE NEGATIVE

Naiman-Fishes
4-1 W-14
Behnke

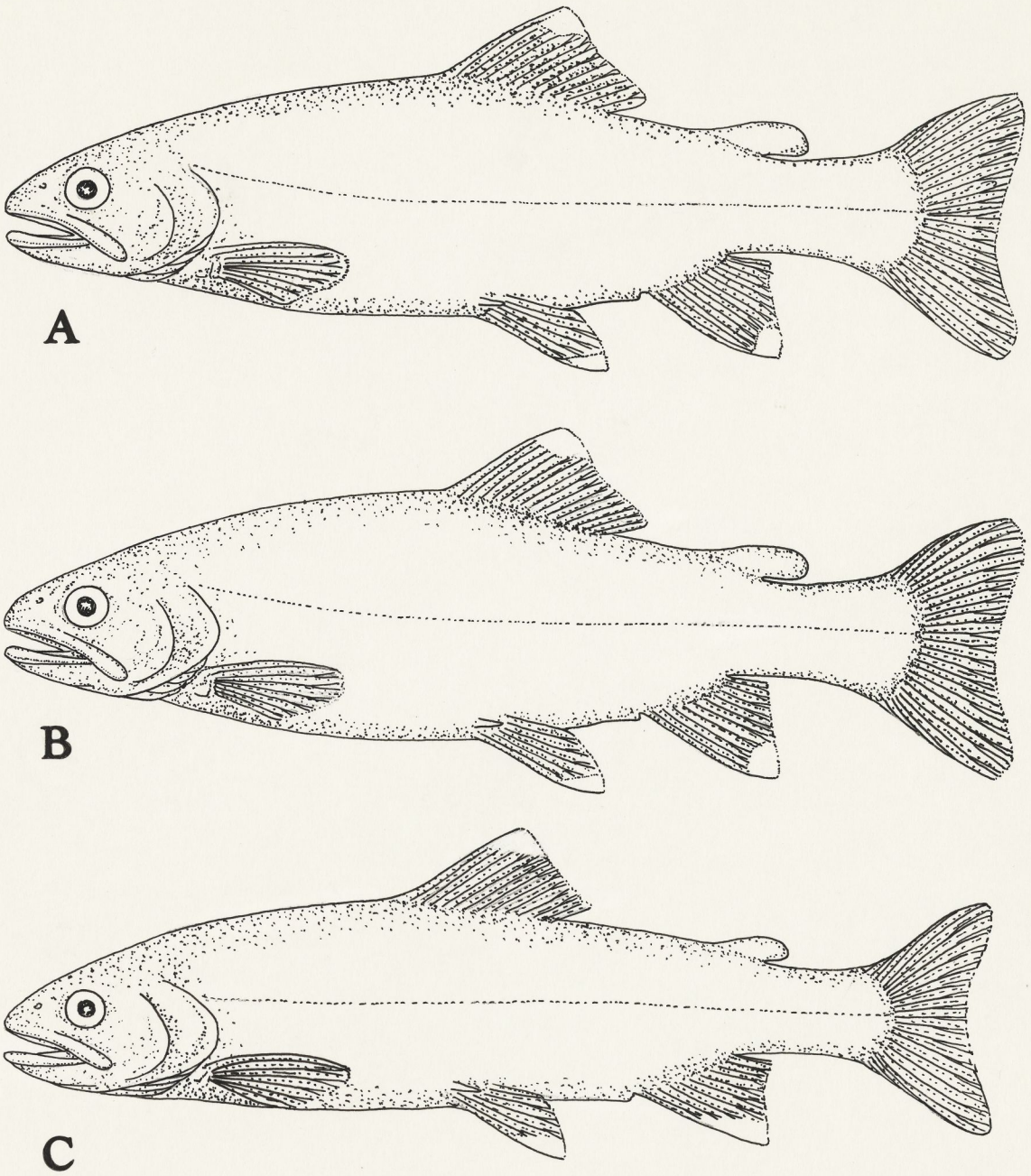
51%

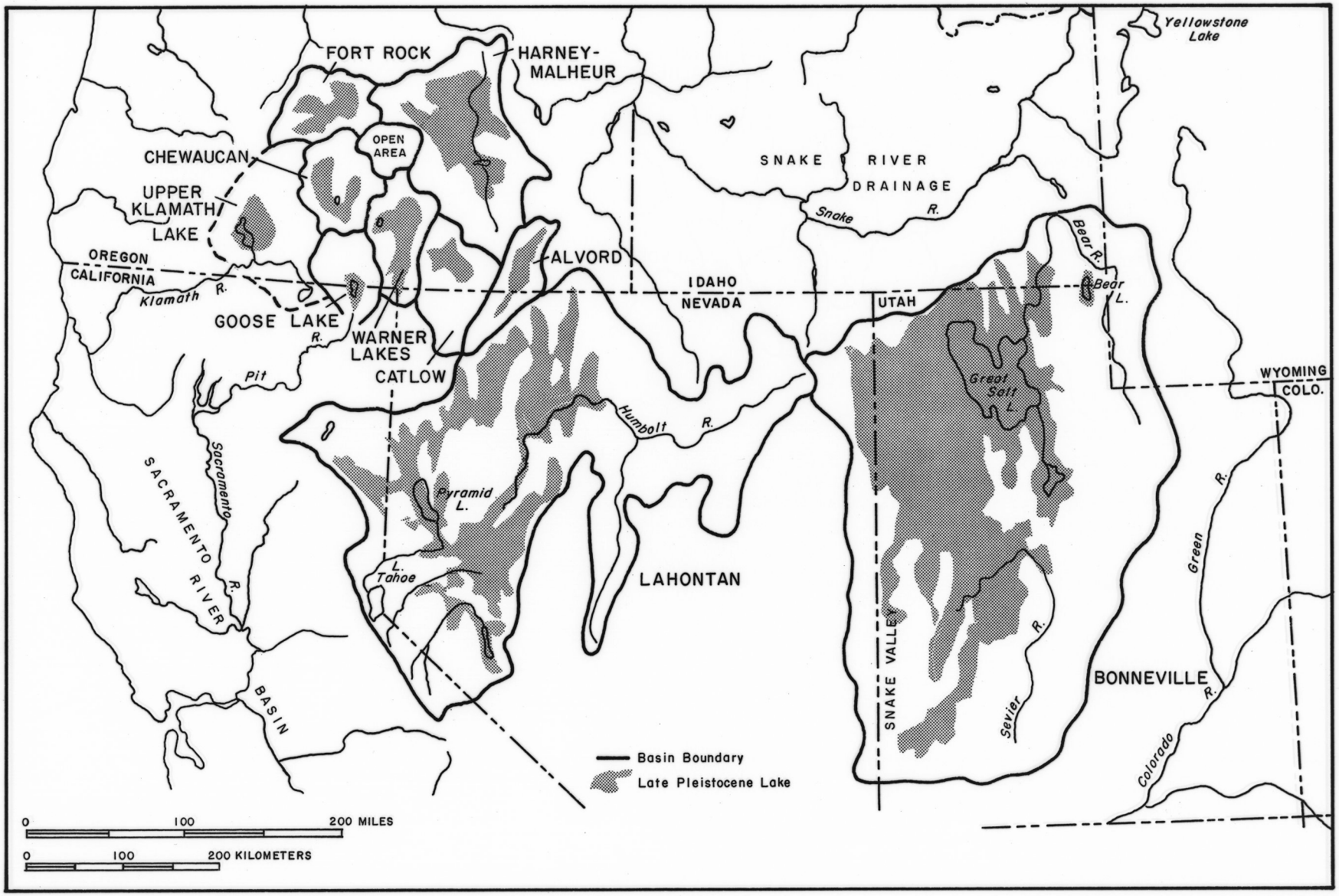
Naiman-Fishes

4-2 W-15

P. 99

39%


A
B
C


FORT ROCK
HARNEY-
MALHEUR
OPEN
AREA
CHEWAUCAN
UPPER
KLAMATH
LAKE
OREGON
CALIFORNIA
Klamath R.
GOOSE LAKE
WARNER
LAKES
CATLOW
ALVORD
SNAKE RIVER
DRAINAGE
Snake R.
Yellowstone
Lake
Bear R.
Bear L.
IDAHO
NEVADA
UTAH
WYOMING
COLO.
Great
Salt
L.
Pit
Sacramento
SACRAMENTO
RIVER
BASIN
Humboldt R.
Pyramid
L.
L.
Tahoe
LAHONTAN
SNAKE VALLEY
Sevier R.
Green R.
BONNEVILLE
Colorado R.
Basin Boundary
Late Pleistocene Lake
0
100
200 MILES
0
100
200 KILOMETERS

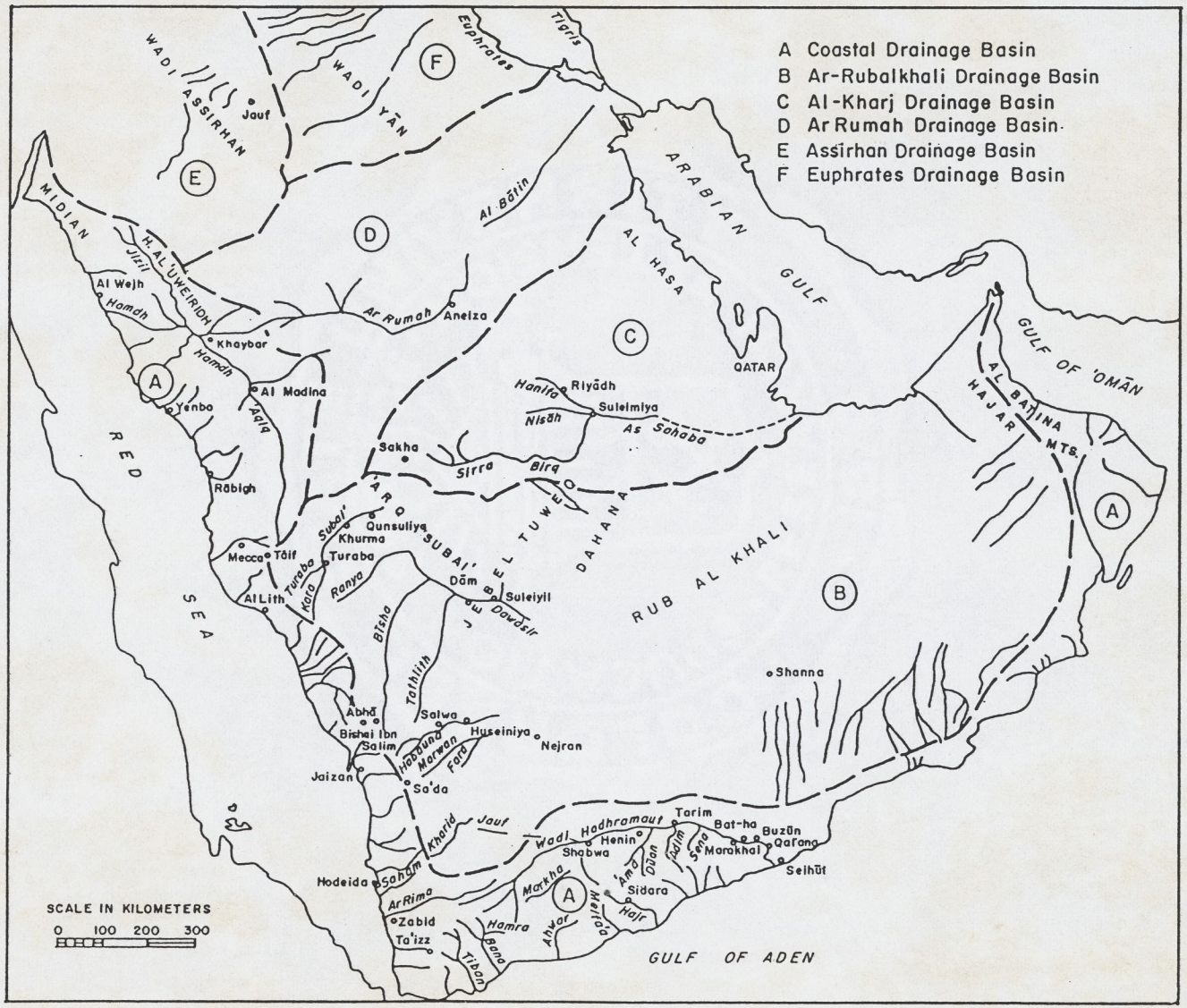
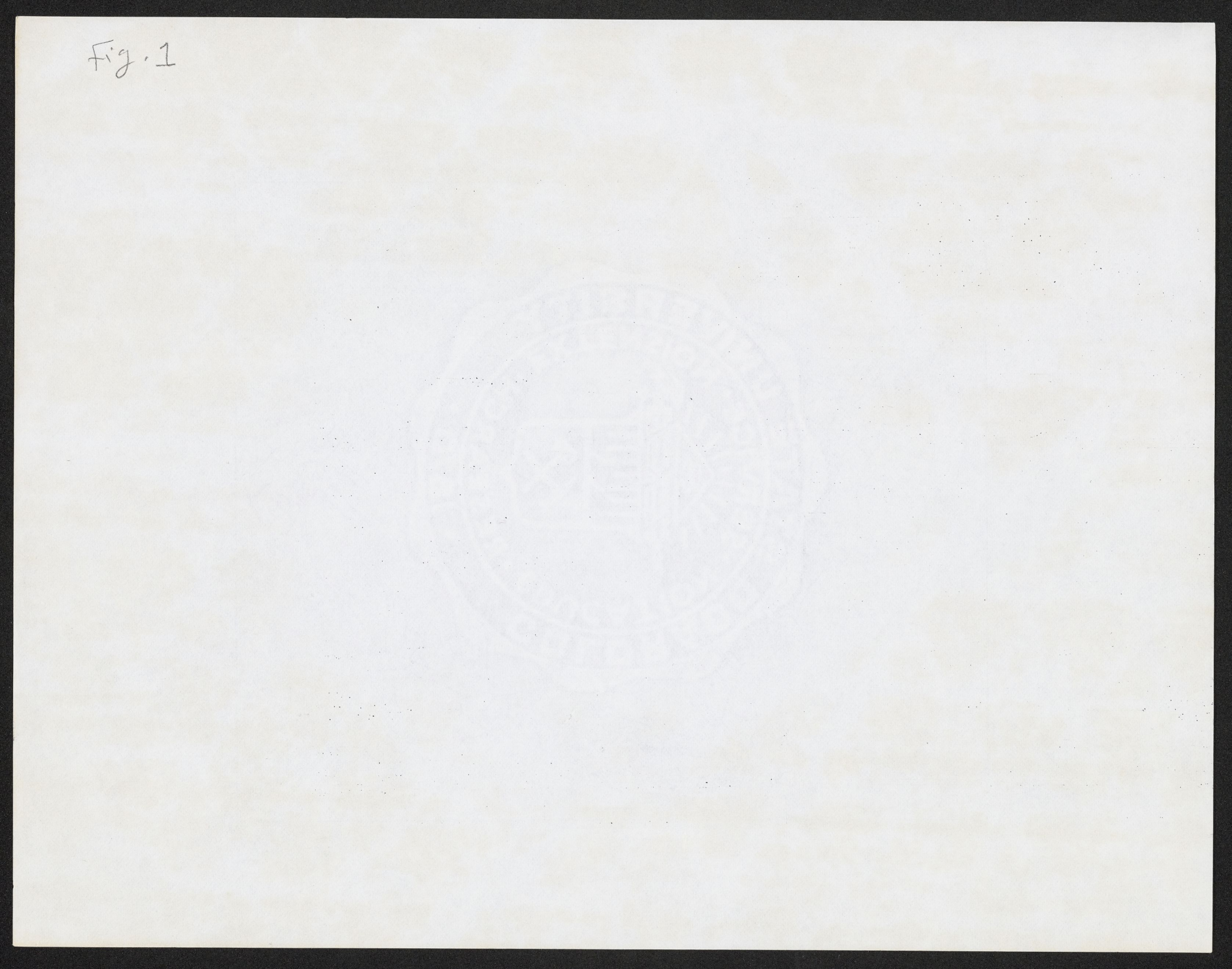
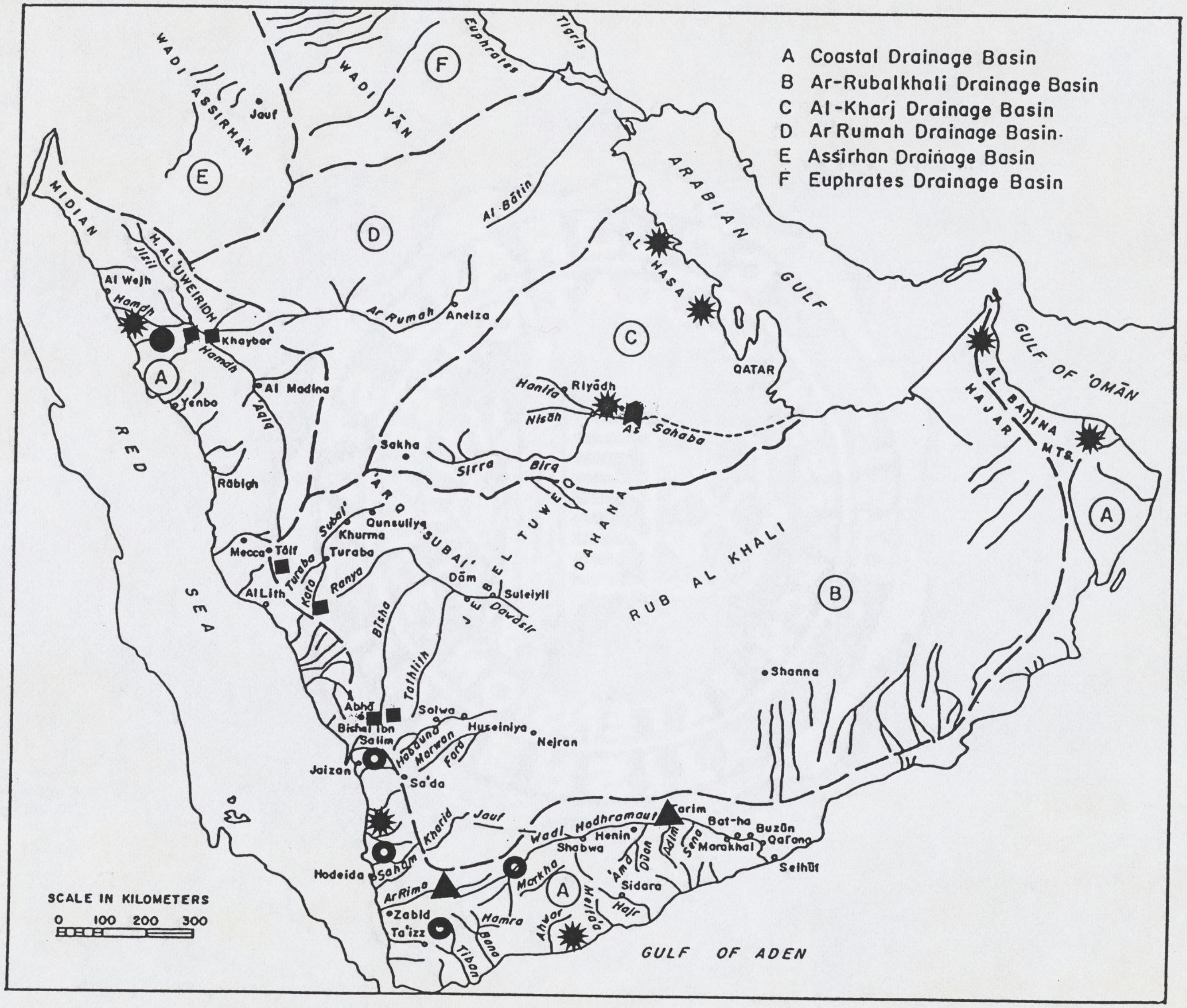

A Coastal Drainage Basin
B Ar-Rubalkhali Drainage Basin
C Al-Kharj Drainage Basin
D Ar Rumah Drainage Basin
E Assirhan Drainage Basin
F Euphrates Drainage Basin
WADI ASSIRHAN
Jauf
WADI YĀN
Euphrates
Tigris
MIDIAN
Jizil
H. AL 'UWEIRIDH
Al Wejh
Hamdh
Khaybar
Ar Rumah
Aneiza
Al Bātin
ARABIAN GULF
AL HASA
QATAR
GULF OF 'OMĀN
AL BATINA
HAJAR MTS.
Hanifa
Riyādh
Nisāh
Suleimiya
As Sahaba
Al Madina
Yenbo
Aqiq
Sakha
Sirra
Birq
RED SEA
Rābigh
'ARQ SUBAI'
Qunsuliya
Khurma
Tōif
Turaba
Mecca
Al Lith
Kara
Ranya
DAHANA
EL TUWAIQ
Dōm
Suleiyil
Dawdsir
RUB AL KHALI
Bīsha
Tathlith
Shanna
Abhā
Bishai Ibn Salim
Salwa
Huseiniya
Nejran
Habuna
Marwan
Farā
Jaizan
Sa'da
Kharid
Jauf
Wadi Hadhramaut
Tarim
Bat-ha
Buzūn
Qa'ang
Henin
Shabwa
Jadim
Sena
Marakhal
Seihūt
Hodeida
Sahum
Markha
'Amd
Dōan
Sidara
Ar Rima
Zabid
Ta'izz
Hamra
Bana
Tibam
Ahwar
Mahfid
Haif
GULF OF ADEN
SCALE IN KILOMETERS
0 100 200 300

Fig. 1





A Coastal Drainage Basin
B Ar-Rubalkhali Drainage Basin
C Al-Kharj Drainage Basin
D Ar Rumah Drainage Basin
E Assirhan Drainage Basin
F Euphrates Drainage Basin
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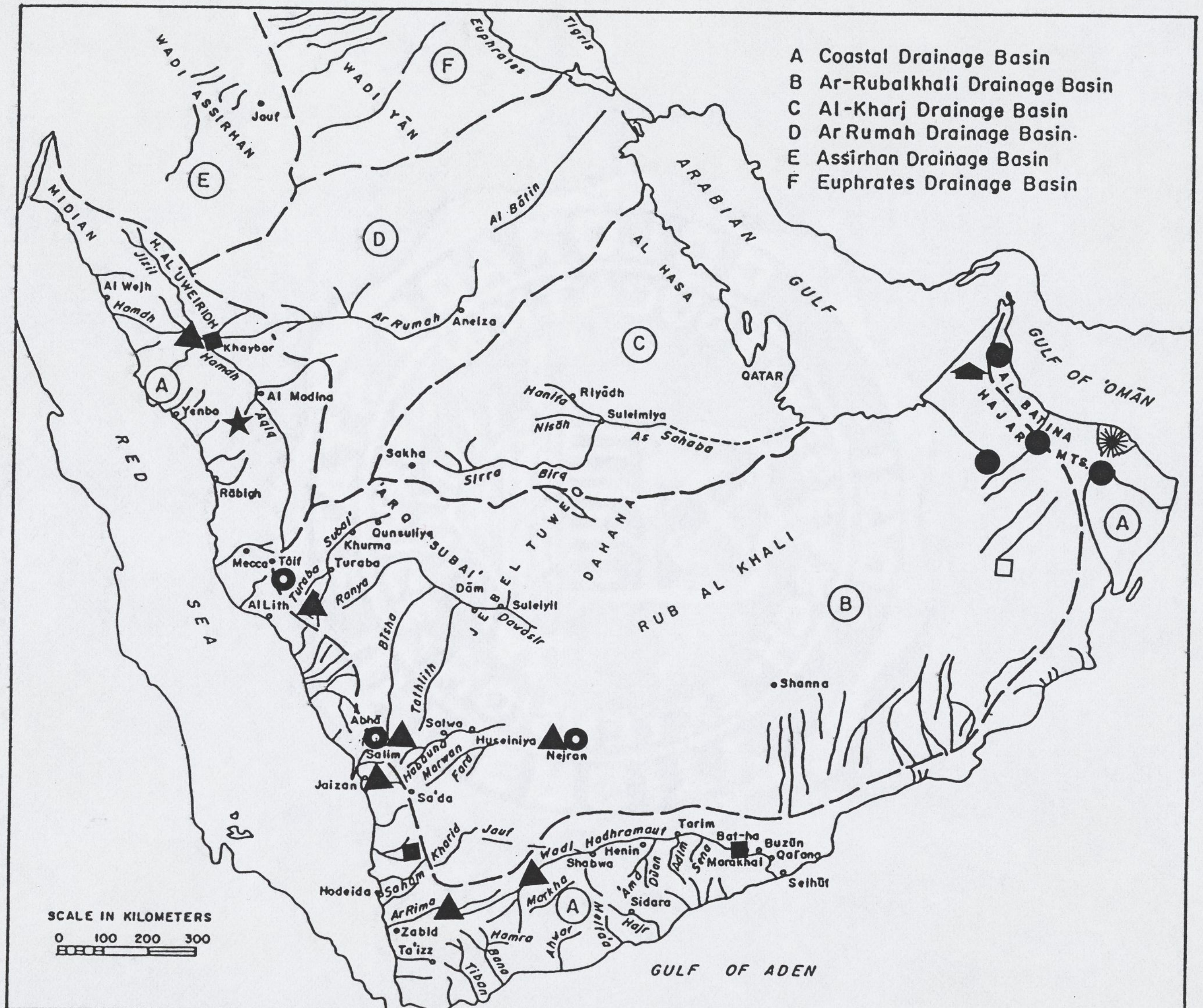
Jauf
WADI YĀN
Euphrates
Tigris
MIDIAN
Al Bātin
ARABIAN GULF
AL HASA
Al Wejh
Hamdh
Khaybar
Ar Rumah
Aneiza
QATAR
GULF OF 'OMĀN
Yenbo
Al Madina
Riyādh
Hanifa
Nisāh
As Sahaba
AL BATINA
HAJAR MTS.
RED SEA
Sakha
Sirra
Birq
Rābigh
DAHANA
Qunsuliya
Khurma
Turaba
Mecca
Tāif
SUBAI'
Ranya
Dām
Suleiyil
Al Lith
Dawāsir
RUB AL KHALI
Bisha
Tathlith
Shanna
Abhā
Solwa
Huseiniya
Nejran
Jaizan
Sa'da
Jauf
Wadi Hadhramaut
Tarim
Bat-ha
Buzūn
Qafona
Henin
Shabwa
Morakhal
Selhūt
Hodeida
Sahām
Ar Rima
Markha
Sidara
Hajr
Zabid
Ta'izz
Hamra
Tiban
GULF OF ADEN
SCALE IN KILOMETERS
0 100 200 300

Fig. 2A


A Coastal Drainage Basin
B Ar-Rubalkhali Drainage Basin
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WADI ASSIRHAN
Jouf
WADI YĀN
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Tigris
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Aneiza
ARABIAN GULF
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HAJAR MTS.
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RED SEA
Rābigh
Hanifa
Riyādh
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Suleimiya
As Sahaba
Sakha
Sirra
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DAHANA
Qunsuliya
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Ronya
SUBAI'
Dām
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Dawāsir
JEBEL TUWEIQ
RUB AL KHALI
Bisha
Tathlith
Shanna
Abhā
Salwa
Huseiniya
Nejran
Salim
Jaizan
Sa'da
Jauf
Kharid
Wadi Hadhramaut
Tarim
Bat-ha
Buzūn
Qal'ana
Henin
Shabwa
Morakhal
Seihūt
Hodeida
Saham
Ar Rima
Markha
Sidara
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Zabid
Ta'izz
Hamra
Tiban
GULF OF ADEN
SCALE IN KILOMETERS
0 100 200 300

Fig. 2B

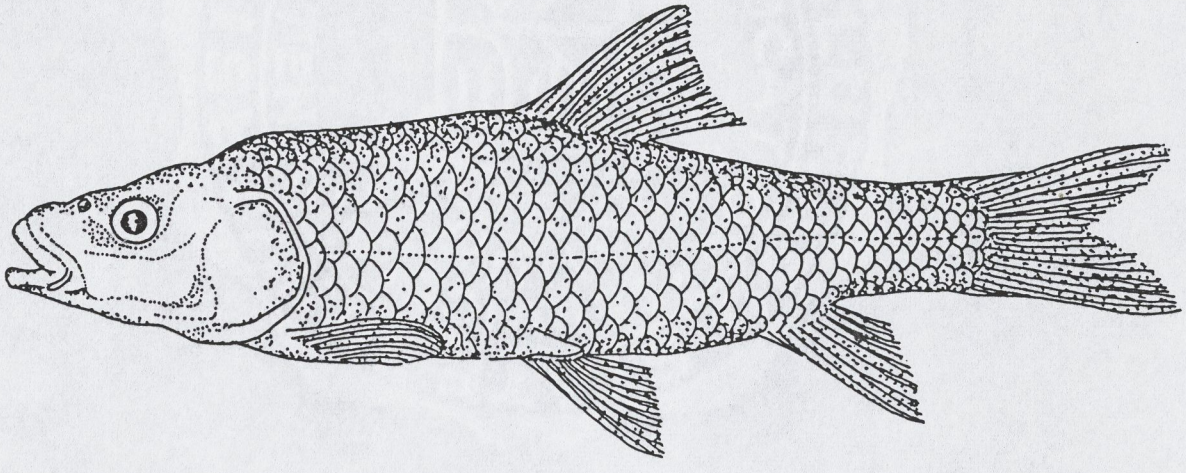


Fig-3

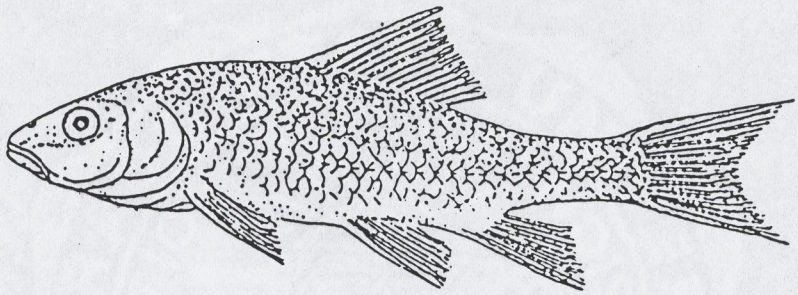


Fig. 4

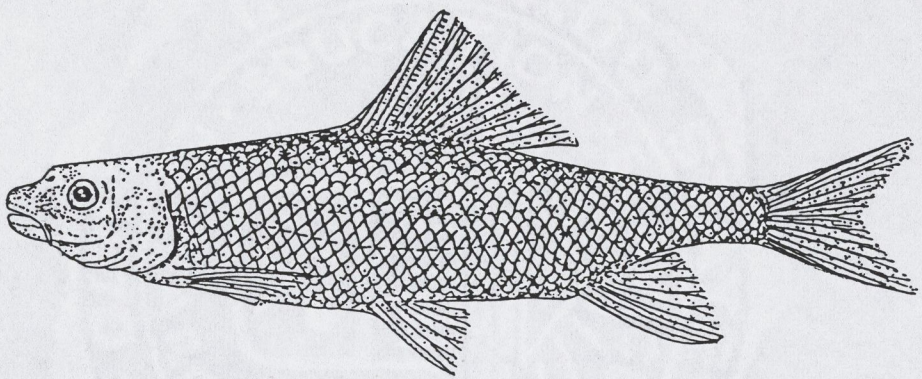
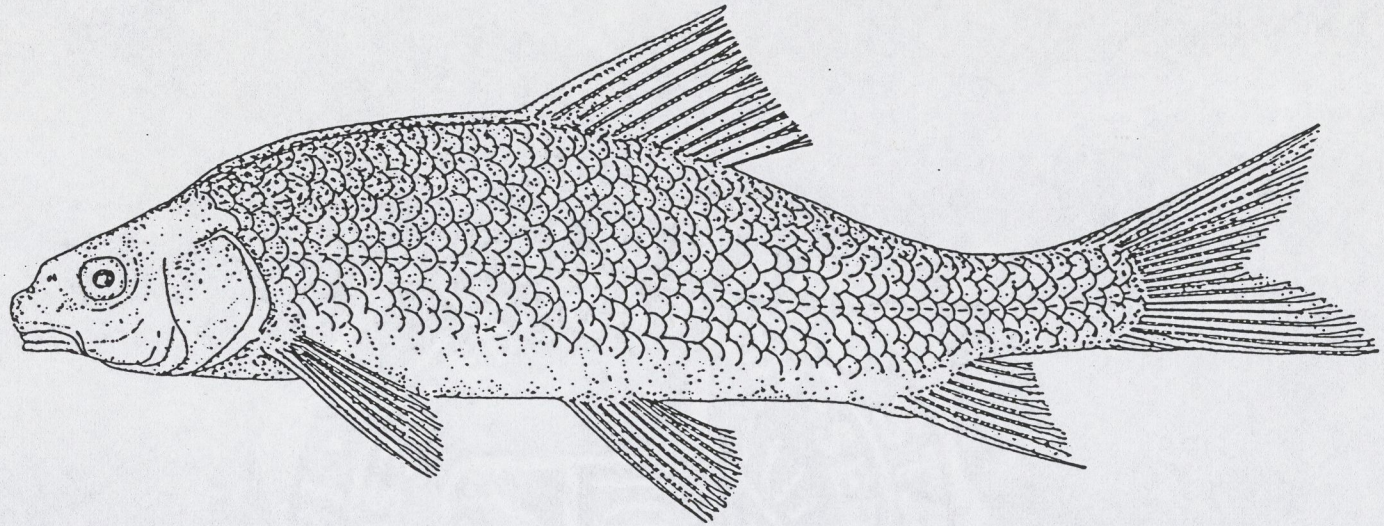


Fig. 5

A



B

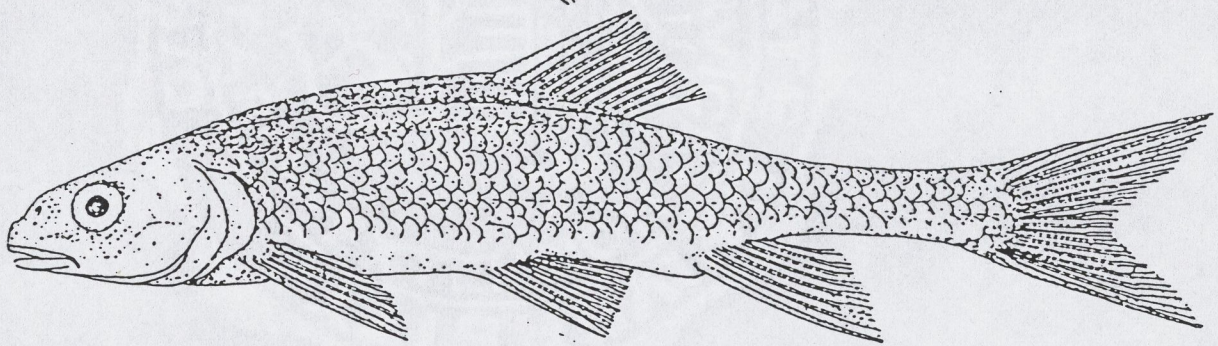


Fig. 6

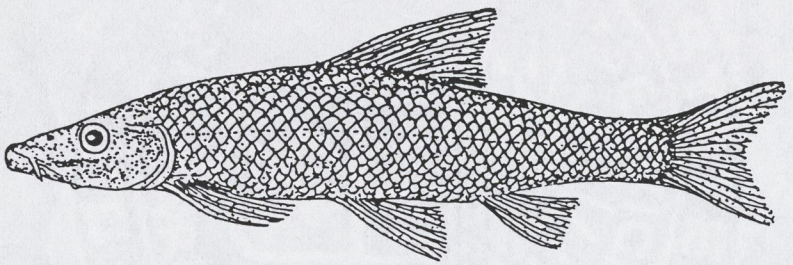


Fig. 7

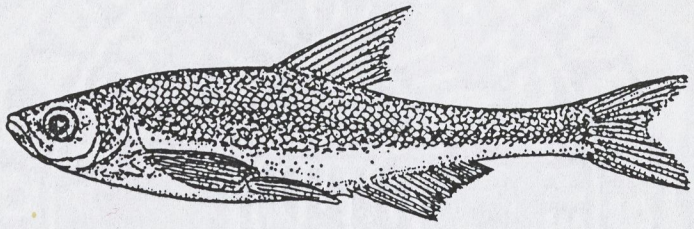
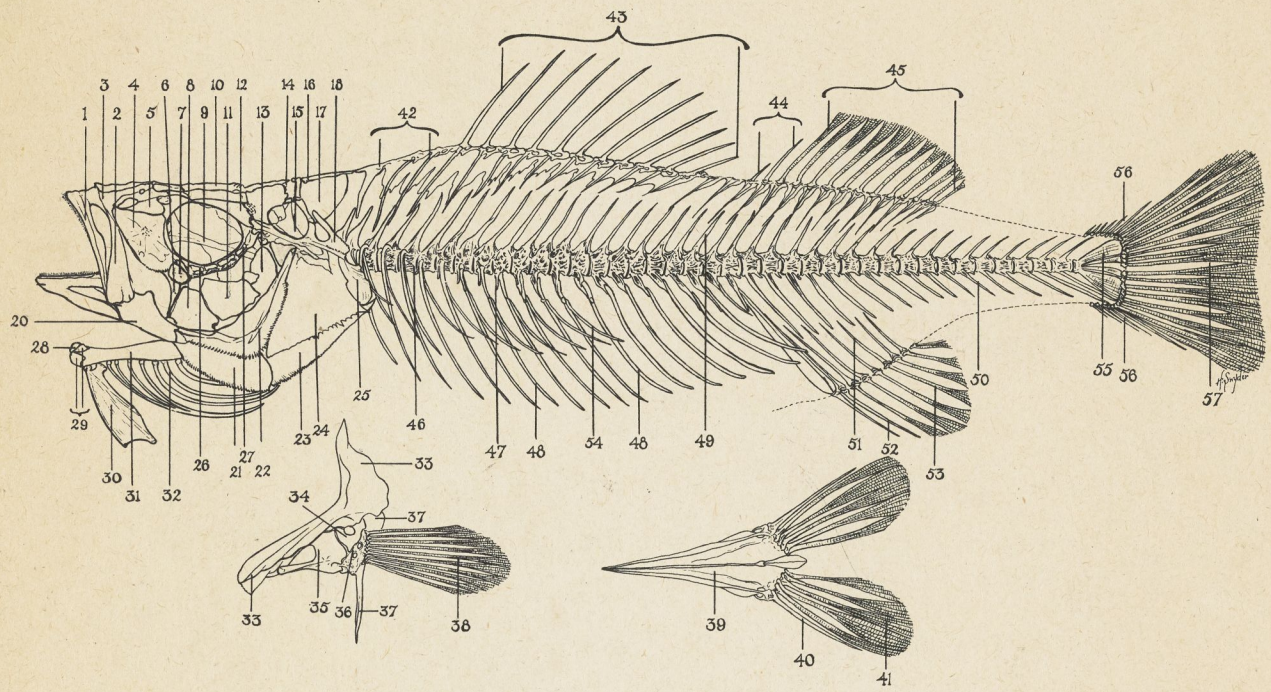


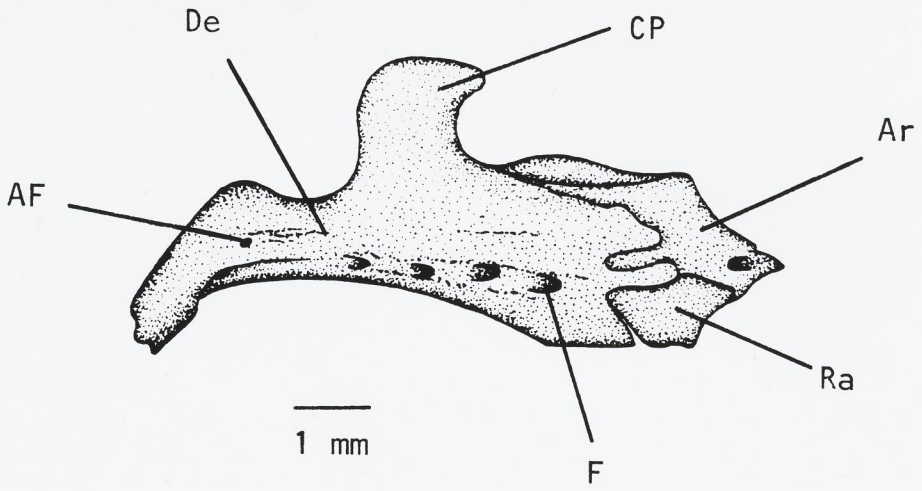
Fig. 5

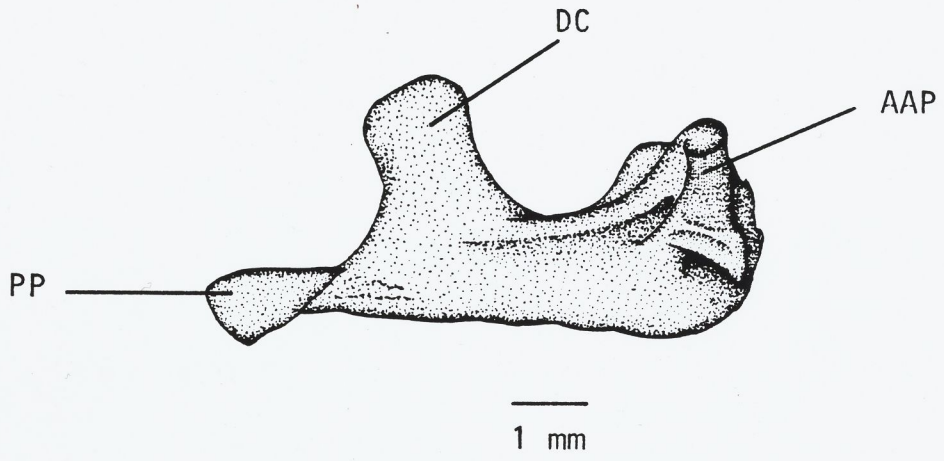
Turtox Skeleton KEY CARD
for
Perch

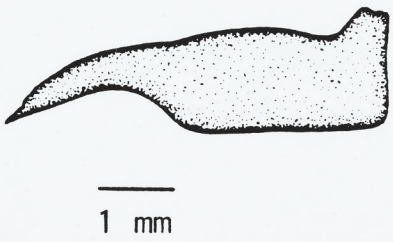


1. Premaxilla
2. Maxilla
3. Nasal
4. Infraorbitalis
5. Prefrontal
6. Ectopterygoid
7. Entopterygoid
8. Quadrate
9. Parasphenoid
10. Frontal
11. Metapterygoid
12. Post frontal
13. Hyomandibular
14. Parietal
15. Paroccipital
16. Supratemporal
17. Supraoccipital
18. Post-temporal
19. Dentary
20. Articular
21. Interopercular
22. Preopercular
23. Subopercular
24. Opercular
25. Supra ~~clavicle~~ cleithrum
26. Suborbital
27. Postorbital
28. Basihyoid
29. Hypohyals
30. Urohyal
31. Ceratohyoid
32. Branchiostegal rays (7)
33. ~~Clavicular~~ Cleithrum
34. Scapula
35. Coracoid
36. ~~Pterygials~~ Actinosts
37. Post ~~clavicle~~ cleithrum
38. Dermal rays of pectoral fin
39. ~~Pelvis~~ Basipterygium
40. Hard ⎫ Dermal rays of
41. Soft ⎭ pelvic fin
42. Ptergiophores or proximal radiacia
43. Anterior dorsal fin rays
44. Hard ⎫ Dermal rays of posterior
45. Soft ⎭ dorsal fin
46. Vertebrae
47. Parapophysis or Transverse process
48. Ribs
49. Neural spines
50. Haemal spine
51. Radials of ventral fin
52. Hard ⎫ Dermal rays of
53. Soft ⎭ Anal fin
54. ~~Subperitoneals or false ribs~~ Epipleural ribs
55. Hypural ~~bones~~ plates
56. Hard ⎫ Dermal rays of
57. Soft ⎭ Caudal fin

Subject No. 23K201
13.14


De
CP
Ar
AF
Ra
1 mm
F


DC
AAP
PP
1 mm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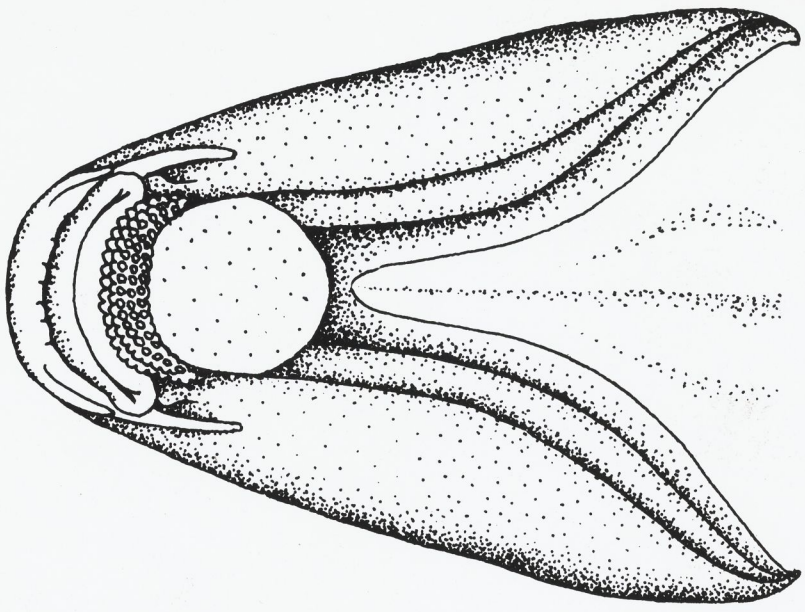
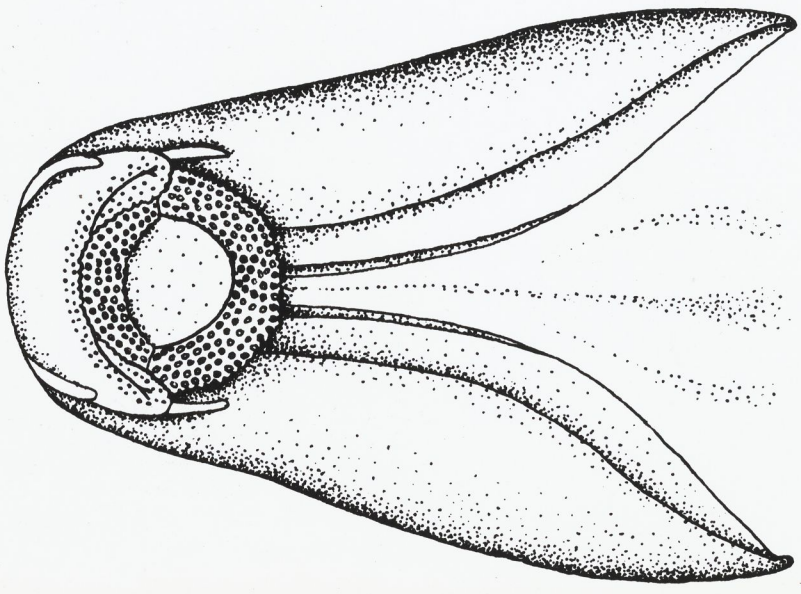
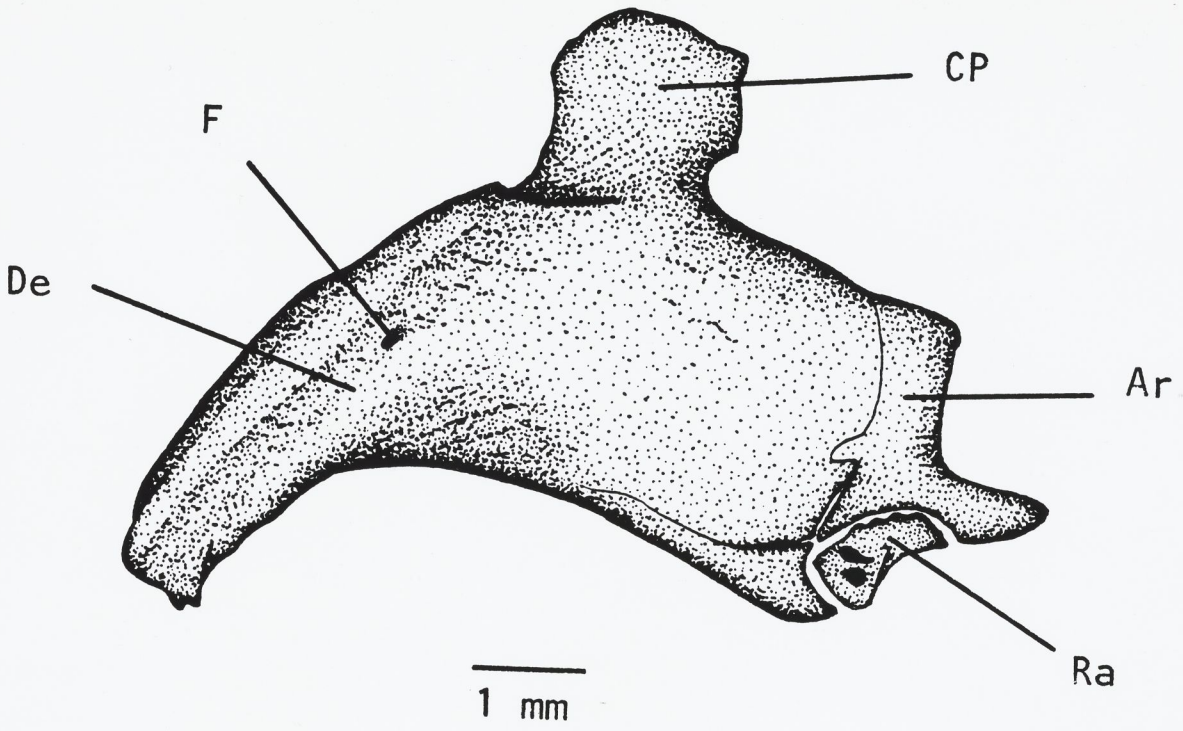
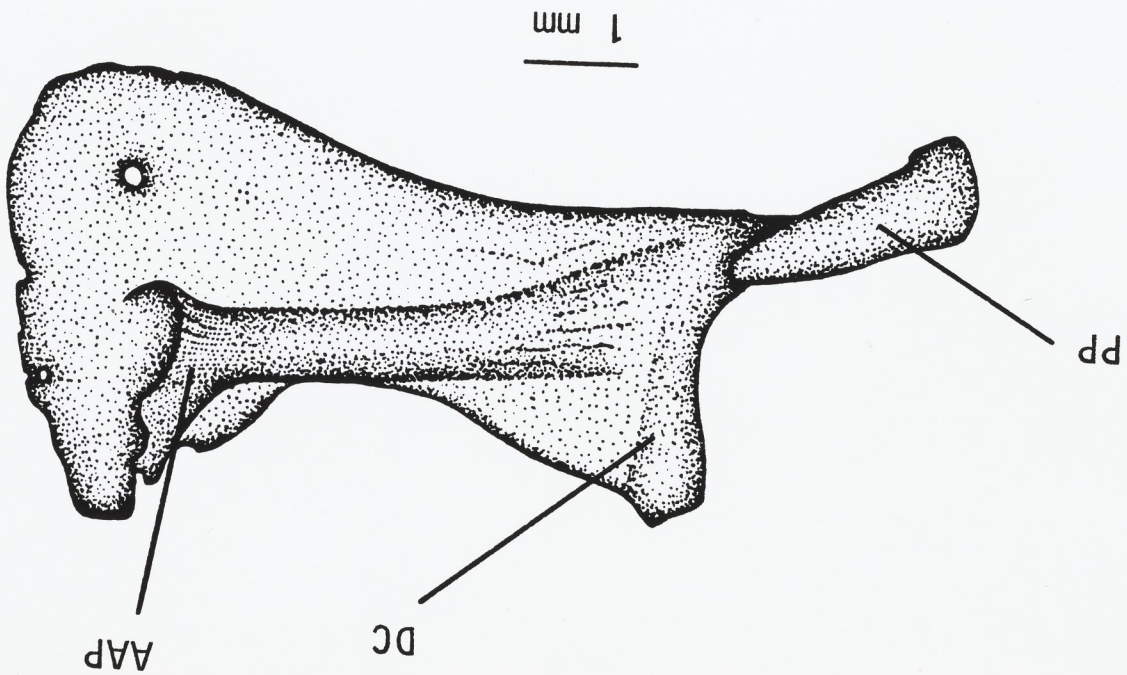





CP
F
De
Ar
Ra
1 mm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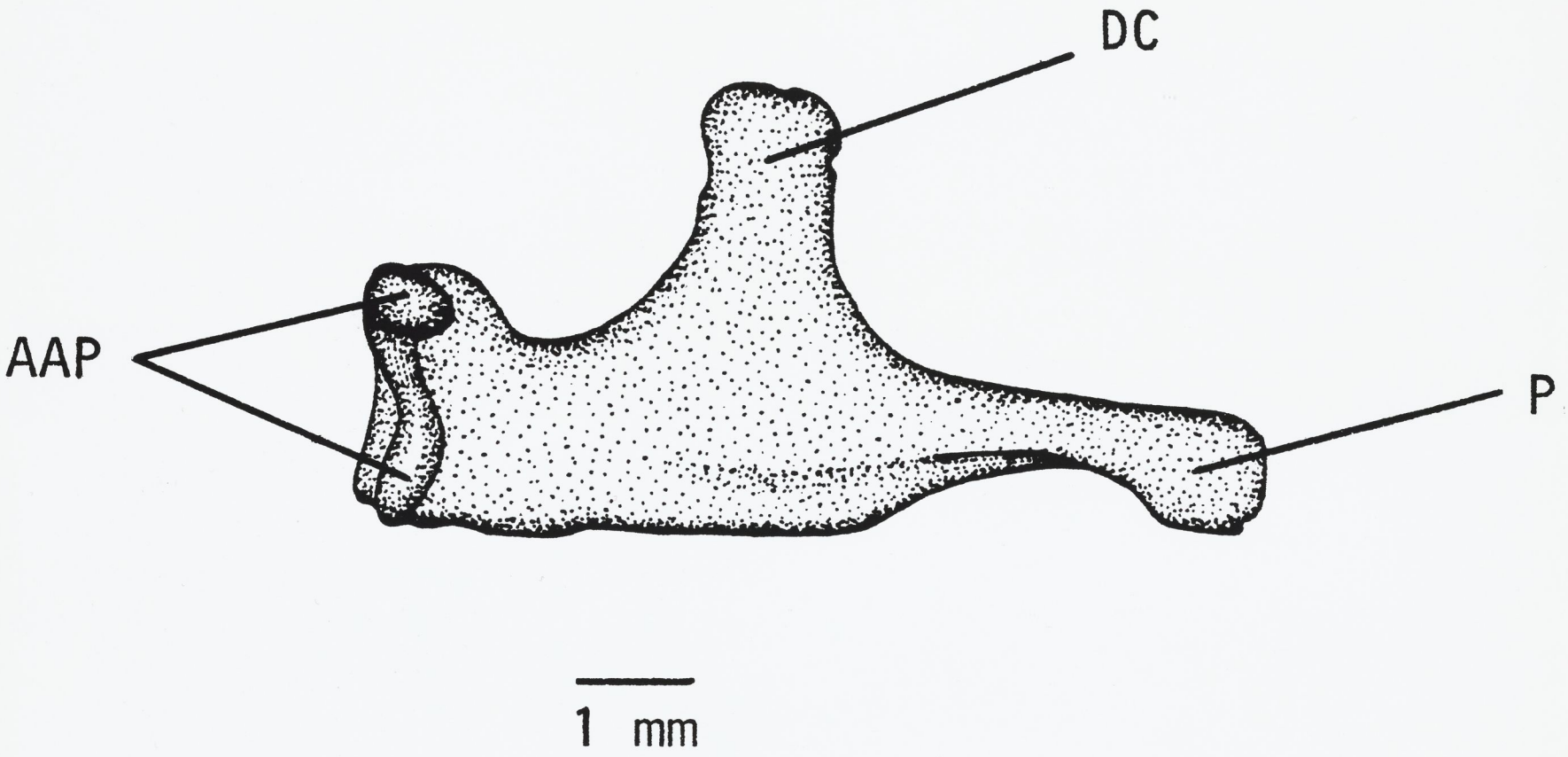
dp
DC
AAP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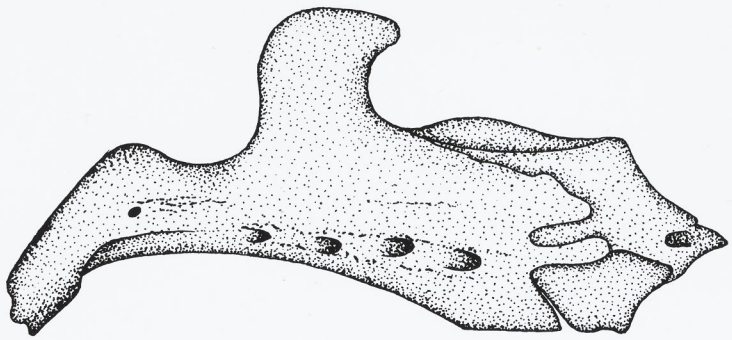
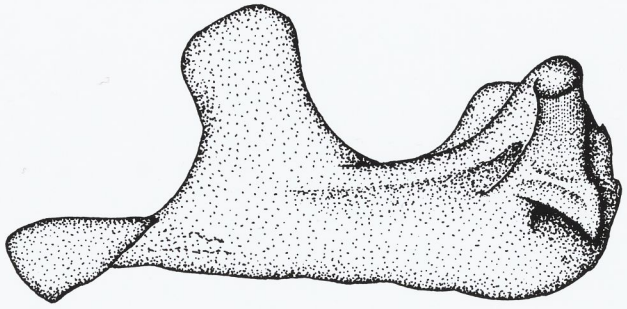
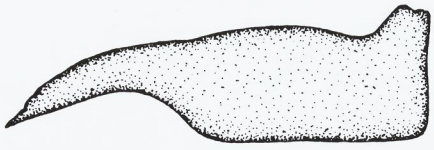
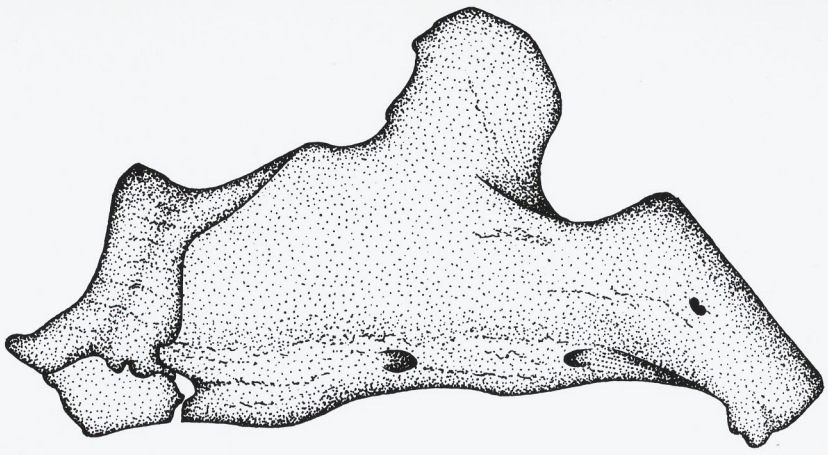
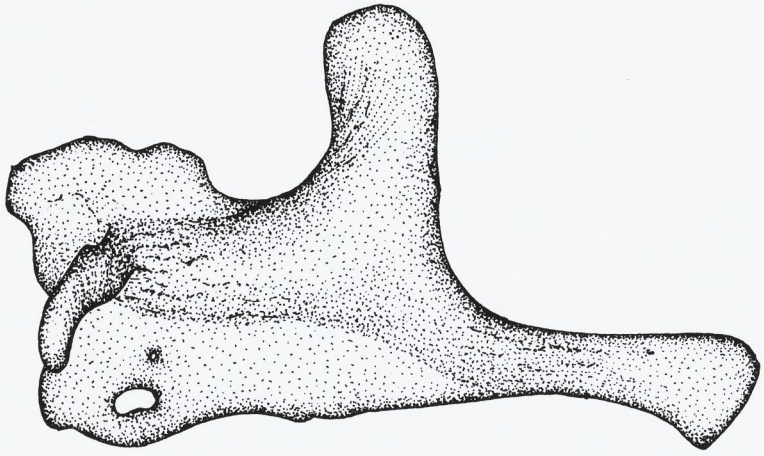
AAP
P
1 mm

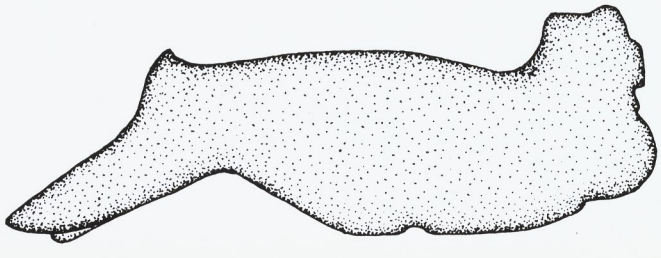


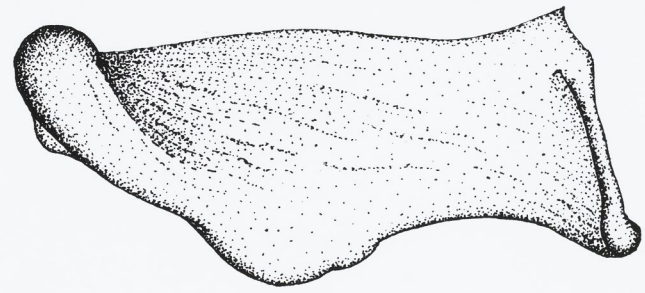


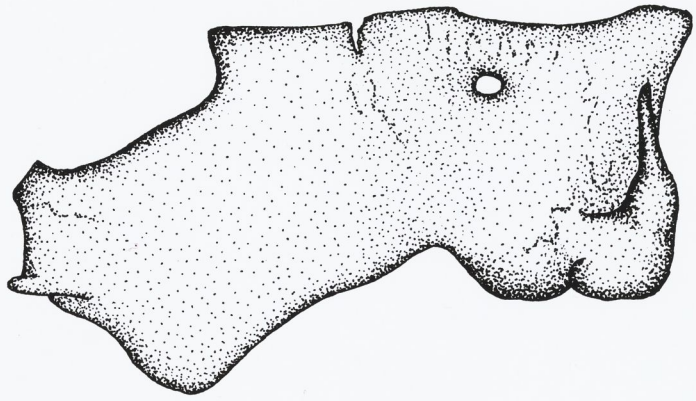


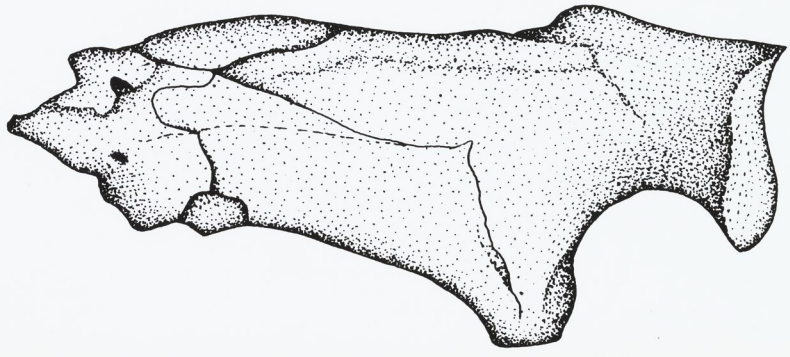


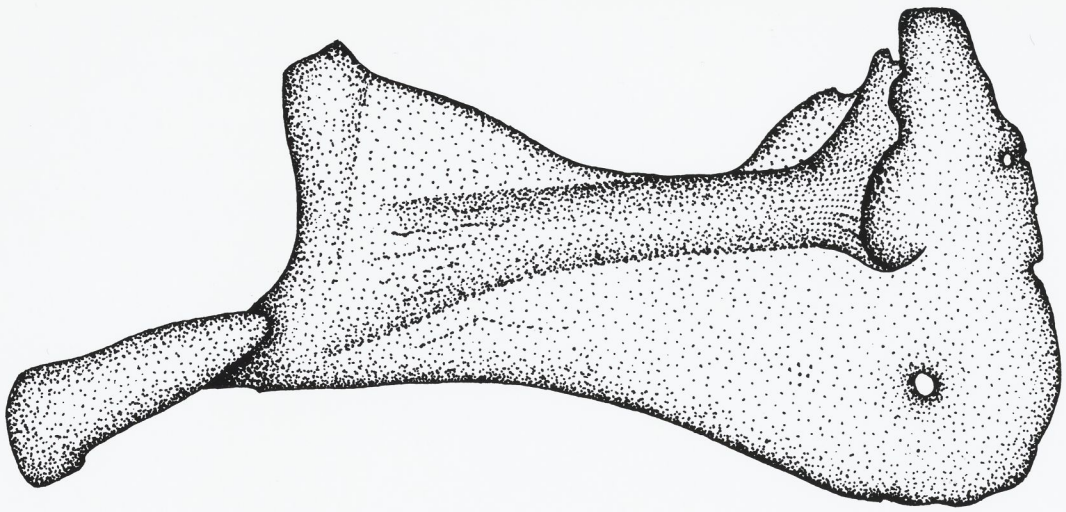


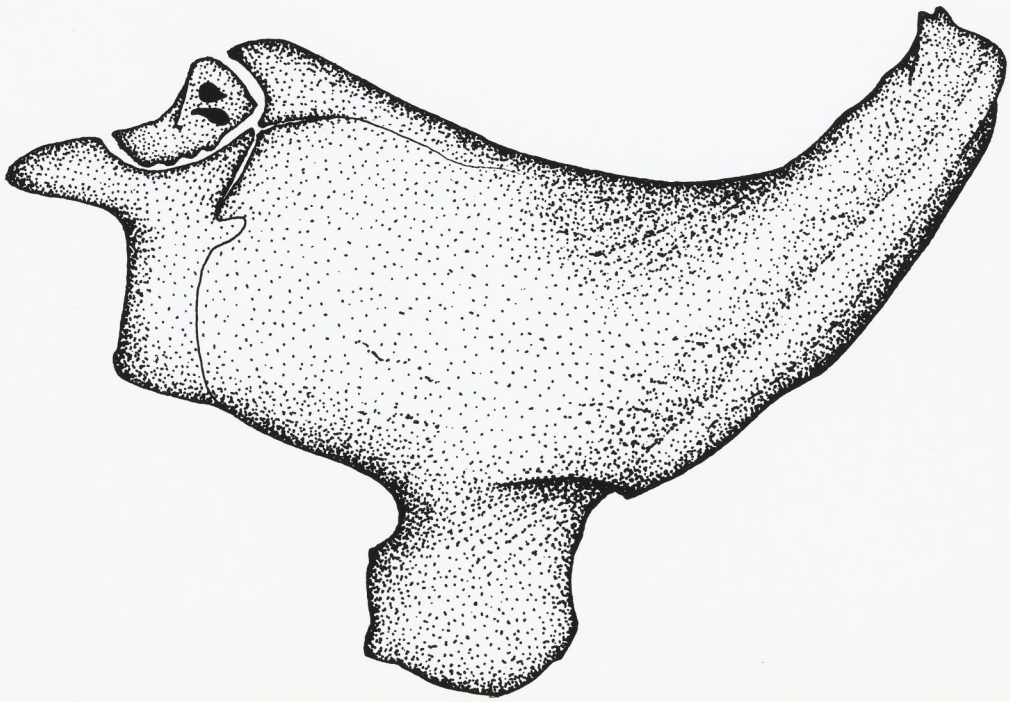


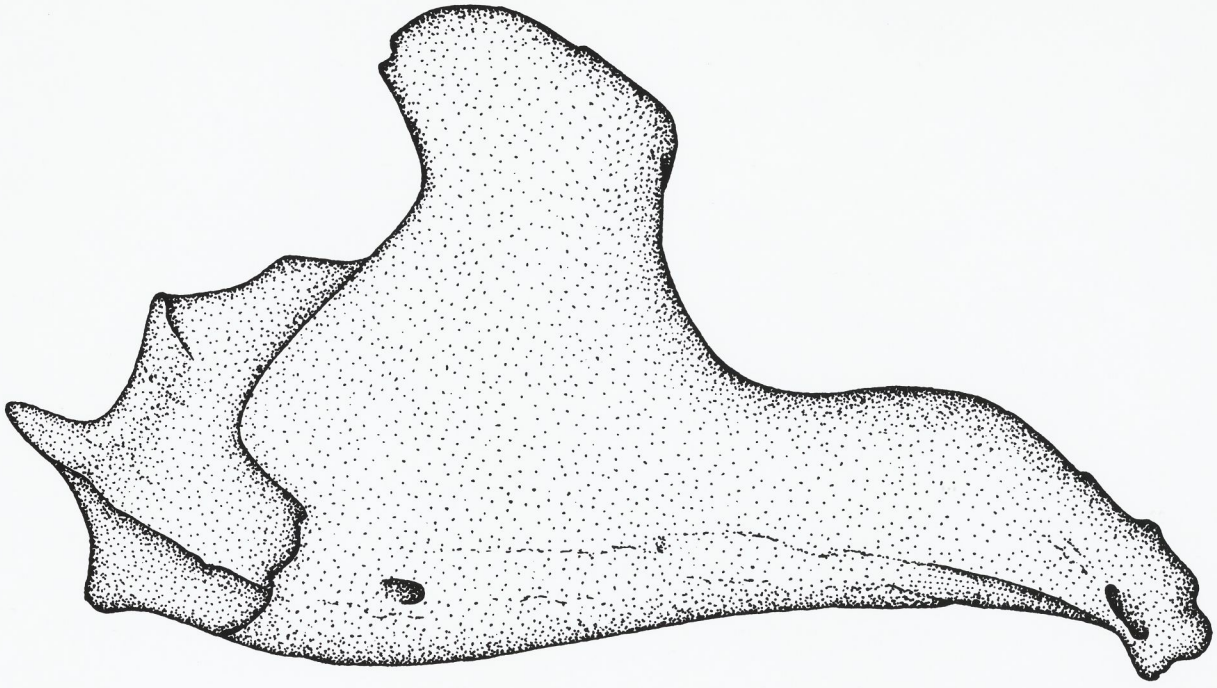


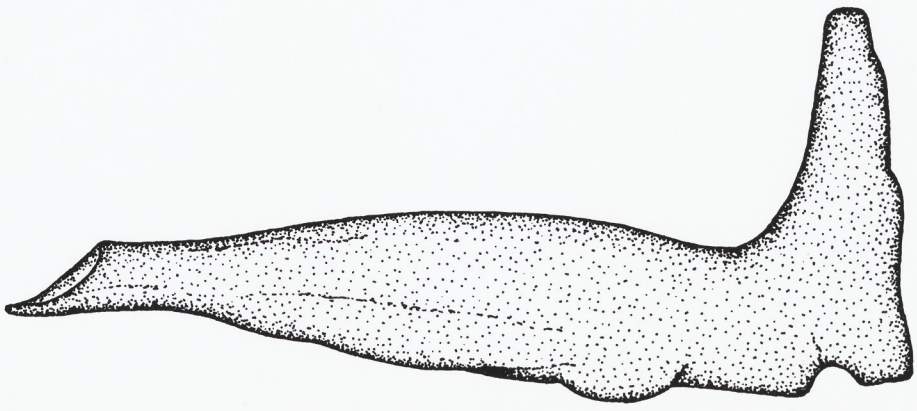


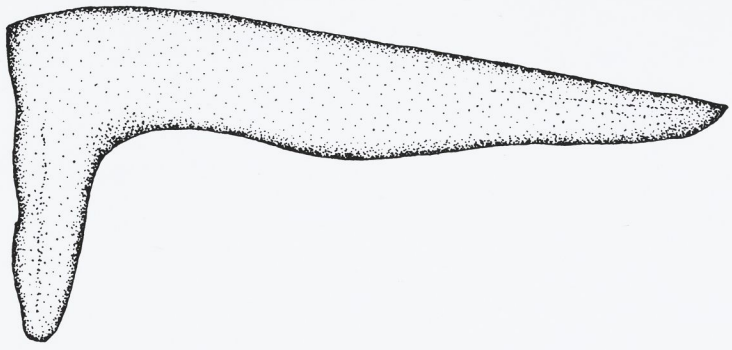


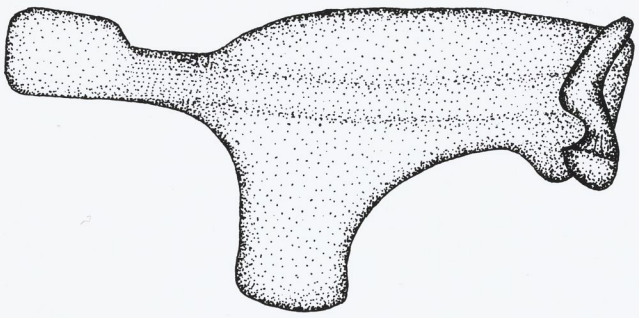


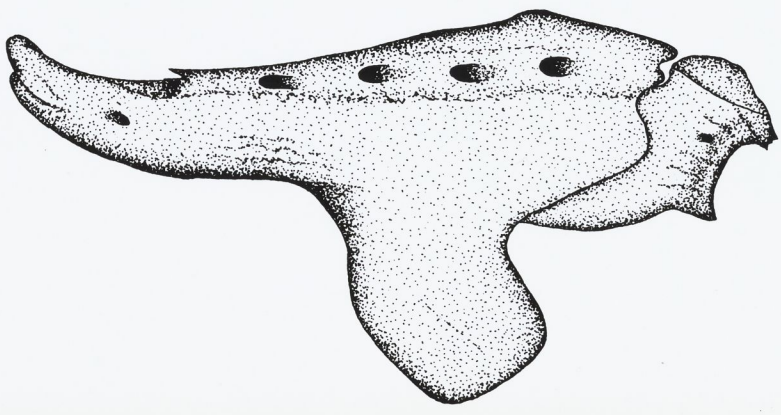


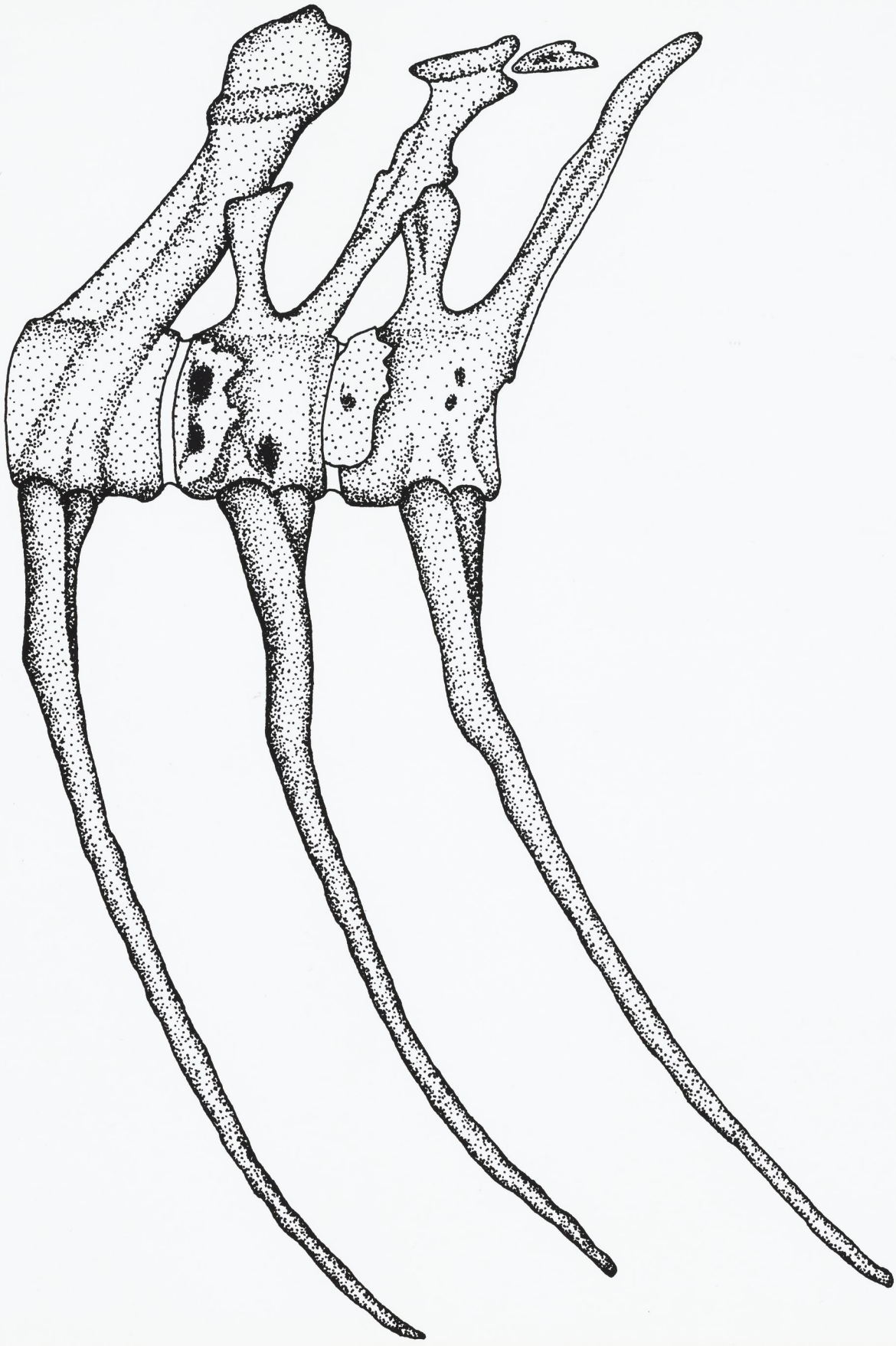


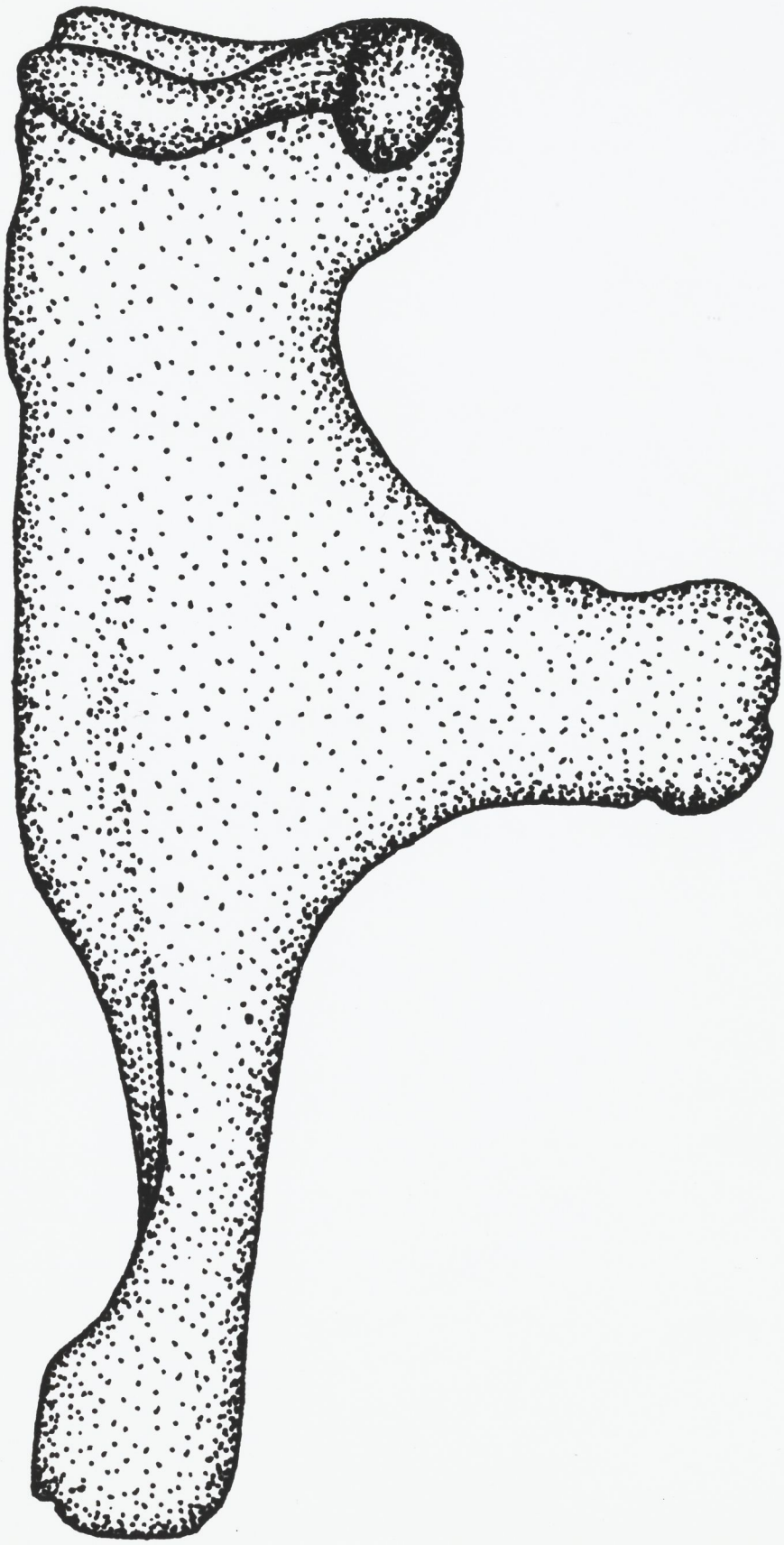


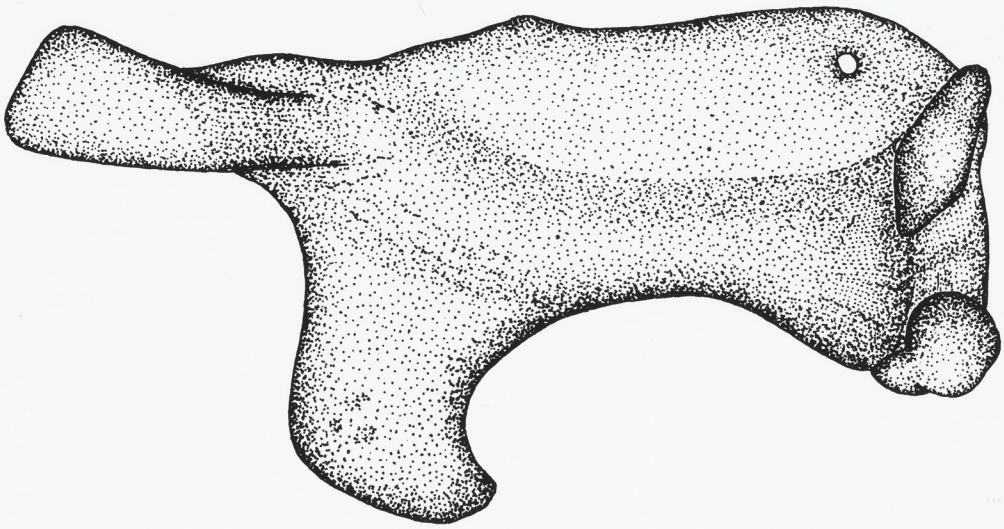


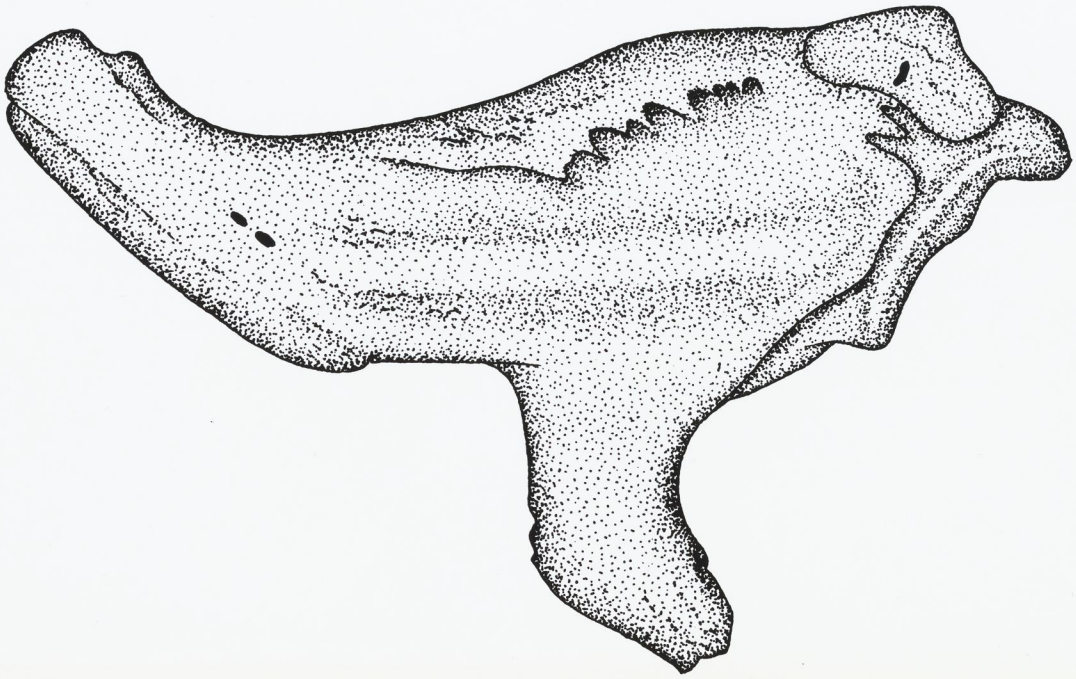


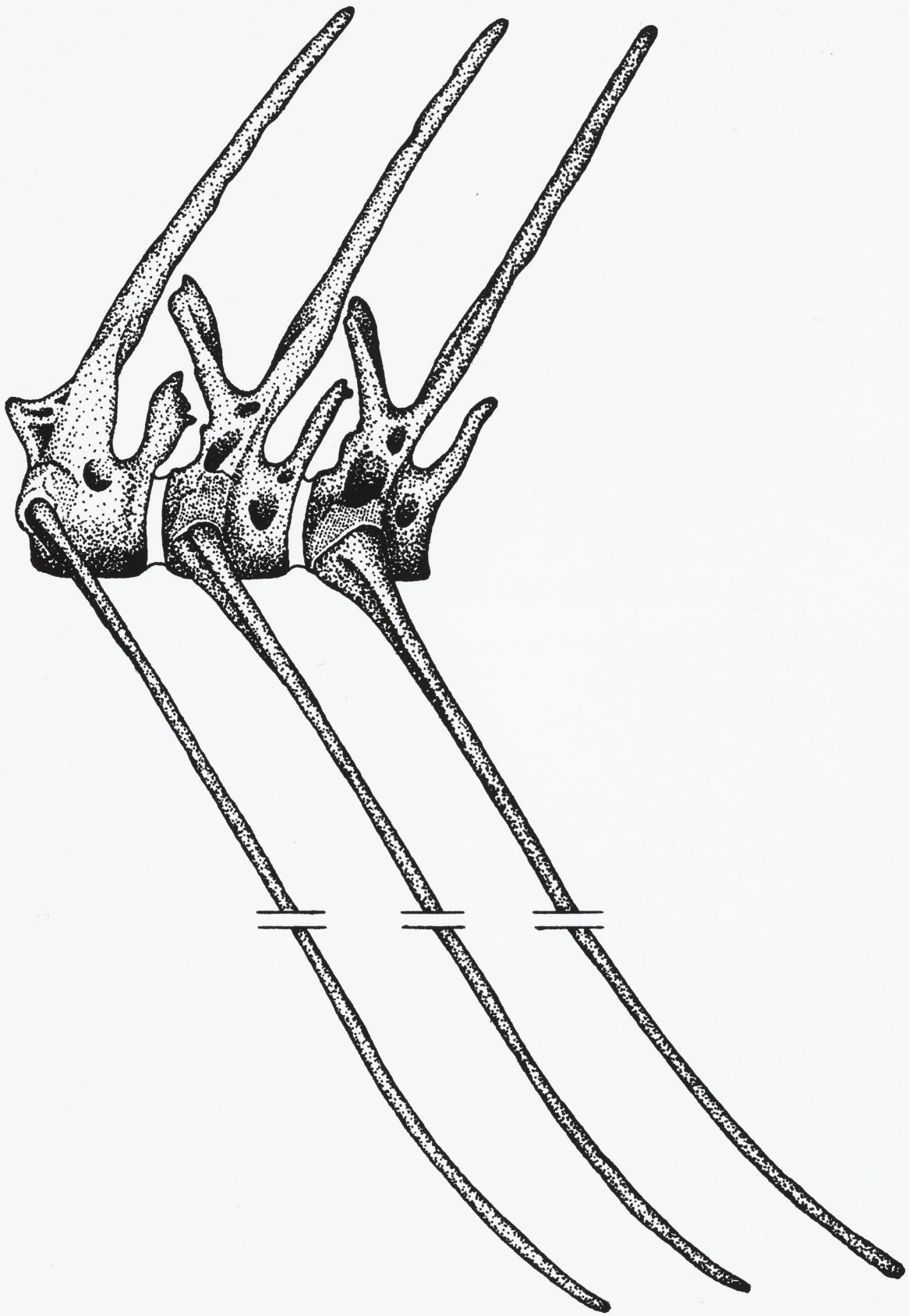


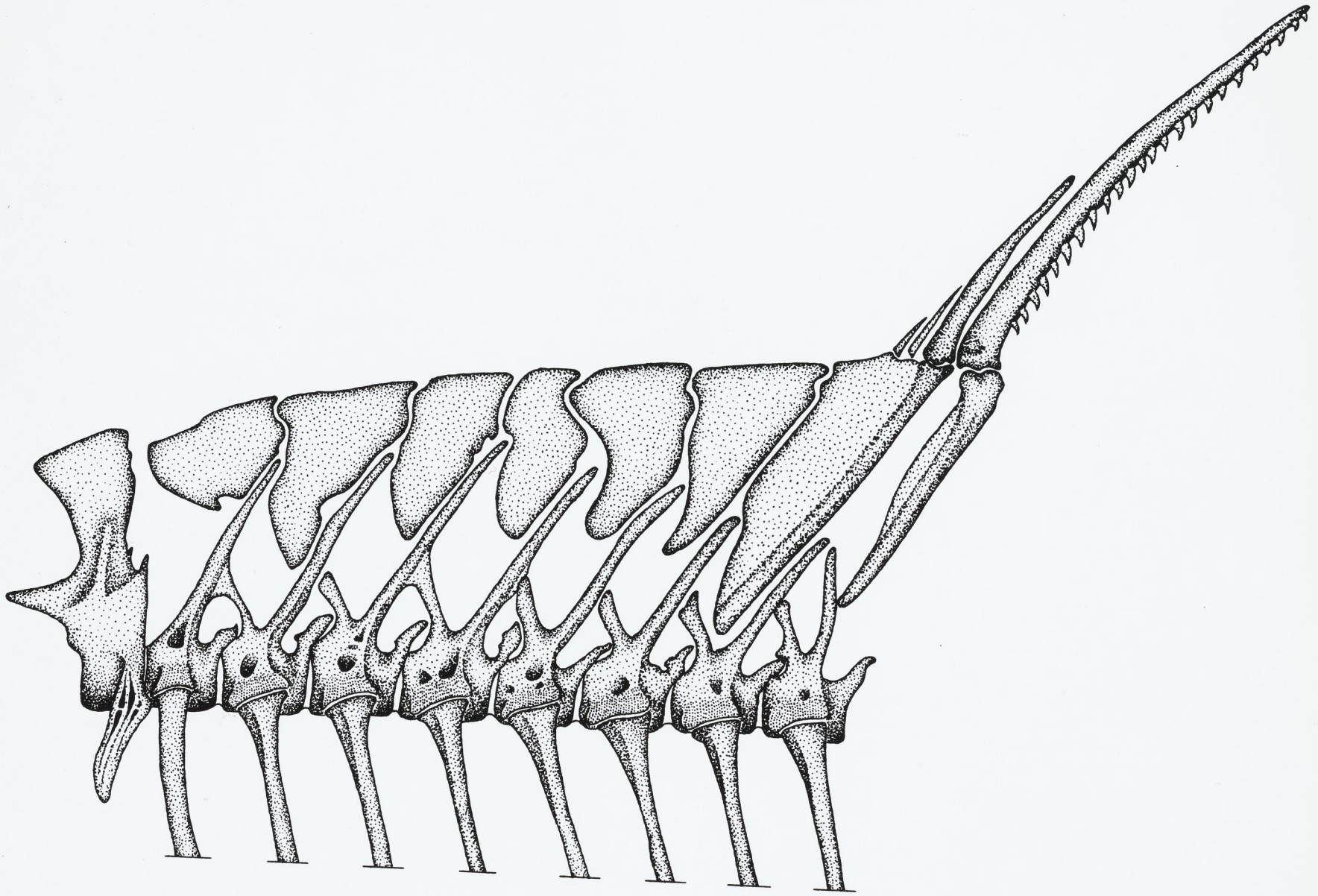


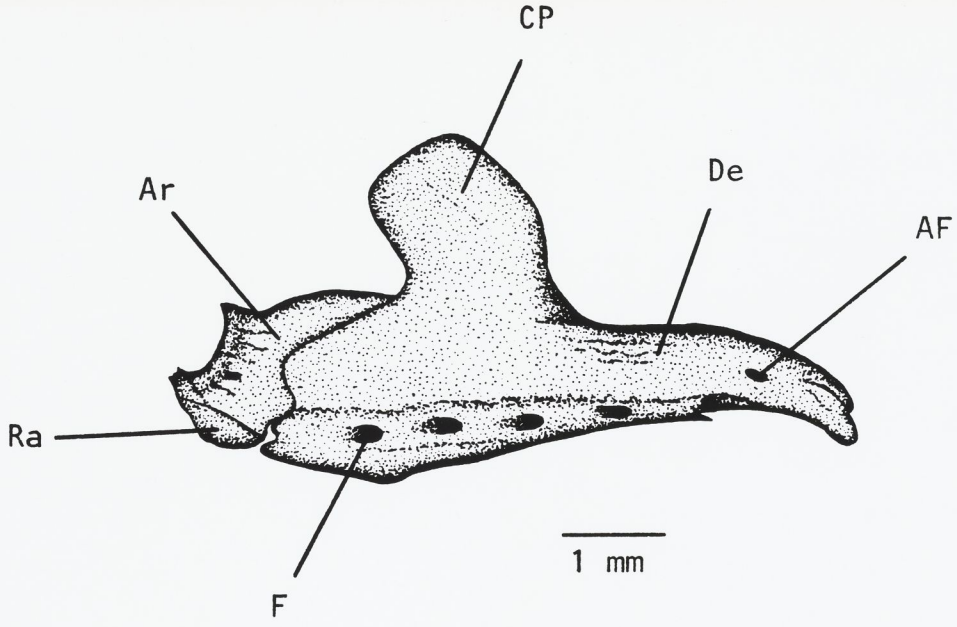











CP
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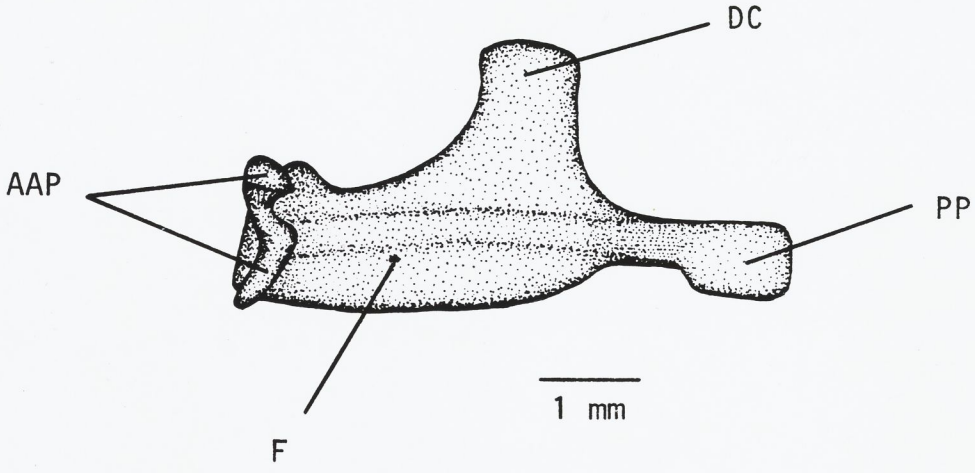
DC
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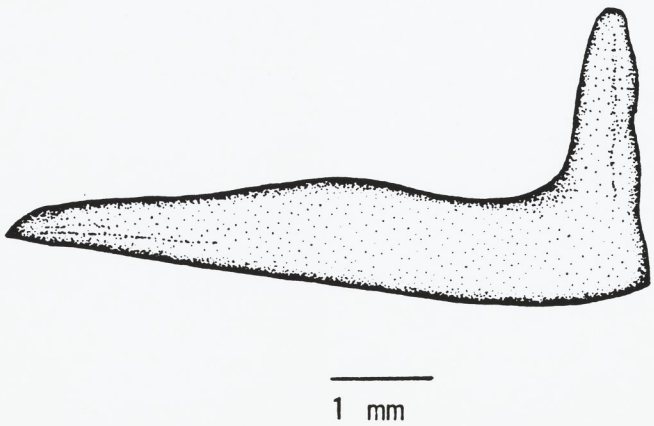
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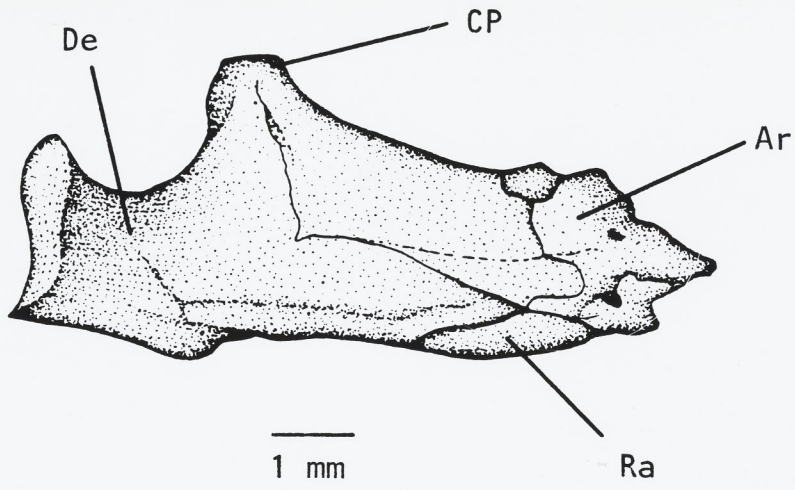
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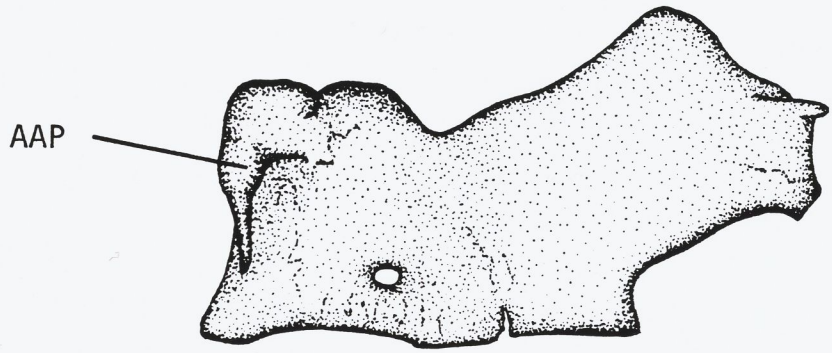
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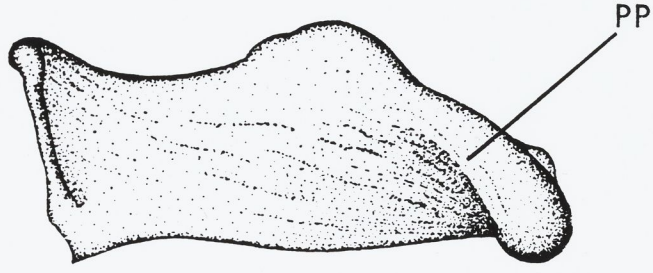
PP
1 mm