

AN INDEXED BIBLIOGRAPHY OF
LITERATURE PERTAINING TO
FISH HARVEST REGULATIONS

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FOREWORD

Fish harvest regulations have become important tools of fishery biologists across the country to limit overharvest and to allow proper functioning of fish communities. This indexed bibliography was compiled to serve as a reference for fishery biologists to aid in their management of our aquatic resources. References were limited to studies dealing directly with warmwater or cool-water fish harvest regulations with a few selected cold-water regulations. Studies on commercial regulations were not included.

Fish regulations originated in Europe during the middle ages and limited who had the right to fish and who did not. Harvest regulations have gone through periods of liberalization and also periods of increased restriction and have evolved into the minimum length limits, slot length limits, catch-and-release fishing, etc. that we have today. The challenge in the future is to educate the public as to the reasons for harvest restrictions so they will both accept and obey them. With the public's cooperation, quality fishing may be possible for all anglers for many years to come.

Many references listed in this bibliography were obtained by searching scientific journals and textbooks from personal libraries and libraries at the University of Missouri - Columbia and the Missouri Department of Conservation Fish and Wildlife Research Center. Others were located by searching the Fish and Wildlife Reference Service and various biological abstracting services. I recognize that this bibliography is not complete, and would appreciate notification of any errors or omissions and new literature. Citations follow the recommendations found in the North American Journal of Fisheries Management, American Fisheries Society, Bethesda, Maryland.

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References were listed alphabetically, numbered, and cross-indexed into six major subject headings with subcategories. Subject heading code numbers, along with subcategories, follow each reference. Following the bibliography, each subject's subcategories are listed, followed by code numbers of the corresponding references.

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SUBJECT HEADINGS AND SUBCATEGORIES

1. Water Type

a. Reservoirs

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 5 | 9 | 21 | 26 | 27 | 33 | 40 | 42 |
| 45 | 46 | 50 | 51 | 52 | 53 | 66 | 67 |
| 70 | 71 | 82 | 85 | 100 | 107 | 109 | 115 |
| 116 | 123 | 125 | 129 | 135 | 137 | 153 | 154 |
| 162 | 163 | 164 | 171 | 175 | | | |

b. Ponds and Lakes

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 5 | 6 | 7 | 12 | 17 | 18 | 20 |
| 22 | 23 | 25 | 28 | 30 | 31 | 34 | 35 |
| 36 | 37 | 39 | 50 | 55 | 60 | 65 | 66 |
| 67 | 69 | 74 | 75 | 76 | 77 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 90 | 92 | 93 |
| 94 | 95 | 97 | 99 | 100 | 102 | 103 | 104 |
| 106 | 108 | 109 | 110 | 112 | 113 | 117 | 118 |
| 119 | 120 | 121 | 124 | 125 | 127 | 128 | 131 |
| 132 | 134 | 136 | 137 | 140 | 142 | 144 | 145 |
| 146 | 147 | 155 | 156 | 157 | 158 | 159 | 160 |
| 162 | 163 | 164 | 167 | 168 | 169 | 173 | 174 |
| 177 | 178 | | | | | | |

c. Rivers and Streams

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 5 | 11 | 13 | 24 | 25 | 32 | 34 |
| 41 | 43 | 44 | 50 | 56 | 57 | 58 | 59 |
| 61 | 62 | 63 | 64 | 66 | 67 | 68 | 73 |
| 78 | 82 | 85 | 86 | 87 | 88 | 89 | 91 |
| 98 | 100 | 125 | 126 | 130 | 137 | 138 | 139 |
| 148 | 149 | 150 | 151 | 152 | 158 | 159 | 162 |
| 163 | 164 | 165 | 166 | 172 | 173 | | |

2. Environment

a. Warm Water

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 5 | 6 | 7 | 9 | 17 | 18 | 19 | 20 |
| 22 | 23 | 26 | 27 | 31 | 33 | 34 | 35 |
| 36 | 37 | 39 | 42 | 45 | 46 | 47 | 48 |
| 51 | 52 | 53 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 |
| 69 | 70 | 71 | 74 | 77 | 81 | 83 | 84 |
| 85 | 89 | 90 | 91 | 95 | 96 | 100 | 102 |
| 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 |
| 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 123 | 125 | 126 | 127 | 128 | 129 | 131 | 134 |
| 135 | 136 | 137 | 139 | 142 | 144 | 147 | 154 |
| 155 | 156 | 158 | 159 | 160 | 162 | 163 | 164 |
| 165 | 166 | 167 | 168 | 169 | 171 | 174 | 175 |
| 177 | 178 | | | | | | |

b. Cool Water

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 10 | 21 | 28 | 30 | 35 | 36 | 37 | 40 |
| 43 | 55 | 65 | 70 | 71 | 76 | 79 | 80 |
| 82 | 92 | 93 | 94 | 95 | 99 | 102 | 103 |
| 104 | 106 | 117 | 121 | 124 | 125 | 127 | 132 |
| 137 | 140 | 143 | 144 | 145 | 146 | 153 | 156 |
| 157 | 158 | 159 | 163 | 164 | 178 | | |

c. Cold Water

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 11 | 12 | 13 | 24 | 25 | 32 | 34 |
| 38 | 41 | 44 | 48 | 73 | 75 | 78 | 86 |
| 87 | 88 | 95 | 97 | 98 | 117 | 125 | 130 |
| 137 | 138 | 144 | 148 | 149 | 150 | 151 | 152 |
| 158 | 159 | 162 | 163 | 164 | 167 | 172 | 173 |

3. Regulation Type

a. Creel Limits (Including Catch and Release)

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 9 | 10 | 11 | 19 | 21 | 22 | 24 |
| 25 | 28 | 31 | 32 | 33 | 34 | 38 | 39 |
| 41 | 44 | 47 | 48 | 49 | 50 | 54 | 56 |
| 57 | 58 | 65 | 66 | 67 | 68 | 70 | 73 |
| 75 | 77 | 80 | 83 | 85 | 86 | 87 | 88 |
| 90 | 94 | 99 | 102 | 105 | 111 | 116 | 120 |
| 124 | 125 | 128 | 130 | 131 | 136 | 137 | 138 |
| 144 | 148 | 150 | 151 | 152 | 153 | 154 | 155 |
| 158 | 159 | 161 | 162 | 163 | 164 | 172 | 173 |
| 174 | 175 | 176 | 180 | | | | |

b. Length Limits

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 19 | 21 | 22 | 23 |
| 25 | 28 | 32 | 33 | 34 | 35 | 36 | 37 |
| 38 | 40 | 42 | 43 | 44 | 45 | 47 | 48 |
| 49 | 50 | 54 | 56 | 58 | 59 | 60 | 61 |
| 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 |
| 70 | 71 | 74 | 76 | 77 | 79 | 80 | 81 |
| 82 | 83 | 84 | 85 | 86 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 |
| 99 | 100 | 103 | 104 | 105 | 108 | 109 | 110 |
| 111 | 112 | 113 | 115 | 119 | 120 | 121 | 123 |
| 124 | 125 | 126 | 127 | 128 | 129 | 131 | 132 |
| 134 | 136 | 137 | 138 | 139 | 140 | 141 | 142 |
| 143 | 144 | 145 | 146 | 147 | 148 | 150 | 151 |
| 152 | 153 | 154 | 155 | 157 | 158 | 159 | 160 |
| 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 |
| 169 | 170 | 173 | 175 | 176 | 177 | 178 | |

c. Seasons

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 8 | 11 | 19 | 20 | 22 | 25 | 26 | 27 |
| 28 | 33 | 36 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 58 | 65 | 66 |
| 67 | 68 | 75 | 76 | 77 | 78 | 80 | 85 |
| 94 | 95 | 96 | 99 | 100 | 103 | 104 | 105 |
| 106 | 107 | 109 | 111 | 114 | 117 | 120 | 121 |
| 122 | 124 | 125 | 128 | 132 | 135 | 136 | 137 |
| 138 | 144 | 152 | 153 | 154 | 156 | 158 | 159 |
| 160 | 161 | 162 | 163 | 164 | 173 | 175 | |

d. Quotas

| | | | | | | | |
|-----|-----|-----|----|----|----|----|-----|
| 3 | 6 | 17 | 39 | 54 | 74 | 77 | 118 |
| 131 | 136 | 137 | | | | | |

e. Tackle and Method

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 13 | 14 | 15 | 16 | 21 | 25 | 28 |
| 32 | 34 | 38 | 41 | 50 | 54 | 55 | 58 |
| 67 | 73 | 75 | 78 | 80 | 86 | 95 | 98 |
| 103 | 104 | 107 | 111 | 117 | 122 | 125 | 130 |
| 133 | 137 | 138 | 144 | 148 | 149 | 151 | 152 |
| 158 | 159 | 162 | 172 | 173 | 174 | 180 | |

4. History

a. 1900 and Before

| | | | | | | | |
|-----|-----|-----|-----|-----|----|-----|-----|
| 13 | 28 | 32 | 55 | 72 | 78 | 114 | 117 |
| 122 | 125 | 137 | 161 | 162 | | | |

b. 1901 - 1940

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 14 | 15 | 16 | 28 | 32 | 67 | 85 | 95 |
| 100 | 114 | 122 | 125 | 133 | 137 | 158 | 159 |
| 162 | 175 | | | | | | |

c. 1941 - 1970

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 17 | 18 | 23 | 26 | 27 | 28 | 30 |
| 32 | 35 | 36 | 37 | 46 | 47 | 48 | 49 |
| 50 | 51 | 52 | 53 | 65 | 67 | 68 | 75 |
| 80 | 85 | 86 | 88 | 89 | 91 | 94 | 96 |
| 99 | 101 | 106 | 107 | 109 | 110 | 111 | 112 |
| 113 | 116 | 120 | 121 | 122 | 124 | 125 | 128 |
| 132 | 137 | 138 | 140 | 141 | 144 | 147 | 148 |
| 149 | 150 | 151 | 152 | 153 | 160 | 161 | 162 |
| 163 | 164 | 165 | 166 | 167 | 168 | 169 | 171 |
| 173 | 176 | 177 | 178 | | | | |

d. 1971 - 1983

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 19 | 20 | 21 | 22 | 24 |
| 25 | 27 | 29 | 31 | 32 | 33 | 34 | 38 |
| 39 | 40 | 41 | 42 | 43 | 44 | 45 | 54 |
| 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 |
| 64 | 65 | 66 | 68 | 69 | 70 | 71 | 73 |
| 74 | 75 | 76 | 77 | 79 | 81 | 82 | 83 |
| 84 | 85 | 86 | 87 | 90 | 92 | 93 | 97 |
| 98 | 102 | 103 | 104 | 105 | 108 | 111 | 115 |
| 118 | 119 | 122 | 123 | 126 | 127 | 129 | 130 |
| 131 | 134 | 135 | 136 | 137 | 139 | 142 | 143 |
| 145 | 146 | 154 | 155 | 156 | 157 | 170 | 172 |
| 174 | 179 | 180 | | | | | |

5. Geographic Region

a. Northeastern

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 13 | 14 | 15 | 16 | 34 | 55 | 65 | 66 |
| 73 | 80 | 82 | 95 | 133 | 137 | 138 | 140 |
| 154 | 159 | 163 | 164 | 173 | | | |

b. North Central

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 5 | 6 | 8 | 11 | 14 | 15 | 16 | 18 |
| 20 | 21 | 22 | 28 | 30 | 31 | 32 | 33 |
| 34 | 35 | 36 | 37 | 42 | 43 | 56 | 57 |
| 59 | 60 | 61 | 62 | 63 | 64 | 66 | 67 |
| 68 | 69 | 70 | 71 | 74 | 76 | 77 | 79 |
| 83 | 84 | 85 | 86 | 87 | 88 | 90 | 92 |
| 93 | 94 | 99 | 100 | 102 | 103 | 104 | 105 |
| 106 | 108 | 114 | 117 | 118 | 119 | 120 | 121 |
| 123 | 124 | 126 | 127 | 128 | 129 | 132 | 133 |
| 134 | 136 | 137 | 139 | 142 | 143 | 144 | 145 |
| 146 | 148 | 149 | 150 | 151 | 152 | 153 | 154 |
| 156 | 157 | 158 | 159 | 160 | 163 | 164 | 173 |
| 174 | 175 | 176 | 177 | 178 | | | |

c. Southern

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 14 | 15 | 16 | 23 | 26 | 27 | 40 | 44 |
| 45 | 46 | 51 | 52 | 53 | 66 | 81 | 89 |
| 91 | 96 | 107 | 109 | 110 | 112 | 113 | 115 |
| 116 | 131 | 133 | 137 | 147 | 154 | 155 | 159 |
| 163 | 164 | 165 | 166 | 167 | 168 | 169 | 171 |
| 173 | | | | | | | |

d. Western

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 12 | 14 | 15 | 16 | 17 | 24 | 25 |
| 34 | 41 | 66 | 75 | 97 | 98 | 130 | 133 |
| 135 | 137 | 154 | 163 | 164 | 172 | 173 | |

6. Species

a. Black Bass

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 14 |
| 15 | 16 | 20 | 22 | 23 | 26 | 27 | 28 |
| 30 | 31 | 34 | 35 | 36 | 37 | 39 | 42 |
| 45 | 46 | 51 | 52 | 53 | 55 | 56 | 57 |
| 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 |
| 66 | 67 | 68 | 69 | 70 | 71 | 74 | 77 |
| 81 | 83 | 84 | 85 | 89 | 90 | 91 | 94 |
| 95 | 96 | 99 | 100 | 102 | 105 | 106 | 107 |
| 108 | 109 | 110 | 112 | 113 | 115 | 118 | 119 |
| 120 | 123 | 124 | 126 | 127 | 128 | 129 | 131 |
| 133 | 134 | 135 | 136 | 137 | 139 | 141 | 144 |
| 147 | 154 | 155 | 158 | 159 | 160 | 163 | 164 |
| 165 | 166 | 167 | 168 | 169 | 173 | 174 | 175 |
| 176 | 177 | 178 | 179 | | | | |

b. Catfish

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 26 | 28 | 35 | 36 | 37 | 51 | 52 | 55 |
| 58 | 65 | 67 | 74 | 83 | 84 | 85 | 90 |
| 91 | 96 | 106 | 112 | 113 | 118 | 119 | 126 |
| 128 | 137 | 158 | 159 | 163 | 164 | 167 | 169 |
| 176 | | | | | | | |

c. Pan-fish

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 5 | 6 | 7 | 8 | 26 | 27 | 28 | 30 |
| 33 | 35 | 36 | 37 | 39 | 46 | 48 | 51 |
| 52 | 53 | 55 | 56 | 57 | 59 | 60 | 61 |
| 62 | 63 | 64 | 67 | 69 | 70 | 74 | 79 |
| 81 | 83 | 84 | 85 | 90 | 91 | 94 | 99 |
| 102 | 106 | 107 | 110 | 112 | 113 | 116 | 118 |
| 119 | 124 | 126 | 128 | 129 | 134 | 135 | 136 |
| 137 | 139 | 142 | 144 | 147 | 158 | 159 | 163 |
| 164 | 167 | 168 | 169 | 176 | 177 | 178 | |

d. Trout (Salmonidae)

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 | 11 | 12 | 24 | 25 | 28 | 32 | 34 |
| 38 | 41 | 44 | 48 | 73 | 75 | 86 | 87 |
| 88 | 95 | 97 | 98 | 117 | 130 | 137 | 138 |
| 144 | 148 | 149 | 150 | 151 | 152 | 158 | 159 |
| 163 | 164 | 167 | 172 | 173 | | | |

e. Walleye

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 26 | 27 | 28 | 30 | 40 | 46 | 51 | 52 |
| 53 | 67 | 70 | 71 | 85 | 94 | 99 | 106 |
| 121 | 124 | 126 | 132 | 137 | 143 | 144 | 145 |
| 146 | 158 | 159 | 163 | 164 | 176 | 177 | 178 |

f. Northern Pike

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 10 | 21 | 28 | 35 | 36 | 37 | 43 | 58 |
| 67 | 70 | 71 | 82 | 92 | 93 | 94 | 103 |
| 104 | 106 | 137 | 144 | 157 | 163 | 173 | 177 |
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g. Muskellunge

| | | | | | | | |
|----|-----|-----|-----|-----|----|----|----|
| 10 | 28 | 30 | 55 | 67 | 76 | 80 | 82 |
| 94 | 124 | 137 | 158 | 159 | | | |

h. Non-game

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 28 | 35 | 36 | 37 | 51 | 52 | 58 | 59 |
| 62 | 63 | 64 | 67 | 85 | 90 | 91 | 95 |
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i. Other

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 26 | 52 | 67 | 78 | 126 | 128 | 137 | 140 |
| 158 | 159 | 163 | 164 | 173 | | | |

REFERENCE SLIP

3/2/81

TO

Bob Behnke
 Dept of Fishery + Wildlife Biology
 Colorado State Univ
 Ft. Collins, Co

 ACTION NOTE AND RETURN APPROVAL PER PHONE CALL AS REQUESTED RECOMMENDATION FOR COMMENT REPLY FOR SIGNATURE OF FOR INFORMATION RETURNED INITIALS SEE ME NOTE AND FILE YOUR SIGNATURE

REMARKS

Bob - here's a copy of
 Tech note 322 you wanted.
 Enjoyed visiting with you
 at Laramie!

I will contact the people in
 N.M. re the riparian
 letter you gave me.
 Keep in touch!
 Regards,

FROM

Don Duff USFS

801-626-3281

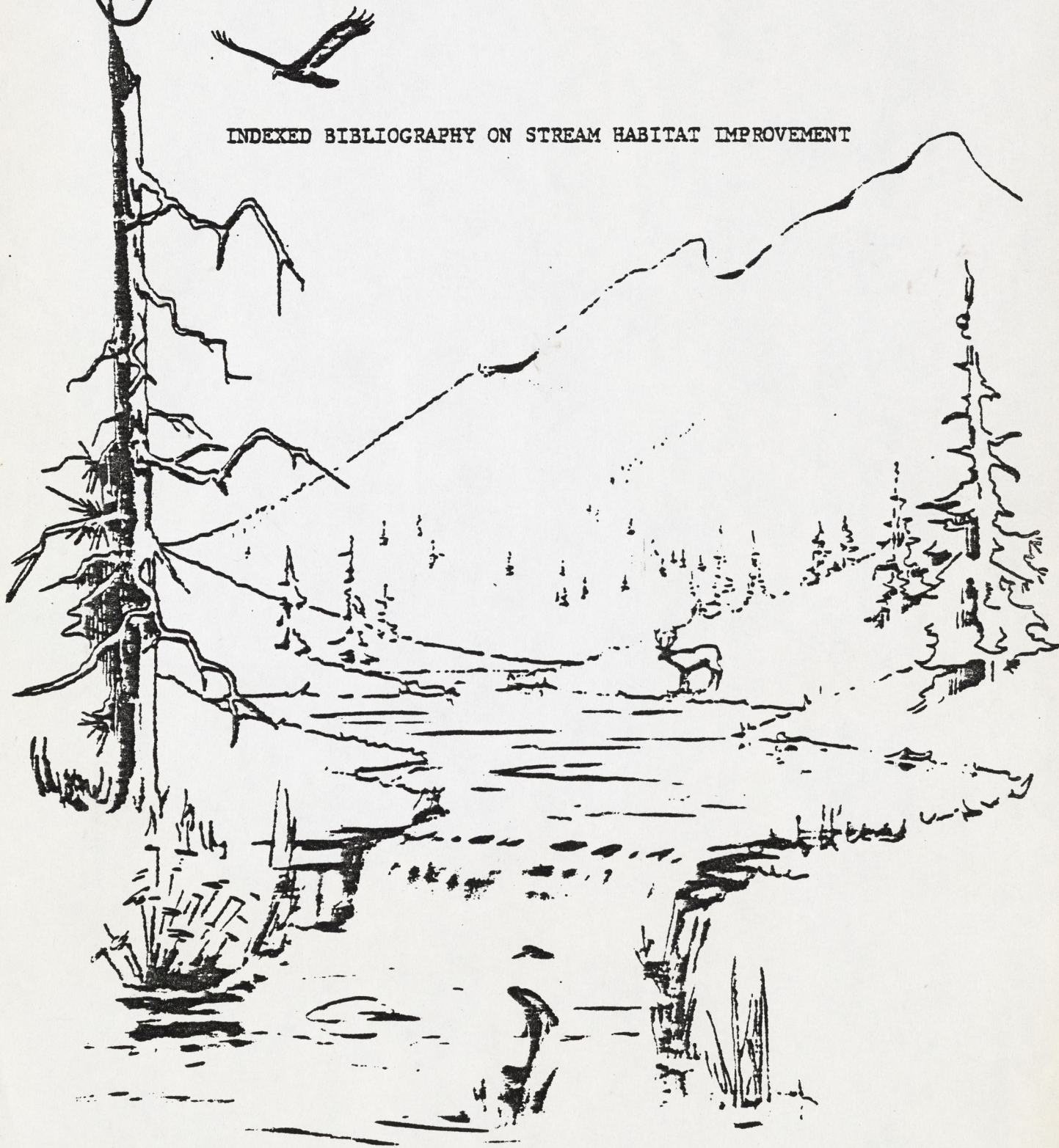
Date Issued | October 1978



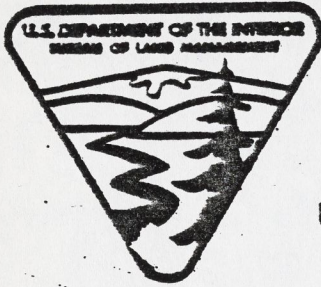
TECHNICAL NOTE

U.S. DEPARTMENT OF THE INTERIOR - BUREAU OF LAND MANAGEMENT

INDEXED BIBLIOGRAPHY ON STREAM HABITAT IMPROVEMENT



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TECHNICAL NOTE

U.S. DEPARTMENT OF THE INTERIOR - BUREAU OF LAND MANAGEMENT

INDEXED BIBLIOGRAPHY ON STREAM HABITAT IMPROVEMENT

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The literature on stream habitat improvement is plentiful but scattered in state publications, completion reports for federal aid projects, popular state conservation magazines, journals outside the field of fisheries and some are published in the common fisheries journals. The main purpose of this bibliography was to compile this diverse literature into a ready reference source for researchers and managers.

The 390 references were placed alphabetically by author and numbered consecutively. A concise index of 20 key subjects categorizes the references by number for quick review. Most references have been placed under the major key subject to which they are applicable. Some references, however, are pertinent to several key subjects and have been categorized accordingly.

Unpublished references or those that are not widely distributed have the sponsoring agency and location in the citation. We have included selected references that may not be involved with stream habitat improvement, per se, but that are applicable to this topic such as fish ecology and behavior and guidelines for maintaining, improving, or protecting stream habitats.

The maintenance, restoration, and protection of watersheds, that are influenced by economical, political, and sociological pressures, may be more beneficial to the improvement of stream habitats than manmade improvements. Since many variables influence decisions regarding the management of watersheds, we have included selected references under the subject of "Environmental Planning" that should be valuable in land use planning. In addition, selected references have been included under the subject of

"Guidelines" that provide insight into the biological, chemical, and physical factors that influence stream habitats. Finally, we have included a number of references pertaining to "Techniques" that will be useful to managers in managing stream habitats and fisheries.

Although a rather thorough search of the literature was made, there will be, no doubt, omissions since the references were widely scattered. We believe, however, that this bibliography will serve as a useful starting place for anyone who has an interest in stream habitat improvement. In addition, we hope that it will also identify gaps in knowledge that is necessary for thorough evaluation of past practices and stimulate future studies that will allow the establishment of effective priorities and procedures for the improvement or management of stream habitats.

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PREPARATION OF THIS DOCUMENT

This bibliography is an attempt by the author to include all known literature, published and unpublished, on hybridization in Salmonidae. The whitefishes and graylings are considered by the author as separate families and are not included. The author would appreciate being informed of any references to salmonoid hybrids known to the reader that are not included in this bibliography, as well as corrections or additions to the annotations, so that they may be included in future revisions or addenda.

Articles not obtained for review are included but not annotated unless referred to in other sources. When abstracts or summaries pertaining to hybridization were included in papers, they have been transcribed in quotation marks verbatim, as are certain passages of text when applicable. Unless otherwise cited, the abstracts were written by the author.

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alpinus, and S. Fontinalis. An excellent
review of previous literature. Alm found
that the S. alpinus X S. fontinalis
hybrid of greater value than the other
hybrids.
Andreeva, M.A. (1954) 010
Tr.Sovesch.Ikhtiol.Kom.Akad.Nauk SSSR,
4:70-7
Fish-cultural and fish protective measures
for the maintenance and propagation of
salmonoid fishes in Kamchatka waters.
Issued also as Transl.Ser.Fish.Res.Board
Can., (420)(1962)

At the hatchery experiments were carried out on the cross-breeding of different species of salmon. The purpose of the experiments were to obtain hybrids which would be hardier than the sockeye and would inherit the age at maturity and body size of chums and the excellent flavour, quality and the fecundity of the sockeye. In 1948, for the first time, viable fry were obtained from crossing sockeye females and chum males.

Arakie, D.H. (1969) 011
Brooklyn, N.Y., 6 p.
Arakie's fishery blue book

Smirnov in 1953 developed and described a hybrid between the chum and pink salmon of the Pacific Ocean. He noted that these hybrids showed a shorter period of incubation, a more complete hatch, and faster growth in length and weight of the fry. The splake, a hybrid resulting from the cross of the eastern brook trout (Salvelinus fontinalis), and the lake trout (Salvelinus namaycush), was described by Buss and Wright in 1959.

Arens, C. (1894) 012
Allg.Fisch.-Ztg., 19:346-7
Ueber den Lachsbastard
According to Dean (1962), infertile Salmo trutta (fario) X S. salar at Hünningen, Alsace.

Arens, C. (1893) 013
Allg.Fisch.-Ztg., 18:148-9
Bastarde zwischen Forelle und Bachsaibling
According to Dean (1962), Salmo trutta (fario) X Salvelinus alpinus (salvelinus).

Atz, W. (1971) 014
New York, American Museum of Natural History, 512 p.
Dean bibliography of fishes 1968
Lists hybrids.

Bailey, M., et al. (1970) 015
Spec.Publ.Am.Fish.Soc., (6):17 p.
A list of common and scientific names of fishes from the United States and Canada

Hybrids between brook trout (Salvelinus fontinalis) and lake trout (Salvelinus namaycush) are known as splake.

Baird, S. (1873) 016
Ann.Rec.Sci., 1873-75:442
Hybrids of salmon and trout
According to Dean (1962), misc. and unimportant.

Bakkala, G. (1970) 017
FAO Fish.Synop., (41):89 p.
Synopsis of biological data on the chum salmon, Oncorhynchus keta (Walbaum) 1792
Issued also as Circ.U.S.Fish.Wildl.Serv., (315):89 p.
Brief review of most hybridization of chum.

Baldwin, N.S. (1965) 018
Sylva, 12(3):6-9
Hybrid trout
A fair account of splake in Canada with data on appearance, habits, and plantings in Ontario.

Bean, T.H. (1889) 019
For.Stream, 33:321
Crossing of salmon and trout

Bean, T.H. (1889a) 020
Bull.U.S.Fish Comm., 7(1887):216
A hybrid between the lake trout and brook trout

Description of hybrids of Salvelinus namaycush and S. fontinalis from Corry Station, Pennsylvania Fish Commission.

Bean, T.H. (1889b)
Trans.Am.Fish.Soc., 18:12-20
Hybrids in Salmonidae

Reviews an account in The American Angler of a supposed cross between Salmo gairdneri ♀ X Salvelinus fontinalis ♂. Fish of unknown origin from Wytheville, Virginia. Morphometric and meristic data on hybrid. A more complete report of Bean (1889a) is presented on hybrids of S. namaycush and S. fontinalis.

Bean, T.H. (1889c)
For.Stream, 31:520
Lake and brook trout hybrid

According to Dean (1962), Salvelinus fontinalis X S. namaycush at Corry Station Pennsylvania.

Bean, T.H. (1889d)
For.Stream, 32:401
Saibling and brown trout hybrid

According to Dean (1962), Salmo trutta (fario) X Salvelinus alpinus (umbla) hybrid received at U.S. National Museum from Norway.

Bean, T.H. (1890)
For.Stream, 35:377
A supposed hybrid trout

According to Dean (1962), Salvelinus fontinalis X S. namaycush hybrid at Corry Station, Pennsylvania.

Bean, T.H. (1910)
For.Stream, 35:429
Is the golden trout a hybrid?

Bean, T.H. (1910a)
For.Stream, 35:353
A new hybrid trout

According to Dean (1962), Salvelinus fontinalis X S. alpinus aureolus at Sunapee Lake hatchery with fertile hybrid.

Behnke, R.J. (1966)
Copeia, 1966 (2):346-8
Relationships of the far eastern trout, Salmo mykiss Walbaum

021 I suspect that mykiss and gairdnerii, if crossed, would prove to be fully fertile and might properly be considered only subspecies.

Behnke, R.J. (1968) 028
Mitt.Hamb.Zool.Mus.Inst., 66:1-15
A new subgenus and species of trout, Salmo (Platysalmo) platycephalus, from south-central Turkey, with comments on the classification of the subfamily Salmonidae

022 Salmo marmoratus Cuvier freely hybridizes with Salmo trutta producing hybrid swarms. (Numann, 1964).
Natural hybrids of Brachymystax lenok and Hucho taimen from the Amur River system in China (Se, Huan, and Yuan, 1959).

Behnke, R.J. (1969) 029
023 Proc.West.Assoc.Game Fish Comm., 48:533-5
(Mimeo reprint)
Rare and endangered species: the native trouts of western North America

Introductions of rainbow trout into interior waters where only the cutthroat trout is native, and subsequent hybridization between the two, has been a major factor in the decline of populations of native interior cutthroat trout.

Behnke, R.J. (1970) 030
Trans.Am.Fish.Soc., 99(1):237-48
The application of cytogenetic and biochemical systematics to phylogenetic problems in the family Salmonidae

025 When rainbow trout are introduced into cutthroat trout populations in interior waters where rainbow trout is not native, hybrid swarms are the typical result.

026 Behnke, R.J. (1970a) 031
Rep.Colo.Coop.Fish.Unit.Colo.State Univ.
12 p. (Unpubl.MS)
Rare and endangered species report: new information on gila trout, Salmo gilae

Hybridization with introduced rainbow trout is the major reason for the almost complete elimination of pure populations of S. gilae. Hybrids may be recognized by the intermediacy of several characters such as spotting pattern, number of scales, vertebrae and pyloric caeca and some morphometric comparisons.

Reciprocal crosses of Salmo trutta and Salvelinus alpinus are described from Norway.

It is suggested that Green (1881) possibly made a mistake in his crosses of S. fontinalis with Oncorhynchus tshawytscha and Salmo gairdneri. Behnke's examination of specimens sent by Green to the Smithsonian Institution resulted in no difference between the two crosses.

Behnke, R.J., Ting Pong Koh and P.R. Needham (1962) 032
Copeia, 1962(2):400-7
Status of the landlocked salmonid fishes of Formosa with a review of Oncorhynchus masou (Brevoort)

Russians have been experimenting with Oncorhynchus keta X O. gorbuscha hybrids.

Behrens, G. (1885) 033
Biol.Zentralbl., 1885-86, 5:639-40
Die Hybridisation von Salmoniden
According to Dean (1962), notice of Day's work.

Bellesmes, J. de 034
La pisciculture en France. p. 168
According to Phillips (1923) quoting Richmond (1919), "In France, Dr. Joussell de Bellesmes, Director of Fish-culture in Paris states (La Pisciculture en France, p. 168) that he obtained a successful cross at the Trocadero Aquarium in Paris on 3rd February, 1890, getting eight hundred ova which survived and developed satisfactorily, the majority of the hybrids resembling rainbow trout in outward appearance. Two of them lived in the aquarium till 1897, and grew to a good size, reaching a length of 85 cm, when in that year they spawned and died. It is curious that Dr. de Bellesmes has found a similar delay in arrival at sexual maturity in the cross, which is easily made, between the American brook-char and the brown trout, the hybrid from which in this country has usually been regarded as sterile." Phillips and Richmond were concerned with hybrids of Salmo trutta and S.gairdneri.

Berst, A.H., and G.R. Spangler (1970) 035
J.Fish.Res.Board Can., 27(6):1017-32
Population dynamics of F splake (Salvelinus fontinalis X S. namaycush) in Lake Huron.

Planted F₁ splake tended to remain in the general vicinity of the planting sites. They fed upon smelt and alewives, which are presently abundant in Lake Huron. The hybrids grew more rapidly at ages I through VIII than native and planted lake trout and contributed to a commercial fishery within 2 years of planting. A considerable number of splake survived to maturity in the presence of an intensive commercial fishery and a lamprey population that was unaffected by chemical control. We believe that these attributes of splake will be preserved and enhanced in a stock of hybrids selected through several generations for early maturity.

Bonham, K., and A.H. Seymour (1949) 036
Copeia, 1949 (2):69
Hybrid of chinook and silver salmon from Puget Sound

Morphometric and meristic data for a natural hybrid of Oncorhynchus kisutch and O. tshawytscha. Also report of natural cross-mating observed by Mr. Elmer Quistorff, Superintendent of the Washington State Department of Fisheries Issaquah Salmon Hatchery.

Bouck, G.R., and R.C. Ball (1968) 037
J.Fish.Res.Board Can., 25(7):1323-31
Comparative electrophoretic patterns of lactate dehydrogenase in three species of trout

The total number of LDH isozymes in tissue extracts of brook-brown trout (F₁) hybrids were difficult to assess but showed essentially the same number of LDH isozyme systems as did the parent types. The outstanding difference in the hybrid specimens was that the total number of isozymes rose markedly within a given system. Also, a given isozyme system occupied essentially the same space but it contained so many isozymes that the total number could not be counted accurately. At least 27 were counted in the extracts of one hybrid specimen but only 25 were counted in the other specimens. These numbers must be viewed as representing minimum counts.

Brown, B.E. (1961)
Trans.Am.Fish.Soc., 90(3):328-9
Behavior of splake and brook trout
fingerlings

In these observations domesticated trout behaved exactly as in previous tests carried out by Vincent (1960). Splake, however, showed a contrasting behavior in all trials attempted. In this respect they resembled the wild brook trout observed by Vincent in having a well-developed hiding reaction, a tendency to seek depths, and negative phototropism. The latter trait is characteristic of young lake trout reared in New York hatcheries. It is concluded that the responses of this domesticated stock of brook trout relative to these traits were not transferred to the F₁ hybrid.

Brown, C.J.D. (1966)
Copeia, 1966(3):600-1
Natural hybrids of Salmo trutta X
Salvelinus fontinalis

Morphometric and meristic data for three natural "tiger" trout from Montana.

Fertile hybrids found among the fish tested were splake (lake trout X brook trout) and the backcross progeny of splake X brook trout. Limited fertility was found in one 'tiger' trout male (brown trout female X brook trout male) and in nine yearling males originating from crosses of rainbow trout females X brook trout males. These fertile individuals have been backcrossed to the parental species with limited results to date.

Brown, E.E. (1970)
Prog.Fish-Cult., 32(1):8
Hybrid vigor reported

Description of "rainbows" produced at the Eagle Mountain Trout Farm in Georgia by crossing Salmo trutta females with S. gairdneri males.

Bruyant, C. (1910)
Ann.Stn.Limnol.Besse, 2:125-33
Hybrides de truite et d'omble-chevalier

According to Dean (1962), Salmo trutta (fario) X Salvelinus alpinus (umbla) in France.

038 Budd, J.C. (1957) 042
Can.Fish.Cult., 20:25-8
Introduction of the hybrid between the eastern brook trout and lake trout into the Great Lakes

Marked yearling hybrids between eastern brook trout and common lake trout were planted in South Bay in northern Lake Huron in the spring of 1954. Growth was rapid and after one year in the lake the hybrids averaged 13.9 inches in fork length. A number of the fish were tagged and subsequent recapture data recorded. Seven tags were returned from distances up to 100 miles. Two of the tagged fish had entered streams while the other five were taken by commercial gear. Ripe male hybrids were taken in South Bay during late October and early November.

039 Budd, J.C. (1959) 043
Trans.Northeast.Wildl.Conf., 10:115-6
The use of the hybrid between eastern brook trout and lake trout in fishery management

According to Carlander (1969), concerns splake.

Burkhard, W.T. (1961) 044
Q.Rep.Colo.Coop.Fish.Res.Unit, (7):41-52
Life history of the splake trout - Parvin Lake

Burkhard, W.T. (1962) 045
Thesis, Colorado State University, Fort Collins, 91 p. (Unpubl.MS)
A study of the splake trout in Parvin Lake, Colorado.

040 The present study has followed Leik's (MS, 1960) and has expanded on his material and included two new age groups not previously available for study. With the inclusion of 3- and 4- year-old fish, the important aspects of splake trout maturation and reproduction were included.

041 Burrard, G. (1944) 046
Game Gun Anglers Mon., Nov. issue
The hybridization of trout.

Buss, K. (1956)
Pa.Angler, 25(5):2-7
The splake

A popular account of published data on splake and discussion of work at the Benner Springs Research Station.

Buss, K., and J. Miller (1967)
Tech.Pap.Bur.Sport Fish.Wildl., (14):1-30
Interspecific hybridization of Esocids: hatching success, pattern development, and fertility of some F₁ hybrids
Very brief mention of hybridization in Salmonidae.

Buss, K., and J.E. Wright, Jr. (1956)
Prog.Fish-Cult., 18(4):149-58
Results of species hybridization within the family Salmonidae

A preliminary but comprehensive report of hybridization of Salmo salar sebago, S. trutta, S. gairdneri, Salvelinus namaycush, and S. fontinalis. See Buss and Wright (1958).

Buss, K., and J.E. Wright, Jr. (1958)
Trans.Am.Fish.Soc., 87:172-81
Appearance and fertility of trout hybrids

Mature hybrids among brook trout (Salvelinus fontinalis), brown trout (Salmo trutta), rainbow trout (Salmo gairdneri), and lake trout (Salvelinus namaycush) involving reciprocal crosses, backcrosses and three-way crosses were utilized to test fertility and to present photographic records of external characteristics.

Fertile hybrids found among the fish tested were splake (lake trout X brook trout) and the backcross progeny of splake X brook trout. Limited fertility was found in one 'tiger' trout male (brown trout female X brook trout male) and in nine yearling males originating from crosses of rainbow trout females X brook trout males. These fertile individuals have been backcrossed to the parental species with limited results to date.

047 Camp, R.R. (1953) 051
New York Times
December 1953

According to Martin (1960), "General comments on hybrid trout. Critical of hybrid and principle of hybridization."

048 Canada, Minister of Game and 052
Fisheries, Province of Quebec
(1947)
General report of the Minister of Game and Fisheries for year ended March 31, 1946

According to Martin (1960), "700 hybrid fingerlings (splake) planted in 1944 from Baldwin Mills Hatchery."

049 Carl, G.C., W.A. Clemens and C.C. 053
Lindsey (1959)
Handb.B.C.Prov.Mus., (5):70 p.
The fresh-water fishes of British Columbia

Cutthroat and rainbow which occur naturally together do not often hybridize and are probably kept apart by differences in behaviour rather than by physical inability to cross. On the other hand, in areas which originally contained only one of the species, the artificial introduction of the other often results in extensive hybridization and the production of offspring combining characters of both parents. Such hybrids were at one time produced deliberately and planted in certain waters in the Cranbrook area. These trout were referred to as 'Cranbrook trout'.

Carlander, K.D. (1969) 054
Ames, Iowa, Iowa State Univ.Press,
vol.1:752 p.
Handbook of freshwater fishery biology
Lists trout hybrids.

Chamberlain, F.M. (1907) 055
Rep.U.S.Bur.Fish.Doc., (627):10-1
Hybridization. In Some observations on salmon and trout in Alaska

Discusses the question of natural hybrids of trout and of salmon, and mention of the latter in commercial catches.

- Christie, W.J. (1960) 056 Cope, O.B. (1956) 060
Can.Fish Cult., 26:15-21
Variation in vertebral count in F₂ hybrids
of Salvelinus fontinalis X S. namaycush
The wide range of vertebral number in
this sample and perhaps also the range in
size, appear to be good evidence of
normal pairing of chromosomes and subse-
quent segregation in the F₂ generation. ...
We can therefore tentatively conclude
that the splake is a true hybrid, from
recently evolved parent species, and
selection for desirable characters to
produce a new form is theoretically
possible.
- Christie, W.J. (1970) 057 According to Dean (1962), Salmo gairdneri
Res.Inf.Pap.Ont.Dep.Lands For., (370):14 p.
A review of the Japanese salmon
Oncorhynchus masou and O. Rhodurus with
particular reference to their potential
for introduction into Ontario waters
♀ X Salvelinus alpinus (umbla)♂ and Salmo
trutta (fario) X S. alpinus (umbla) in
France.
- Oshima (1957) demonstrated in hybridi-
zation experiments that the red spots of
O. rhodurus are genotypic, and recessive
to the O. masou coloration.
- Clemens, W.A. (1953) 058 Crossman, E.J., and K. Buss (1966) 062
Trans.R.Soc.Can., (3),47(5):1-13
On some fundamental problems in the
biology of Pacific salmon
Copeia, 1966(2):357-9
Artificial hybrid between kokanee
(Oncorhynchus nerka) and brook trout
(Salvelinus fontinalis)
The two S. fontinalis female X O. nerka
male individuals described were the only
survivors of two attempts to produce
hybrids from kokanee and brook, brown,
and rainbow trout (reciprocal crosses).
- That the separation of the species (of
Oncorhynchus) may have been of compara-
tively recent date is indicated by the
fact that cross-breeding is possible,
as shown by the cross-fertilization
experiments carried out by Foerster
(1935).
- Cuerrier, J.P. (1954) 063
For.Outdoors, (May):17-8
The splake: this trout is a great fighter!
Review of Stenton (1950 and 1952).
F₂ splake planted in Agnes Lake, Banff
National Park (Alberta) in 1953
- Collins, J.W. (1892) 059 Day, F. (1882) 064
Rep.U.S.Fish.Comm., (1888):3-269
Report on fisheries of the Pacific Coast
of the United States
Proc.Zool.Soc.Lond., 1882:751-3
On hybrids between salmon and trout
Early report of hybrids of Salmo salar,
S. trutta, Salvelinus fontinalis, and
S. alpinus.
An unreliable report of a hybrid (not
classified) from the Columbia River is
included in a list of the names of 12
salmon. This matter is referred to in
order to remove a quite common error.

- Day, F. (1882a)
J.Linn.Soc.Lond.(Zool.), 17:13-9
On variations in form and hybridism in
Salmo fontinalis.
- Day, F. (1884)
Proc.Zool.Soc.Lond., 1884:17-40,
376-80, 581-93
On races and hybrids among the
Salmonidae. Part 1-3
Issued also as: Am.Nat., 18:1158-60
Continuation of Day (1882) with additional
crosses and backcrosses.
- Day, F. (1884a)
Nature, Lond., 30:488
Salmon breeding
- Day, F. (1885)
Nature, Lond., 31:599-600
Hybridization among Salmonidae
- Day, F. (1885a)
Proc.Zool.Soc.Lond., 1885:241-3
On races and hybrids among the Salmonidae
Part 4.
Additional data on Day (1884).
- Day, F. (1885b)
Trans.Linn.Soc.Lond.(Zool.), 2(15):447-68
On the breeding of salmon from parents
which have never descended to the sea
Mention of Day's earlier papers.
- Day, F. (1886)
Rep.Br.Assoc.Adv.Sci., 55:1059-63
On the hybridisation of Salmonidae at
Howietoun
Summary of Day's earlier reports. Review
of earlier hybridization without refer-
ences.
- Day, F. (1887)
London, Williams and Norgate, 298 p.
British and Irish Salmonidae
Review and discussion of Day's earlier
reports.
- 065 Day, F. (1888) 073
Proc.Zool.Soc.Lond., 3
Exhibition of, and remarks upon, a
specimen of the Spanish loach (Cobitis
toenia) and of some hybrid Salmonidae
- 066 Day, F. (1890) 074
Fish.Proc.Gotteswold Nat.Field Club,
9:334-73
Notes on hybridization
- Dean, B. (1962) 075
New York, Russell and Russell Inc.
3 vols. Reprint of Vol.1, 1916,
Vol.2, 1916, Vol.3, 1923
A bibliography of fishes
Brief abstracts on many old references.
- 067
- Duff, D.C.B. (1933) 076
Trans.Am.Fish.Soc., 62:249-55
Furunculosis on the Pacific coast
An outbreak of the epizootic in British
Columbia was noted among three year old
hybrids of Oncorhynchus nerka and O. keta.
- 068
- 069
- Duff, D.C.B. and B.J. Stewart (1933) 077
Contrib.Can.Biol.Fish., 8:103-22
Studies on furunculosis of fish in
British Columbia
According to Foerster (1968) there was
one instance of furunculosis reported
for British Columbia, at the Smith
Falls hatchery rearing ponds, Cultus
Lake, where Foerster's (1935) artifi-
cially produced Oncorhynchus hybrids were
being retained to maturity.
- 070
- Duke, E. (1970) 078
Contribution to 6th Annual meeting,
Freshwater Research Group, Dublin
- Dunbar, C.E. (1969) 079
Natl.Cancer Inst.Monogr. 31:167-71
Lymphosarcoma of possible thymic origin
in salmonid fishes
Because of the cytologic similarities
between the tumors in brook trout and
in splake, and because such tumors have
not been reported in lake trout, it seems
likely that a predisposition of splake to
develop thymic lymphoma is genetically
transmitted from the brook trout.
- 071
- 072

Dvinin, P.A. (1953)
Rybn.Khoz., 5
Experiments in the artificial feeding of young salmon and their hybrids
According to Smirnov (1969), hybrids of Oncorhynchus nasou and O. gorbuscha.

Dymond, J.R. (1932)
Bull.Fish.Res.Board Can., 32:35 p.
The trout and other game fishes of British Columbia

Fertile hybrids were produced at the Cranbrook hatchery (British Columbia) from Salmo gairdneri and S. clarki. F₂ fry were raised in 1927 and 1928.

Eipper, A.W. (1955)
Typewritten job completion report, Dingell-Johnson Project F-4-R-3.
Investigation of farm fish ponds and bait ponds in New York State (Unpubl.MS)

According to Buss and Wright (1956), hybrids of Salvelinus namaycush ♀ X S. fontinalis ♂ and S. fontinalis ♀ X Salmo gairdneri ♂.

Eipper, A.W. (1964)
Mem.Agric.Exp.Stn.Cornell Univ., (388):67 p.
Growth, mortality rates, and standing crops of trout in New York farm ponds
According to Carlander (1969), Salmo gairdneri X S. trutta failed to survive to fry stage at Cornell and Benner Springs Hatcheries. Salvelinus fontinalis X S. gairdneri failed at Cornell but one batch showed 0.6% survival at Benner Springs. Also tiger and splake.

Fabricus, E. (1953)
Rep.Inst.Freshwat.Res.Drottningholm, (34):14-48
Aquarium observations on the spawning behaviour of the char

Ferguson, R.G. (1958)
J.Fish.Res.Board Can., 15(4):607-24
The preferred temperature of fish and their midsummer distribution in temperate lakes and streams

080 In two Algonquin Park lakes thermal stratification varied considerably in depth and constitution in the different years, but the thermal position of the splake (Salvelinus namaycush ♀ X S. fontinalis ♂) remained similar.

081 Fehlmann, W. (1926)
Jahresber.Kant.Schaffhausen, 1926:1-112
Die Ursachen des Ruckganges der Lachsfischerei im Hochrhein

082 Alm (1955) reports that in the Rhine as early as the latter half of the 19th century hybridization between S. salar and S. trutta was regularly carried out in connection with salmon hatching. This often occurred because male salmon were not available in sufficient quantities, but also for the purpose of combining certain good qualities in the parents which was, however, not successful. During the years 1918-1922 Fehlmann (1926) carried out new experiments and reared the hybrids in ponds to an age of 3 years. The majority were then sexually mature and attempts were made to obtain an F₂ generation. Mortality before the fry stage was however 100%.

083 Fish Commission of Oregon (1970)
Ann.Rep.Fish.Comm.Ore.Fish Cult.Div. Hatchery Biol.Sec., 1970:3-4
Cooperative studies (MS)
In Development and improvements of hatchery techniques for Pacific salmon and steelhead trout.

084 Results of preliminary studies on hybrid salmon indicate that crosses between chinook males and pink or chum females produce viable fry which adapt quickly to full-strength sea water. Early indications from this would suggest that hybrid salmon exhibit good growth in sea water during early juvenile stages.

Fisheries Research Board of Canada (1967)
Rev.Fish.Res.Board Can., 1965-66:94
Sockeye and pink salmon hybrids

085 Brief mention of the crosses

086

087

088

085

- Fisheries Research Board of Canada (1969) 089
Rev. Fish. Res. Board Can., (1965-66):5
Salmon hybrids
Brief mention of pink and sockeye, sockeye and chum hybrids.
- Fitzinger, L.J.F.J. (1875) 090
Sitzungber. Akad. Wiss. Wien (Math.-Nat.),
70(1):394-400
Bericht über die an den oberösterreichischen Seen und in den dortigen Anstalten für künstliche Fischzucht gewonnenen Erfahrungen bezüglich der Bastardformen der Salmonen
- Fitzinger, L.J.F.J. (1875a) 091
Zool. Gart., Frankf. A.M., 16:156-7
Sind Fischbastarde fruchtbar? (Abstr.)
- Fitzinger, L.J.F.J. (1876) 092
Sitzungber. Akad. Wiss. Wien (Math.-Nat.),
72(1):235-40
Bericht über die an den Seen des Salzkammergutes, Salzburgs und Berchtesgadens gepflogenen Nachforschungen über die Natur des Silberlachs (Salmo schiffermülleri Bloch)
- Flick, W.A. and D.A. Webster (1964) 093
Trans. Am. Fish. Soc., 93(1):58-69
Comparative first year survival and production in wild and domestic strains of brook trout, Salvelinus fontinalis
Some splake backcrossed to female brook trout used in study.
- Foerster, R.E. (1930) 094
Prog. Rep. Pac. Biol. Stn. Nanaimo, (6):6-8
The hybridization of salmon
First report of hybridization at Cultus Lake. See Foerster (1935).
- Foerster, R.E. (1935) 095
Trans. R. Soc. Can., (3):29, (5):21
Inter-species cross-breeding of Pacific salmon
The first comprehensive study on all five species of North American Oncorhynchus. Reciprocal crosses made and some backcrosses and F₂ hybrids. Literature review.
- Foerster, R.E. (1955) 096
Bull. Int. North Pac. Fish. Comm.,
(1):1-56
The Pacific salmon (genus Oncorhynchus) of the Canadian Pacific coast, with particular reference to their occurrence in or near fresh water
- Brief mention of Foerster (1935).
- Foerster, R.E. (1968) 097
Bull. Fish. Res. Board Can., (162):422 p.
The sockeye salmon, Oncorhynchus nerka
Review of Foerster (1935), Russian hybridization, and possibilities of selective crossbreeding of salmon.
- Fowler, H.W. (1944) 098
Bienn. Rep. Pa. Board Fish. Comm.,
1941-2:55-63
The salmon-like fishes of Pennsylvania
- According to Brown, C.J.D. (1966), Fowler describes 2 dwarf brown trout which Brown recognizes as hybrids.
- Fraas, C.N. (1854) 099
München, 2nd ed.
Die künstliche Fischerzeugung nach den Erfahrungen der künstliche Fischzucht-Anstalt der General-Comité des Landwirtschaftliche Vereins von Bayern. (Abstracted in Deau, 1962)
Hybrid of Salmo trutta (farior) X Lota marmorata.
- Fry, F.E.J. and M.B. Gibson 100
J. Hered., 44(2):56-7
Lethal temperature experiments with speckled trout X lake trout hybrids
- Fujita, T. (1926) 101
Dobutsugaku Zasshi, 38(488):39-51
Issued also as Transl. Ser. Fish. Res. Board Can., (1062)
On the characteristics of hybrids (F₁) among Japanese salmon and trout
Reciprocal crosses between Oncorhynchus keta, O. masou, and O. gorbusha. The hybrid of O. masou female X O. keta male was the only cross not described and discussed fully beyond the fry stage.

- Garside, E.T. and F.E.J. Fry (1959) 102
Can.J.Zool., 37(4)
A possible relationship between yolk size and differentiation in trout embryos
According to Martin (1960), reciprocal crosses of Salvelinus namaycush and S. fontinalis yolk sac size limited myomere number counts
- Gaylord, H.R. (1910) 103
J.Am.Med.Assoc., 54(3):227
An epidemic of carcinoma of the thyroid gland among fish
Gaylord and Marsh (1912) record that "Another observation of importance is the discovery that lots of fish are immune. This is particularly shown in hybrid fish, in which one lot of hybrid salmon 1 year old were reduced from 1,043 in April to 44 sound fish remaining in August, whereas another lot of yearling hybrid salmon, although badly exposed by being placed in ponds into which the water from infected ponds ran, remained free from the disease throughout."
- Gaylord, H.R. and M.C. Marsh (1912) 104
Bull.U.S.Bur.Fish., 32:363-524
Carcinoma of the thyroid in the salmonoid fishes
Hybrids of Salvelinus fontinalis female X Salmo salar sebago and S. fontinalis female X S. aureolus (alpinus) male reported hardy (mature) and exhibit some immunity to tumor formation.
Hybrids of Oncorhynchus kisutch ♀ X O. gorbuscha ♂, O. kisutch ♀ X O. tschawytscha ♂, O. nerka ♀ X O. gorbuscha ♂, and O. gorbuscha ♀ X O. nerka ♂ were not hardy and were highly susceptible to tumour formation.
- Gibson, R. (1929) 105
Rep.Commer.Fish.Prov.B.C., 1928:50-2
The spawning-beds of the Skeena River
An unusual incident was noticed by Mr. Hearne - a female pink spawning with a male sockeye. This female chased the males of its own species away in order to spawn with the sockeye. At the time there was no scarcity of male pinks or female sockeye.
- Gilmour, W.M. (1950) 106
Thesis, University of Alberta, Edmonton. 59 p.
A study of the Lower Bow River trout with special reference to taxonomy (Unpubl. MS)
Neither the native Salmo clarki nor the introduced S. gairdneri seem to be present in the Bow River as a true species. This leads to the supposition that the Bow River trout is a hybrid between the rainbow and the cutthroat.
- Goldberg, E. (1966) 107
Science, N.Y., 151(3714):1091-3
Lactate dehydrogenase in trout: hybridization in vivo and in vitro
Speckled trout and lake trout contain five forms of lactate dehydrogenase, but a different electrophoretic distribution of isozymes characterizes each species. The hybrid splake, which is produced artificially by fertilizing lake trout eggs with speckled trout sperm, contains nine isozymes. This complement of isozymes in vivo could be produced in vitro by recombination of subunits from tissues of the parent species. In the splake trout, this complement is the result of heterozygosity at the gene locus responsible for synthesis of LDH-5. Extracts of trout eyes contain at least two additional forms of LDH which could not be demonstrated in other tissues.
- Goldberg, E., J.P. Cuerrier and J.C. Ward (1967) 108
Nat.Can., 94:297-304
Lactate dehydrogenase isozymes, vertebrae and caeca numbers in an isolated, interbreeding population of splake trout
Distribution of lactate dehydrogenase (LDH) isozymes genotypes has been studied with an isolated population of splake trout.
LDH genes have been shown to be evolutively stable. However, this genetic equilibrium does not seem to apply to the total gene pool since determination of pyloric caeca and vertebrae numbers does not show such a stability.

- Goldberg, E., J.P. Guerrier and J.C.Ward (1969) 109
Biochem.Genet., 2:335-50
 Lactate dehydrogenase ontogeny, paternal gene activation, and tetramer assembly in embryos of brook trout, lake trout, and their hybrids
- Measurement of lactate dehydrogenase in reciprocal hybrids of trout during development revealed that a maternal effect was involved in the regulation of enzyme levels until resorption of the yolk sac was complete.
- Malate dehydrogenase specific activities were the same in these embryos and larvae. Activation of the paternal A gene in reciprocal hybrids occurred at a relatively late stage with the LDH subunit specific to the retina appearing after hatching.
- Green, S. (1879) 110
For.Stream, 13:885
 Hybrid trout
- Green, S. (1880) 111
For.Stream, 15:366
 Fertile hybrids
- Green, S. (1880) 112
Chic.Field, 14:284
 Hybrid trout
- Green, S. (1881) 113
Trans.Am.Fish.Cult.Assoc., 10:5-9
 Hybridizing fishes
- Fertile hybrids of Salvelinus fontinalis ♀ X S. Namaycush (Lake Ontario salmon trout) ♂ produced F2 generation as well as back crosses with both parents. Only female hybrids with eggs too large to pass through vent produced from S. fontinalis ♀ X Oncorhynchus tshawytscha (California salmon) ♂. No eggs hatched when fertilized with S. fontinalis milt. Also mentions without results a cross of S. fontinalis and Salmo gairdneri (California mountain trout).
 Species identified in Bean (1889b).
- Grieg, J.A. (1906) 114
Jager Fisker Foren.Tidskr., 67
 Karusformet ørret
- According to Dean (1962), misc. and unimportant.
- Grimm, O.A. (1881) 115
Tr.Imp.Petrograd.Obshch.Estestvoispyt., 12(1)
 A note concerning the cross-breeding of fish.
- Gould, W.R. (1966) 116
Copeia, (3):599-600
 Cutthroat trout (Salmo clarkii Richardson) X golden trout (Salmo aquabonita Jordan) hybrids
- Colour, meristic, and morphometric data presented on S. aquabonita ♀ X S. clarkii ♂.
- Haack, H. (1880) 117
Oesterr.Fisch.-Ztg., 1880:59
 Die Fortpflanzungsfähigkeit der Bastarde
- Haack, H. (1894) 118
Allg.Fisch.-Ztg., 19:280-1
 Lachsbastarde auf der Schweizerischen Fischerei-Ausstellung in Zürich
- Haacke, J.W. (1893) 119
Allg.Fisch.-Ztg., 18(14):210
 Bastardirung der Forelle durch den Bachsaibling
- According to Dean (1962), Salmo trutta (fario) X Salvelinus alpinus (salvelinus).
- Haen, P.J. and F.J. O'Rourke (1968) 120
Nature, Lond., 217(5123):65-7
 Protein and haemoglobins of salmon-trout hybrids
- Hybrids of Salmo salar and S. trutta compared by electrophoresis for eye lens, muscle and serum proteins, and haemoglobins with both parents.
- Haen, P.J. and F.J. O'Rourke (1969) 121
Proc.R.Ir.Acad., 68(B4):67-75
 Comparative electrophoretic studies of soluble eye-lens proteins of some Irish freshwater fishes
- Haen, P.J. and F.J. O'Rourke (1969a) 122
Proc.R.Ir.Acad., 68(B7):101-8
 Comparative electrophoretic studies of the water soluble muscle proteins of some Irish freshwater fishes

- Hagen, W. (1959) 123
Circ.U.S.Fish Wildl.Serv., (58)
Public fish culture in the United States,
1958. A statistics summary
Tables of distribution of splake from
hatcheries in Michigan, Minnesota, New
Hampshire, New York, and Wyoming.
- Hallock, C. (1873) 124
For.Stream, 1:22
The introduction of hybrid fish
According to Dean (1962), misc. and
unimportant.
- Hansen, D.W. (1952) 125
Thesis, Ia. State College Library 55 p.
Life history studies of the trout of
Pathfinder Reservoir, Wyoming
(Unpubl.MS)
According to Carlander (1959), Salmo
clarki X S. gairdneri.
- Hardy, E. (1961) 126
Salmon Trout Mag., (163):132-8
New salmon in Europe and research leading
to the introduction of Pacific Oncorhynchus
- Harris, G. (1969) 127
Trout Salmon Mag., 1969(86):31,33,35
Hybrids - success or failure?
Review of hybrids (Salmonidae) in general
and the "sunbeam" (see Knowles, 1969) and
the "ten-ton" trout in particular.
The sunbeam is a backcross of Salmo gairdneri
♀ X S. trutta ♂ to S. trutta ♂.
The ten-ton trout is reported hybrid of S.
gairdneri and Oncorhynchus tshawytscha
with exceptional hybrid vigor. (Angling
Times November 28, 1968).
- Harrison, A.C. (1961) 128
Piscator, 50:85-93
Tiger trout (Salmo trutta female X
Salvelinus fontinalis male).
According to Carlander (1969), 55 hybrid
trout in South Africa.
- Hartman, G.F. (1956) 129
Thesis, University of British Columbia
A taxonomic study of cutthroat trout
Salmo clarki clarki Richardson, rainbow
trout Salmo gairdneri Richardson and
reciprocal hybrids
(Unpubl.MS)
Fish bearing some of the distinguishing
features of each specie suggested hybridi-
zation. Salmo clarki and S. gairdneri
were reciprocally hybridized with no loss
in viability.
- Hayaguri, M. (1936) 130
Suisan Kenkyushi, 31(5):251-8.
Hybridization of trout
Issued also as Trans.Ser.Fish.Res.Board
Can., (1167)(1968)
Reciprocal hybridization of Salvelinus
pulvius, S. fontinalis, and Oncorhynchus
masou. F₁ of S. pulvius and S. fontinalis
backcrossed to S. fontinalis. The hybrids
of S. pulvius and O. masou did not mature.
The F₁ hybrids of S. fontinalis and O.
masou were maturing at the time of writing
(1936).
- Henking, H. (1929) 131
Rapp.P.-v.Réun.Cons.Perm.Int.Explor.Mer.,
61:1-99
Untersuchungen an Salmoniden mit
besonderer Berücksichtigung der Art- und
Rassenfragen. Teil 1.
- Henking, H. (1931) 132
Rapp.P.-v.Réun.Cons.Perm.Int.Explor.Mer.,
73:1-122
Untersuchungen an Salmoniden mit
besonderer Berücksichtigung der Art- und
Rassenfragen. Teil 2.
Alm (1955) reports that hybridization
between S. salar and S. trutta was
regularly carried out during the 20th
century in the Baltic River Persante.
- Hikita, T. and Y. Yokohira (1964) 133
Sci.Rep.Hokkaido Fish Hatchery, 18:57-65
Biological study on hybrids of the
salmonoid fishes. A note of F₁ hybrids
between chum (Oncorhynchus keta) and
pink salmon (Oncorhynchus gorbuscha)
Issued also as Trans.Ser.Fish.Res.Board
Can., (1064)(1968)

Observations on reciprocal hybridization of O. keta and O. gorbuscha fry. Adults not returned at time of writing report. See Simon and Noble (1968) for a review.

Hitzeroth, H., et al. (1968) 134
Biochem.Genet., 1(3):287-300
Asynchronous activation of parental alleles at the tissue-specific gene loci observed on hybrid trout during early development

Hofer, B. (1909) 135
Halle am S, Verlag Schlüter & Mass. 558 p.
Die Süßwasserfische von Mittel-Europa
Alm (1955) reports that Hofer says only hybridization between Salmo salar females and S. trutta males is possible and not the opposite cross. "Ubrigens lassen sich Forelleneier von Lachsmilch überhaupt nicht befruchten."

Hubbs, C.L. (1955) 136
Syst.Zool., 4(1):1-20
Hybridization between fish species in nature

Among the trout we find occasional inter-generic hybrids in nature as well as in culture. Most of these are between the native brook trout and the introduced brown trout. In the West the cutthroat and rainbow trouts, both belonging to the genus Salmo, live side by side with little or no crossing in many coastal streams but in the interior, where the cutthroat alone was native, the introduction of rainbows has repeatedly led to very extensive hybridization, and frequently to the elimination of the cutthroat, through a combination of hybridization and superior competition. The rainbow and golden trouts hybridize similarly. In the hatcheries many crosses have been produced between good species of chars, trouts, and salmons. Some of these produce fertile offspring, and by mating one hybrid with one of another cross, four species of the Pacific salmons have been combined in one individual (among the poeciliids we have thus combined as many as five species and twelve subspecies or races). One combination, between the brook trout and the lake trout, is being propagated in Canada with promise of use in fish management. The parental species were formerly classed as distinct genera, but in the current lumping spree both are put in

Salvelinus - which action does not lessen the difference between the species.

Hunter, J.G. (1949) 137
Progr.Rep.Pac.Coast.Stn., (81):91-2
Occurrence of hybrid salmon in the British Columbia commercial fishery
Meristic and morphometric data on natural hybrids of Oncorhynchus gorbuscha and O. keta.

Inaba, D. (1953) 138
J.Tokyo Univ.Fish., 39(2):215-21
On the breeding and hybridization among the salmonoid fishes

Irving, R.B. (1953) 139
Thesis, Utah Stat.Agricultural College, 101 p. (MS)
Ecology of the cutthroat trout, Salmo clarki Richardson in Henry's Lake, Idaho

According to Carlander (1969), S. clarki X S. gairdneri.

Ismach, J. (1971) 140
Seattle Post-Intell., 1971, April 22:7
Salmon farm under experiment in sound
Reference to hybrids for hardiness and superior eating quality. See Mahnken, Novotny, and Joyner (1970).

Jones, J.W. (1947) 141
Proc.Zool.Soc.Lond., 117(4):708-15
Salmon and trout hybrids
Description of hybrids of S. salar ♀ and S. trutta ♂, including a backcross of same with a male S. salar, obtained from experiments from January 1934 to January 1938 at Fordingbridge by H.J. Skinner (1938) for Sir Ernest Wills.

Jones, J.W. (1959) 142
New York, Harper & Brothers, 192 p.
The salmon
Review of Jones (1947) and Alm (1955).

Jordan, D.S. (1906)
Science, N.Y., 23(585):434
Hybridization of Pacific salmon

A report of J.A. Richardson crossing all of the North American species of Oncorhynchus. He found the O. gorbuscha ♀ X O. nerka ♂ hybrid superior.

Jubb, R.A. (1961)
Bulawayo, Stuart Manning (PVT.) Ltd., 151 p.
An illustrated guide to the freshwater fishes of the Zambezi River, Lake Kariba, Pungwe, Sabi, Lundi and Limpopo Rivers

Kamyshnaia, M.S. (1961)
Nauchn. Dokl. Vyssh. Shk. (Biol. Nauki), 4:29-33
On the biology of the hybrid between chum and pink salmon: Oncorhynchus keta (Walbaum), Infras. autumnalis Berg X O. gorbuscha (Walbaum)—Family Salmonidae
Issued also as Transl. Ser. Fish. Res. Board Can., (403)(1962)

Hybrids of Oncorhynchus keta ♀ X O. gorbuscha ♂ in Sakhalin hatcheries having fast growth, early maturity, and excellent edible qualities.

Kamyshnaia, M.S. (1963)
Rybn. Khoz., (4)
Hybrids of chum-pink salmon in the rivers of the North

Kato, T. (1966)
Bull. Freshwat. Fish. Res. Lab., 16:59-65
Studies on the techniques of salmon- and trout culturing. 3. Growth and survival rate of Salvelinus pluvius, Salvelinus fontinalis and the hybrid, Salvelinus pluvius ♀ X Salvelinus fontinalis ♂
(In Japanese, English summary)

According to Suzuki and Kato (1966), F₁ hybrids, both male and female, were fertile.

Kawashima, K. and R. Suzuki (1968)
Bull. Freshwat. Fish. Res. Lab., 18(1):49-59
Lepidological study in some Japanese salmon
(In Japanese, English summary)

Hybridization of an unknown Oncorhynchus sp. with O. rhodurus and O. masou to show that the unknown species was actually O. rhodurus.

143 Kendall, W.C. (1921)
Trans. Am. Fish. Soc., 50:187-99
What are rainbow trout and steelhead trout?

Intraspecific hybridization of Salmo gairdneri. Reference to Day's work.

Kimura, S. (1961)
144 Bull. Biogeogr. Soc. Jap., 22(5):69-73
A new salmonid fish, Oncorhynchus iwame sp. nov., obtained Kyushu, Japan

Klein, W.D. (1966)
145 Progr. Fish-Cult., 28(3):146-51
The summer movement of hybrid and brook trout into an inlet stream
Hybrid trout (Salvelinus fontinalis X S. namaycush) and brook trout (Salvelinus fontinalis) were recovered in a trap in the inlet of Parvin Lake during the summer of 1962.

Klein, W.D. (1961)
146 Progr. Fish-Cult., 29(3):140-9
Evaluation of a pulsating direct-current shocking device for obtaining trout from a lake for population estimates.
Splake (Salvelinus namaycush ♀ X S. fontinalis ♂) are numerous in Parvin Lake, Colorado.

Kner, R. (1865)
147 Verh. Zool.-Bot. Ver. Wien, 15:199-202
Ueber Salmoniden-Bastarde
Issued also as Z. Gesamte Naturwiss., 27:453-4 (Abstr.)
According to Dean (1962), Salmo trutta (fario and including Trutta lacustris) X Salvelinus alpinus (salvelinus) in Barau near Gmunden, Austria.

Knoch, J. (1884)
148 Korresp.-Bl. Naturforsch., Riga, 27:1-13
Die kunstliche Zucht der Lachse, Lachsforellen, Forellen und der Bastarde derselben, sowie ihre Verpflanzung und Acclimatisation in den Flüssen Welikaja Pskowa und in dem Pleskauer See.

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According to Dean (1962), Salmo trutta (fario) X Salvelinus alpinus (salvelinus).

Knowles, A. (1969) 155
Trout Salmon Mag., 1969(86):30, 32-3
How I bred the 'Sunbeam'

An account of the Fishery Officer for the West Somerset Water Board at Durleigh Reservoir hatchery's fast growing hybrid backcross of Salmo gairdneri ♀ X S. trutta to S. trutta ♂, named the "sunbeam". The F₂ generation of the sunbeam was 90% fertilized.

Also reported in the Angling Times May 22, 1969.

Kobayashi, H. (1963) 156
Cytologia, 28(4):365-75
Some cytological observations on fertilization in the cross between the dog-salmon and the pink-salmon (From Sport Fish.Abstr., No. 87237)

The process of fertilization and the course of early cleavages in the cross between the dog-salmon (Oncorhynchus keta) and the pink-salmon (Oncorhynchus gorbuscha) and in its reciprocal cross were found to proceed in normal manner. No di- and polyspermic condition in insemination was found. The behaviour of the chromosomes during early cleavage of the hybrid egg showed nothing unusual. There was no lag or elimination of any chromosomes. There was no evidence to indicate that the spermatozoa acted as a parthenogenetic agent.

Kobayashi, H. (1964) 157
Sci.Rep.Hokkaido Fish Hatchery, 18:67-71
Biological study of hybrids of the salmonid fishes. Cytological observation of fertilization in the cross between chum and pink salmon
Issued also as Transl.Ser.Fish.Res.Board Can., (1050)(1968)

The results of the cytological study on the fertilization in reciprocal crosses of Oncorhynchus keta and O. gorbuscha coincided with those of normal O. keta.

Koshida, H. (1926) 158
Suisan Kenkyushi, 35(7):180-3.
Ecology and hybridization of Masu. 1
Issued also as Transl.Ser.Fish.Res. Board Can., (1165)(1968)

155
Colour data on fertile hybrids of Oncorhynchus masou ♀ X Salmo macrostoma ♂.

Koshida, H. (1926a) 159
Suisan Kenkyushi, 35(8):201-3
Ecology and hybridization of Masu. 2
Issued also as Transl.Ser.Fish.Res. Board Can., (1166)(1968)

Crosses of Salmo gairdneri ♀ X Salmo macrostoma ♂ and S. gairdneri ♀ X Salvelinus fontinalis ♂ all died before reaching complete germination.

Krykhtin, M.L. (1962) 160
Izv.Tikhookean.Nauchno-Issled.Inst. Morsk.Rybn.Khoz.Okeanogr., 48
Data on the stream period of life of masu salmon

Kruse, T.E. (1959) 161
Fish.Bull.U.S.Fish.Wildl.Serv., 59(149):307-63
Grayling of Grebe Lake, Yellowstone National Park, Wyoming

In 1907 Salmo gairdneri and in 1912 S. clarki were planted in Grebe Lake. Since that time the two salmonid species have hybridized to such an extent that by 1952 no fish were found which were definitely pure strains of cutthroat or rainbow trout, but with a red slash on each side of the hyoid membrane. Hyoid teeth, a cutthroat characteristic, were present in all specimens examined. Body forms range from the typical elliptical shape of the cutthroat to the blunt, stocky, high-shoulder outline of the rainbow.

Kuznetsov, I.I. (1928) 162
Izv.Tikhookean.Nauchno-Promysl.Stn., 2(3):109
Some observations on the spawning of the Amur and Kamchatka salmon.
(In Russian)

It is worthwhile to note that the external species characteristics of certain fish sometimes were shown so indistinctly that experienced Japanese sorters made mistakes determining species and threw a chum in with the sockeye and vice versa. In such cases the determination of the species was made by us by the colour of the meat, which gave a sharp contrast from one species to another. The crossing of the characteristics of the fish (which has effect, one must suppose, in some degree or other, also on their fecundity), is probably the result of the chum and the sockeye spawning in the same place, giving a crossbreed. At any rate, the experience of crossbreeding on the Amur pink and summer chum points out the possibility of obtaining hybrids also between the chum and the sockeye or with the coho.

Leik, T.H. (1959) 163
 Job completion reports in Q.Rep.Colo.Coop. Fish.Res.Unit, (5)

According to Martin (1960), "Ecology and life history, downstream migration studies, and creel census of hybrid trout in Parvin L., Colorado." (Splake)

Leik, T.H. (1960) 164
 Thesis, Colorado State University, Fort Collins, 98 p.
 Immature splake trout in a lentic environment (Unpubl.MS)

An initial 2-year study dealing with morphological characteristics, growth and food habits, distribution, environmental requirements, and harvest of the hybrid between Salvelinus namaycush ♀ X S. fontinalis ♂ or S. mocrstoma ♀ X an undefined hybrid ♂ (could be Oncorhynchus masou ♀ X S. mocrstoma ♂ in Koshida, 1926a).

Lieder, U. (1956) 165
Z.Fisch., 4(7/8):589-94
 Chromosomenstudien an Knochen fischen.
 4. Die Chromosomenverhältnisse bei der Regenbogen-und Bachforelle und ihren Bastarden

The chromosome relationship between Salmo gairdneri and S. trutta and their hybrids support Svardson (1945).

Leopold, A. (1918) 164
Trans.Am.Fish.Soc., 47:101-2
 Mixing trout in western waters

Discussion of planted trout hybridizing with each other and native trout. Mentions fishermen's reports of rainbow and a native black-spotted trout (species unknown to author) cross.

Leuckart, F.R. (1882) 167
Arch.Naturges., 48(2):309-15
 Hybridism in fishes

Leuckart, F.R. (1882a) 168
 Berlin, 9 p.
 Ueber Bastardfische

According to Dean (1962), a review of Overbeck (1880).

Lewis, R.C. (1944) 169
Calif.Fish Game, 30(2):95-7
 Selective breeding of rainbow trout at Hot Creek Hatchery.
 p. 71 Needham and Gard, 1959

MacCrimmon, H.R. and J.S. Campbell (1969) 170
J.Fish.Res.Board Can., 26(7):1699-725
 World distribution of brook trout, Salvelinus fontinalis

Liebmann and Reichenbach-Klinke state that, in some waters (in West Germany), brook trout cross with brown trout (Salmo trutta L.) and give rise to the sterile hybrid (Tigerfisch). (Personal communication, Liebmann, H., and H. Reichenbach-Klinke. 1967. Bayerische Biologische Versuchsanstalt München, 8 München 22, Federal Republic of Germany).

In Poland the high vulnerability of brook trout to angling pressure and natural hybridizing with brown trout limits its numbers. (Personal communication, Sakowicz, Stanislaw. 1967. Instytut Rybactwa Srodladowego Olsztyn-Kortowo, Poland).

In South Africa "male brook trout are now kept at the Jonkershoek Hatchery solely for crossing with the brown trout (S. trutta) to produce the 'Tiger Trout' hybrid." (Personal communication, Smith, D.F. 1967. Department of Nature Conservation, Stellenbosch, South Africa.)

MacCrimmon, H.R., B.L. Gots and J.S. Campbell (1971)
J.Fish.Res.Board Can., 28(3):452-6
 World distribution of brook trout, Salvelinus fontinalis: further observations

Both brook trout and tiger trout (brown X brook hybrid) have been stocked in Rhodesian waters.

MacCrimmon, H.R., T.L. Marshall and B.L. Gots (1970)
J.Fish.Res.Board Can., 27(4):811-8
 World distribution of brown trout, Salmo trutta: further observations

Brown trout is now naturalized in the mountain waters of the Oriental and Real ranges, and hybridization with the rainbow trout occurs (Terrazas, personal communication).

MacPhee, C. (1966)
Trans.Am.Fish.Soc., 95(4):381-7
 Influence of differential angling mortality and stream gradient on fish abundance in a trout-sculpin biotope

At the end of a summer period, Svårdson (1949) found that a hatchery trough environment favoured the survival of alpine chars over char X trout hybrids and these hybrids survived better than brown trout when all three fish were mixed together.

Mahnken, C.V.W., A.J. Novotny and T. Joyner (1970)
Am.Fish Farmer, 2(1):12-5, 27
 Salmon mariculture potential assessed

Hybrid of Oncorhynchus tshawytscha X O. gorbuscha used in experimental floating pens in Puget Sound.

Martin, N.V. (1960)
Res.Inf.Pap.Ont.Dep.Lands For.(Fish.), (7):12 p.
 Annotated bibliography of the eastern brook trout X lake trout hybrid (Salvelinus fontinalis X Salvelinus namaycush)

Bibliography of splake through 1960.

171 Martin, N.V. and N.S. Baldwin (1960) 176
J.Fish.Res.Board Can., 17(4):541-51
 Observations on the life history of the hybrid between eastern brook trout and lake trout in Algonquin Park, Ontario

In most features investigated, the hybrid trout has a greater affinity to the brook trout than to the lake trout. In angling, depth distribution, food, maturity, fecundity, and time and duration of spawning the hybrid trout is closer to the brook trout than the lake trout. Length-weight relationship, and place of successful spawning, are more similar to the lake trout. The hybrids grow faster than either parent, and school more strongly. Their spawning behaviour shows characteristics of each parent.

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Martin, N.V. and D.C. Scott (1959) 177
Progr.Fish-Cult., 21(4):183-4
 Use of Tricaine methanesulfonate (M.S. 222) in the transport of live fish without water

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Movement of Salvelinus namaycush X S. fontinalis hybrids by air in Ontario.

Massaro, E.J. and C.L. Markert (1968) 178
J.Exp.Zool., 168(2):223-38
 Isozyme patterns of salmonid fishes: evidence for lactate dehydrogenase polypeptides

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From these observations, it has been concluded that salmonids are tetraploids. In our view, it seems most likely that they arose through allotetraploidization of a primitive hybrid ancestor.

Mather, F. (1876) 179
For.Stream, 6:69
 Hybrid Salmonidae

175

According to Dean (1962), misc. and unimportant.

McCauley, R.W. and J.S. Tait (1970) 180
J.Fish.Res.Board Can., 27(10):1729-33
 Preferred temperature of yearling lake trout, Salvelinus namaycush

The lake trout, like Oncorhynchus keta and brook X lake trout hybrid (Pearson, MS, 1952), belongs to type 5 of Zahn's classification characteristic of species having a moderate degree of stenothermality.

McPhail, J.D. (1961)
J.Fish.Res.Board Can., 18(5):793-816
A systematic study of the Salvelinus alpinus complex in North America

The validity of doubtful species pairs can be established if they occur sympatrically without mass hybridization. Occasional hybridization may occur, but as long as the hybrids are rare the species can be considered valid. In Karluk and Fraser Lakes S. malma and S. alpinus occur sympatrically. The evidence indicates that within these lakes hybridization between S. malma and S. alpinus rarely, if ever, occurs. From the data presented, S. alpinus and S. malma are considered as discrete species, each subject to geographic variation, which occur sympatrically in certain areas of Alaska with little or no hybridization.

Miller, R.B. (1949)
Alberta, Department of Lands and Forests, 139 p.
Preliminary biological surveys of Alberta watersheds, 1947-1949
According to Carlander (1969), Salmo clarki X S. gairdneri.

Miller, R.B. (1957)
J.Fish.Res.Board Can., 14(6):797-806
Have the genetic patterns of fishes have been altered by introductions or by selective fishing?

Changes in some salmonids may be assigned to introgressive hybridization, particularly where rainbow and cutthroat trout have been put together on the eastern slopes. In many cases, however, exotics have apparently failed to contribute to the gene pool of the resident population, and most hybrids, when they occur have been of low fertility. Limited review of other works.

Miller, R.R. (1950)
Occas.Pap.Mus.Zool.Mich.Univ., (529):42 p.
Notes on the cutthroat and rainbow trouts with the description of a new species from the Gila River, New Mexico

181 Miller, R.R. (1960)
Univ.Calif.Publ.Zool., (67):124 p.
Review of rainbow trout in Mexico and California with notes on the cutthroat series by Paul R. Needham and Richard Gard

Review of Needham and Gard (1959). Suggests that introduced trout may have hybridized with native stocks in Mexico. The native trout of the Gila River basin in New Mexico and Arizona are reduced through hybridization and introgression of characters.

Miller, R.R. and J.R. Alcorn (1943)
Trans.Am.Fish.Soc., 73:173-93
The introduced fishes of Nevada with a history of their introduction

Milne, D.J. (1948)
Thesis, McGill University Department of Zoology, Montreal, 101 p. (Unpubl.MS)
The growth, morphology and relationship of the species of Pacific salmon and the steelhead trout
Review of Foerster (1935).

Morrison, W.J. (1970)
Trans.Am.Fish.Soc., 99(1):193-206
Non-random segregation of two lactate dehydrogenase subunit loci in trout

Two of the five lactate dehydrogenase (LDH) subunit loci known to exist in salmonid fishes were obtained in heterozygous condition in the hybrid of lake trout (Salvelinus namaycush Walbaum) X brook trout (S. fontinalis Mitchell) and linkage tests were performed.

Morrison, W.J. and J.E. Wright (1966)
J.Exp.Zool., 163:259-70
Genetic analysis of three lactate dehydrogenase isozyme systems in trout: evidence for linkage of genes coding subunits A and B

Various crosses and backcrosses involving S. fontinalis and Salvelinus namaycush demonstrate that subunits A and B are each coded by different autosomal genes (LA and LB).

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Comparison of patterns of S. fontinalis and S. trutta and their hybrid seems to indicate that two additional subunits are involved in a third series of five isozymes found in the skeletal muscle of each species examined."

Mulch, E.E. and W.C. Gamble (1954)
Pub.Ariz.Game Fish Dep., 19 p.
Game fishes of Arizona

The Arizona native trout, Salmo gila (Miller) "is native to the headwaters of the Gila River watershed and has hybridized with the rainbow trout. The fish is now (1954) restricted to the upper headwaters of Eagle Creek in Greenlee Country in its pure strain, and is probably also present in hybrid form in the Black and White Rivers and the steams of Mount Baldy."

Nall, G.H. (1930)
London, Seeley Services & Co.
Life of the sea trout

According to Jones (1959), Nall suggests that hybridization in nature may take place in small streams.

Neave, F. (1958)
Trans.R.Soc.Can., (3), 52 (5):25-39
The origin and speciation of Oncorhynchus

Most of the species of Oncorhynchus show a high degree of interfertility.

Needham, P.R. (1938)
Progr.Fish-Cult., 37:1-10, 43
Notes on the introduction of Mexican trout

p. 71 Needham and Gard, 1959

Needham, P.R. and R.J. Behnke (1962)
Progr.Fish-Cult., 24(4):156-8
The origin of hatchery rainbow trout

Introgression of Salmo clarki genes into S. gairdneri.

Needham, P.R. and R. Gard (1959)
Univ.Calif.Publ.Zool., 67(1):124 p.
Rainbow trout in Mexico and California with notes on the cutthroat series

Natural hybrids of Salmo gairdneri with S. aquabonita and S. clarki.

Needham, P.R. and R. Gard (1964) 196
Copeia, 1964(1):169-73

A new trout from Central Mexico: Salmo chrysogaster, the Mexican golden trout

190 Salmo chrysogaster believed derived by hybridization of a primitive S. gairdneri with a primitive S. clarki.

Nelson, J.S. (1965) 197
J.Fish.Res.Board Can., 22(3):721-53
Effects of fish introductions and hydroelectric development on fishes in the Kananaskis River system, Alberta

Reference to Gilmour (MS 1950) and stocking of Salmo clarki X S. gairdneri hybrids.

Nelson, J.S. (1968) 198
J.Fish.Res.Board Can., 25(2):409-14
Distribution and nomenclature of North American kokanee, Oncorhynchus nerka

192 Neresheimer, E. (1937) 199
Handb.Binnenfisch.Mittel-Eur., 3(5):219-370
Die Lachsartigen (Salmonidae)

193 New York (State), Commissioners of Fisheries of the State of New York (1879) 200
Rep.Comm.Fish.State N.Y., (11):7-10
Eleventh report of the Commissioners of Fisheries of the State of New York
According to Martin (1960), splake raised at Caledonia Hatchery, by 1991 had a small brood stock and plantings made but never followed up.

194 Nikoliukin, N.I. (1964) 201
Izv.Vses.Nauchno-Issled.Inst.Morsk. Rybn.Khoz.Okeanogr., 55
The hybridization of fish and its significance in acclimatization

According to Smirnov (1969), Nikoliukin believes salmon hybrids in general are rare.

- Nyman, O.L. (1965) 202
Rep.Swed.Salmon Res.Inst., 1965(13):1-11
Variation of proteins in hybrids and parental species of fishes
Electrophoresis protein patterns were summations of the parental species, with few exceptions, in the hybrid broding (Salvelinus alpinus and S. fontinalis). In splake (S. namaycush X S. fontinalis) the patterns were not distinguishable from S. fontinalis.
- Nyman, O.L. (1966) 203
Rep.Swed.Salmon Res.Inst., 1966(3):1-6
Geographic variation in Atlantic salmon
All the diverging electrophoretic protein bands in the parental species were summed up in the F₁ hybrids of Salmo salar and S. trutta.
- Nyman, O.L. (1967) 204
Rep.Inst.Freshwat.Res.Drottningholm, (47):5-38
Protein variation in Salmonidae
- Nyman, O.L. (1970) 205
Trans.Am.Fish.Soc., 99(1):229-36
Electrophoretic analysis of hybrids between salmon (Salmo salar L.) and trout (Salmo trutta L.)
Analysis of hybrids of Piggins (1965).
- Nümann, W. (1964) 206
Schweiz.Z.Hydrol., 26(1):102-46
Formenkreise der italienischen, jugoslawischen and adriatischen Forellen, zugleich ein Beitrag über den Wert einiger meristischen Merkmale für Art und Rasseanalysen
Behnke (1968) discusses Salmo marmoratus Cuvier hybridizing with S. trutta.
- Ohno, S. et al. (1969) 207
Chromosomes Today, 2:139-47
Diploid-tetraploid relationship in clupeoid and salmonoid fish
In view of the drive toward the fusion of homologues demonstrated by these tetraploid salmonoid fish, the linkage of two gene loci which arose as a result of duplication by tetraploidy is expected.
- Oshima, M. (1934) 208
Proc.Pac.Sci.Congr., 5(1933):3751-73
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Reciprocal crosses, backcrosses, and F₂ hybrids of Oncorhynchus masou and O. rhodurus. At the time, the cross performed extensively and great numbers of F₁ liberated into the streams.
- Oshima, M. (1957) 209
Nire Shobo (Nire Book Company), Tokyo
Sakura-masu to Biwa-masu (Oncorhynchus masou and Oncorhynchus rhodurus)
- Oshima, M. (1957a) 210
79 p. (in Japanese)
Studies on the dimorphic salmons Oncorhynchus rhodurus Jordan & McGregor, found in Japan and adjacent territories
According to Christie (1970), "Oshima (1957) demonstrated in hybridization experiments that the red spots of O. rhodurus are genotypic, and recessive to the O. masou coloration."
- Oshima, M. (1959) 211
Dobutsugaku Zasshi, (Zoological Magazine) 68(7):259-62.
Occurrence of the natural hybrid between Oncorhynchus masou and Oncorhynchus rhodurus in the upper streams of Tenryu River.
Issued also as Transl.Ser.Fish.Res. Board Can., (1098)(1968)
- Oshima, M. (1969) 212
Dobutsugaku Zasshi, 68(7)
On the F₁ of Amago and Yamame of Sanpo up stream of Tenryu River
Terao and Hayashinaka (1961)
- Overbeck, G. (1880) 213
Dtsch.Fisch.-Ztg., 67
Sind Bastardfische fruchtbar oder steril?
Issued also as Oesterr.Fisch.-Ztg., 1:36
According to Dean (1962), Salmo salar X S. trutta (fario) at Winkelsmuhle Düsseldorf.

- Paust, G. (1955)
Sports Illus., July 11:36-9
Canada creates a great new trout.
According to Martin (1960), report of splake.
- 214 Summary of calculated growth data on Montana fishes, 1948-61.
According to Carlander (1969), Salmo clarki X S. gairdneri.
- Pavlov, I.S. (1959)
Rybn.Khoz., 35(6):23-4
Experiments on the hybridization of Pacific salmon
Issued also as Transl.Ser.Fish.Res.Board Can., (263) (1960)
Meristic and morphological data on Oncorhynchus keta ♀ X O. gorbuscha ♂ hybrid, which returned in two years with an average weight in excess of O. keta.
- 215 Phillipps, W.J. (1923) 220
Salmon Trout Mag., 31:100-3
Hybridism of Salmo irideus and Salmo fario in Australasia
Issued also as N.Z.J.Sci.Technol., 5(2)
Reviews hybrids of Salmo gairdneri and S. trutta and traces the results of experiments in hybridization of same in Australasia.
- Pearson, E. (1952)
Rep.Ont.Fish.Res.Lab., Univ.Toronto, 24 p. (Unpubl.MS)
The behaviour of a sample of hybrid trout (Salvelinus fontinalis X Cristivomer namaycush) in a vertical temperature gradient.
- 216 Piggins, D.J. (1965) 221
Atl.Salmon J., Fall issue:3-5
Salmon and sea trout hybrids
Hybrids of Salmo salar ♀ X S. trutta ♂ proved to show hybrid vigour for their first two years. Backcrosses of both sexes to both species have been successful.
- Pegington, C.J. and H. Rees (1967)
Chromosoma, Berl., 21(4):475-7
Chromosome size in salmon and trout
Measurements of a specific chromosome, S. of the salmon (Salmo salar) complement and of another, S. of the trout (Salmo trutta) complement in nuclei of parent species and of the hybrid show that the difference in size is maintained in hybrid nuclei.
- 217 Piggins, D.J. (1965 a) 222
Rep.Salmon Res.Trust, Irel., 1964:27-37
Salmon and sea trout hybrids
F.1 hybrids of salmon and sea trout (almost 5 years old at the end of 1964) reached an average length of 17.3" and were stripped for the third time. F.2 hybrids resulting from earlier strippings were reared in ponds and released into a land-locked lake where their average size as 1+ fish was 10", with some specimens of over 12" in length.
- Pennsylvania, State Commissioners of Pennsylvania, (1890-1901)
Annual reports of State Commissioners of Pennsylvania for years 1887-1901
According to Martin (1960), "Distribution lists for Corry Pennsylvania Hatchery. Total of 485,900 hybrids stocked in Pennsylvania streams between 1892 and 1900. Mostly fry, some 1 year and 2 year olds."
- 218 Piggins, D.J. (1966) 223
Rep.Salmon Res.Trust, Irel., 1965:7-9
Salmon X sea trout hybrids
Further inter-specific hybridization work was commenced in 1965, when crosses of male and female grilse with male and female sea trout were attended by normal results for fertilization and early incubation. Two years old F.2 hybrids numbering 700 were allowed to go to sea in April 1965. A total of 18 migratory and 10 non-migratory forms were recaptured during 1965. The
- Peters, J.C. (1964)
Montana Fish and Game Department, Department of Fisheries, 76 p.(Mimeo)
D-J. Job Completion Rep. F-23-R-6 (jobs I-II).
- 219

migratory forms resembled sea trout finnock and one was caught some 40 miles from this fishery. Limited rod-fishing for land-locked hybrids in Ballinlough resulted in a total catch of over 600 fish averaging 3/4-lb. in weight at two years of age, with occasional specimens of up to 1/2 lbs.

Piggins, D.J. (1967)
Rep.Salmon Res.Trust, Irel.,
1966:29-32

Further studies on the specific characteristics of brown trout and salmon-sea trout hybrids

There was approximately 50% survival to under-yearlings of salmon X sea trout hybrids obtained by fertilizing grilse ova with milt from sea trout in 1965. The complementary cross using sea trout ova and milt from grilse was a failure. Some 480, 2+ hybrid smolts were allowed to go to sea in 1966, of which 18 have been recaptured resembling sea trout finnock, as in 1965. Rod-fishing for land-locked hybrids continued in 1966 when the fish averaged 1/2 lbs. in weight at 3+ years of age.

Piggins, D.J. (1971)
Salmon Research Trust Ireland
Salmon X sea trout hybrids (1960-1970)

A quite complete review of hybridization work in Ireland.

Plaza, M.L. Fuster de (1949)
Publ.Misc.Minist.Agric.Ganad., (319)
Hybridization between Salmo iridea (Gibb.) and Salvelinus fontinalis (Jord.)
Issued also as Transl.Ser.Fish.Res. Board Can., (13)

Description of hybrid between Salvelinus fontinalis female and Salmo gairdneri male. Mention of S. trutta and S. salar sebago, S. fontinalis and S. trutta hybrids.

Purkett, C.A., Jr. (1951)
Trans.Am.Fish.Soc., 80:251-9
Growth rate of trout in relation to elevation and temperature

Lengths of Salmo gairdneri X S. clarki hybrids.

Rasch, H.H. (1867) 228
Forh.Videnskapsselskap.Kristiania,
1866(1867):326-7

Resultatet af nogle af ham anstillede bastarderingsforsøg mellem forskjellige arter af ørretartede fiske

According to Dean (1962), misc. and unimportant.

224 Raveret-Wattel and Bartet (1883) 229
Bull.U.S.Fish Comm., 3:207-208

Reproduction of California salmon in the aquarium of Trocadero
Issued also as C.R.Hebd.Seances Acad.Sci.,
Paris 96(12):796-7

Oncorhynchus tshawytscha eggs milted with unspecified trout because of lack of ripe male salmon - the experiment did not succeed.

Rees, H. (1967) 230
Chromosoma, Berl., 21(4):472-4
The chromosomes of Salmo salar

A new chromosome number of 2n=58 given for S. salar and 2n=69 for S. salar X s. trutta hybrids.

225 Regier, H.A. (1966) 231
Progr.Fish-Cult., 28(1):3-17

A perspective on research on the dynamics of fish populations in the Great Lakes

Development of a deep-swimming strain of splake to avoid lamprey predation.

226 Richmond, F.G. (1919) 232
Salmon Trout Mag., 20:63-73

About rainbow trout

Phillipps (1923) reports that on page 72, "Personally I have met with no instances of brown trout and rainbow trout crossing. My attempts to cross them have always failed. I know water where the spawning-time of the latest brown trout overlaps that of the earliest rainbows; but I have never seen in this water any fish which looked like a hybrid, nor have I seen the two kinds on the reeds together."

227

Roberts, F.L. (1967)
Progr.Fish-Cult., 29(2):75-83
Chromosome cytology of the Osteichthyes

In experimental studies of hybridization, chromosome studies can be used to confirm that actual hybridization, rather than gynogenesis (that is, induction of cleavage by sperm without contribution of paternal chromosomes), has occurred. Further, chromosome analysis makes possible the proof of hybridization in the embryo or sac-fry, and also supplements nicely any morphological data that might be obtained from adult specimens.

Roberts, F.L. (1970)
Trans.Am.Fish.Soc., 99(1):105-11
Atlantic salmon (Salmo salar) chromosomes and speciation

Brief mention of Salmo salar and S. trutta, Oncorhynchus keta and O. gorbuscha hybrids.

Roosevelt, R.B. (1880)
Sci.Am., 42:263
Hybrid fish

Roosevelt, R.B. (1880 a)
Trans.Am.Fish.Cult.Assoc., (9):8-13
Hybrids

Brief description of a hybrid of Salvelinus namaycush X S. fontinalis ♂
Hybrid of S. fontinalis ♀ X Oncorhynchus tshawytscha ♂ (California salmon) produced only females with eggs too large to pass through vent. Artificially fertilized eggs with S. fontinalis milt failed to produce fry. Reciprocal crosses of S. fontinalis and Salmo gairdneri (California mountain trout (impregnated about 80% of the eggs used. Also records crossing S. namaycush ♀ with an unspecified whitefish and S. fontinalis ♀ with an unspecified freshwater herring ♂. Results not recorded and no hybrids discussed. Species identified in Bean (1889b).

Roosevelt, R.B. (1884)
Proc.Am.Assoc.Adv.Sci., 33:510-5

233 Rounsefell, G.A. (1962) 238
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Relationships among North American Salmonidae

A quite complete discussion and review of hybridization in Salmonidae.

Rurh, C.E. (1952) 239
Iowa State J.Sci., 27(3):55-77
Fish population of a mining pit lake, Marion County, Iowa

Runnstrom, S. (1950) 240
Rep.Inst.Freshwat.Res.Drottningholm, 31:5-18
~~Director's report for the year 1949~~

An early review of experiments of Alm (1955).

Sanders, B.G. (1964) 241
In Taxonomic biochemistry and serology, edited by C.A. Leone, New York, Ronald Press Co., pp.673-9
Electrophoretic studies of serum proteins of 3 trout species and the resulting hybrids within the Family Salmonidae

A comparative study of the blood serum of brown trout (Salmo trutta), brook trout (Salvelinus fontinalis), rainbow trout (Salmo gairdneri), and resulting hybrid specimens (tiger trout and brown-bow trout) were analyzed electrophoretically for protein components, and the percentage of proteins in each fraction was determined.

Sano, S. and H. Eguchi (1936) 242
Suisan Fukajyo Fukunei Sho, Showa 11 nen:13.
Interspecific hybridization among salmonid fishes
Issued also as Transl.Ser.Fish.Res. Board Can., (1164)(1958)
Hybrids of Oncorhynchus keta, O. nerka, O. masou, Salmo gairdneri, and Salvelinus fontinalis.

237

Scheuring, L. (1930)
Bad.Fisch.-Ztg., 7:33
Beobachtungen über die Erbrütung und
Aufzucht von Lachsen und Bastarden
zwischen Lachs und Bachforelle

Alm (1955) records that this paper was
not available in Sweden, but referred
to in other papers. Scheuring empha-
sized that S. salar female X S. trutta
male gave far better results than its
reciprocal, which had a larger number
of malformations and more extensive
yolk sac disease. The largest reached
20 cm. after one year in a pond.

Scott, W.B. (1956)
Toronto, Royal Ontario Museum, 7 p.
Wendigo the hybrid trout

An account of splake (Salvelinus
namaycush ♀ X S. fontinalis ♂).

Se, Huan, and Yuan (1959)
Acta Hydrobiol.Sinica, 2:215-20
Lenok and taimen and their natural
hybrids in the Hailungian basin
(In Chinese, Russian summary)
According to Böhnke (1968), natural
hybrids of Brachymystax lenok and
Hucho taimen (Pallas) from the Amur
River system in China.

Seguin, L.R. (1954)
Quebec, Game and Fisheries Department
The "Splake" In Ephemerides of the
Biological Bureau 1(1):21-2

Martin (1960) states, "in 1953 anglers
caught 300 F₁ and F₂ hybrids raised in
Eastern Townships Fish Hatchery."

Seguin, L.R. (1956)
In Booklet of Game and Fisheries
Department, Province of Quebec
Habits and rearing methods of
Quebec trout

According to Martin (1960), "1944 -
700 splake fingerlings planted in Lake
Lyster, Quebec. General description
appearance habits, photographs."

243 Seguin, L.R. (1957) 248
Trans.Am.Fish.Soc., 86:136-43
Scientific fish culture in Quebec since
1945

Artificial hybridization using the
following species: Salvelinus fontinalis,
S. namaycush, S. alpinus marstoni, Salmo
gairdneri, S. trutta, and S. salar.
The best growth was for S. fontinalis ♀
X S. alpinus marstoni ♂.

Shapovalov, L., W.A. Dill and 249
A. Cordone (1959)
Calif.Fish Game, 45(3):159-80
A revised check list of the freshwater
and anadromous fishes of California

244 Planting of splake (Salvelinus namaycush
♀ X S. fontinalis ♂) in Sierra County.

Simon, R.C. and R.E. Noble (1968) 250
Trans Am.Fish.Soc., 97(2):109-18

245 Hybridization in Oncorhynchus (Salmonidae).
1. Viability and inheritance in artificial
crosses of chum and pink salmon

Survival and fertility are substantial
in first generation hybrids. Morpholo-
gical features in the F₁ are either like
one parent, unlike either parent, or
intermediate. Failure of hybrids to be
intermediate in some parental attributes
is contrasted to earlier reports.
Hybrid fertility is equated to persistence
of parental traits in the phenotype of
the F₁. Multiple and additive gene sys-
tems are assumed to be operative wherein
dominance is suspected in two characteris-
tics. Viability data are provided on F₁,
F₂, reciprocal, and backcross hybrids.
Morphological descriptions contained
provide some basis for recognizing
natural chum-pink hybrids.

246 of parental traits in the phenotype of
the F₁. Multiple and additive gene sys-
tems are assumed to be operative wherein
dominance is suspected in two characteris-
tics. Viability data are provided on F₁,
F₂, reciprocal, and backcross hybrids.
Morphological descriptions contained
provide some basis for recognizing
natural chum-pink hybrids.

247 Skinner, H.J. (1938) 251
Field, 1938, 30 July
Salmon and trout hybrids

Slastenenko, E.P. (1953) 252
Rev.Soc.Mex.His.Nat., 14(1-4):71-6
El crecimiento en los híbridos de
Salvelinus fontinalis y Salvelinus
namaycush.

Growth study of the hybrid.

Slastenenko, E.P. (1953)
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Estudio de híbridos artificiales entre
Salvelinus fontinalis Mitchell y S.
namaycush Walbaum

Slastenenko, E.P. (1954)
J.Fish.Res.Board Can., 11(5):652-9
The relative growth of hybrid char
(Salvelinus fontinalis X Cristivomer
namaycush)

Hybrid char from Banff were inter-
mediate between the two parental
species, lake trout and eastern brook
trout, in respect to relative growth
of some characters; in others they
approximated one or other of the parent
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Slastenenko, E.P. (1956)
Istanbul Univ.Fen Fak Mecm, (B), 21(3)
Hybridization as a factor of evolution

Martin (1960) states, "Reference to
Slastenenko (1964). Lake trout X
brook trout hybrids had intermediate
characters and characteristics of one
of the parental species."

Slastenenko, E.P. (1956)
Rev.Soc.Mex.Hist.Nat., 17:63-84
A world list of natural hybrids of
fishes

Smirnov, A.I. (1950)
Rybn.Khoz., (4)
Following up on chum and pink hybrids

Smirnov, A.I. (1953)
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Some characteristics of the inter-
specific hybrid between autumn chum
salmon and pink salmon, Oncorhynchus
keta (Walbaum) infraspecies
autumnalis Berg X O. gorbuscha
(Walbaum), family Salmonidae
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Board Can., (957)(1967)

High percentage of fertilization and
heterosis of the hybrid.

253 Smirnov, A.I. (1953a) 259
Tr.Soveshch.Vopr.Lososev.Khoz.Dal'nego
Vostoka, 1953:94-110.

Problems of rationalization of the bio-
technique of salmon breeding on Sakhalin
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254 Reciprocal hybrids of Oncorhynchus keta
and Salvelinus leucomaenis, O. gorbuscha
and S. leucomaenis, and O. keta ♀ X O.
gorbuscha ♂.

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salmon
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Oncorhynchus kisutch result in cyclops-
like embryos.

255 Smirnov, A.I. (1969) 261
In Genetica, selektsiia i ribridizatsiia
Ryb.Akad.Nauk SSSR, Ichthiol.Komm.,
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Hybrids of Pacific salmon of the genus
Oncorhynchus, characteristics of their
growth and development and prospects of
utilization

256 A quite complete review of hybridization
of Salmonidae in the USSR.

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J.Fish.Res.Board Can., 28(1):112-3

257 An undifferentiated hematopoietic neo-
plasm with histologic manifestations
of leukemia in a cutthroat trout
(Salmo clarki)

258 Dunbar (1969) reported lymphosarcomas
in three brook trout, Salvelinus
fontinalis, and two hybrid splake
(brook trout X lake trout). He
suggested that the tumours were most
likely of thymic origin.

Smith, E. (1915) 263
Trans.Pac.Fish.Soc., 1:71-8
Salmon hybridization

Reciprocal crosses of Oncorhynchus
tachawytscha and O. kisutch with growth
and colour data.

Smith, S.H. (1968)
J.Fish.Res.Board Can., 25(4):667-93
Species succession and fishery exploitation in the Great Lakes
Splake in Ontario.

Soguri, M. (1936)
Suisan Kenkiu-shi, 31:251-8 (in Japanese)
On hybrids among trouts

According to Suzuki and Kato (1966), "Soguri (1936) who obtained firstly the artificial F₁ hybrids of Salvelinus pluvius ♀ X Salvelinus fontinalis ♂ reported that their females were fertilizable, while males were sterile."

Soldwedel, R.H. (1968)
N.J. Outdoors, 18(1):20
Brookbows

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Solman, V.E.F. (1951)
Trans.North Am.Wildl.Conf., 16:225-33
The creel census in the National Parks of Canada

According to Martin (1960), use of splake in mountain lakes, first plant in 1950.

Solman, V.E.F., J.-P. Guerrier and W.C. Cable
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Why have fish hatcheries in Canada's national parks?

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Sowards, C.L. (1959)
Progr.Fish-Cult., 21(4):147-50
Experiments in hybridizing several species of trout

264 The F₁ generation of brookinaw was obtained by crossing a brook trout female and a lake trout male. The hatching success was 73 percent, with good survival. Hatching success for 2 lots of the F₂ generation averaged 68 percent. Hatching success of a back-cross with a brook trout male was 94.1 percent, and that of a back-cross with a brook trout female was 82.2 percent.

A cross between a brookinaw female and a brown trout male yielded a hatching success of 4.8 percent; a cross between a brown trout female and a brookinaw male yielded a hatch of 32.2 percent. The hatching success of a cross between a lake trout female and a brook trout male was 38.5 percent.

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266 Can.Fish Cult., 6:20-2
Artificial hybridization of eastern brook trout and lake trout

Data on reciprocal crosses of Salvelinus namaycush and S. fontinalis.

Stenton, J.E. (1952) 272
267 Can.Fish Cult., 13:15-21
Additional information on eastern brook trout X lake trout hybrids

Meristic and morphological data on fertile hybrids of Salvelinus namaycush ♀ X S. fontinalis ♂.

Stenton, J.E. (1953) 273
268 North.Sportsman, 8(5):12-3
Anglers will have a new opponent
Martin (1960) states, "Popular account of Stenton's work in Alberta based on Stenton (1950, 1952)."

Stokell, G. (1949) 274
Rec.Canterbury Mus., 5:209-12
The numerical characters of five hybrid trout

269 Meristic data on hybrids of Salmo gairdneri and S. trutta.

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270 In Handbook of biological data, 1 p. table
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According to Carlander (1969), splake.

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Suzuki, R. (1965)
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Thremmatological aspects on the hybridization in fish
(In Japanese)
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Hybridization experiments in cyprinid fishes. 11. Survival rate of F1 hybrids with special reference to the closeness of taxonomical position of combined fishes
Interordinal cross with spermatozoa of Salmo gairdneri and eggs of female Tribolodon hakonensis did not develop at all.

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Notes on the edematous fry in fish hybrids
Very brief mention of hybrids in Salmonidae.

Suzuki, R. and T. Kato (1966)
Bull. Freshwat. Fish. Res. Lab., Tokyo, 16(2):83-90
Hybridization in nature between salmonid fishes, Salvelinus pluvius X Salvelinus fontinalis

Meristic and colour characteristics were intermediate of the parental species in natural and artificial hybrids of this cross.

276 Svårdson, G. (1945) 282
Rep. Inst. Freshwat. Res. Drottningholm, 23:1-151

Chromosome studies on Salmonidae
According to Alm (1955), Svårdson claims that hybrids of S. salar and S. trutta are possible only when the salmon is the mother. Alm believes Svårdson got the idea from Hofer (1909) without ever attempting any hybridization experiments himself.

278 Svårdson, G. (1949) 283
Rep. Inst. Freshwat. Res. Drottningholm, 29:108-11

Competition between trout and char, (Salmo trutta and S. alpinus)
According to MacPhee (1966), Svårdson "found that a hatchery trough environment favoured the survival of alpine chars over char X trout hybrids and these hybrids survived better than brown trout when all three fish were mixed together."

279 Tait, J.S. (1970) 284
J. Fish. Res. Board Can., 27(1):39-45
A method of selecting trout hybrids (Salvelinus fontinalis X S. namaycush) for ability to retain swimbladder gas.

A method was developed for selecting hybrid trout for deep-swimming ability, for use in a breeding program to combine in one strain the early-maturing character of brook trout (Salvelinus fontinalis) with the deep-swimming ability of lake trout (S. namaycush). The method involves testing hybrids in pressure tanks and selecting individuals that, like lake trout, retain most of their swimbladder gas during the test period. For a sample of F2 hybrids the range of pressures at which the fish floated when anaesthetized was almost entirely between the medians for samples of the two parent species. Successive tests of marked individuals showed good repeatability of floatation measurements. The method is concluded to be reliable for large-scale selection of fish with ability to retain swimbladder gas.

Tanner, H.A. (1959)
Colo.Outdoors, 8(4):12-5
New Trout for Colorado?

Discussion of trout hybrids, relative success of various crosses, and use of selective breeding to get desirable characteristics.

Taylor, D.M. (1969)
Ocean Ind., 4(12):43-9
Japan and the sea

Reference to Ryo Suzuki, "by cross-breeding rainbow trout and salmon, he has produced mutants that are healthy, have long lives and are a delight for fish lovers. But like most mutants, they cannot reproduce." Salmon not identified.

Terao, A. (1935)
Jap.J.Genet., 9(3):183
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Sci.Rep.Hokkaido Fish Hatchery, 16:51-62
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Issued also as Transl.Ser.Fish.Res.Board Can., (1047)(1968)

Reciprocal crosses of Oncorhynchus keta, O. nerka, and O. masou. The best results of fertilization, hatching and growth were obtained from reciprocal crosses of O. keta and O. nerka. Good results were also obtained from the hybrid between O. keta ♀ X O. masou ♂. Observations on the growth of two-year-old hybrids of O. keta ♀ X O. nerka ♂ and one-year-old O. nerka ♀ X O. keta ♂ after lake growth. Meristic and morphometric data.

Terao, T. et al. (1963)
Sci.Rep.Hokkaido Fish Hatchery, 18:45-58
Studies on the interspecific salmonid hybrids between chum salmon, Oncorhynchus keta (Walbaum) and kokanee salmon, Oncorhynchus nerka var. adonis (Jordan et McGregor). 1. Survival and growth from fertilized eggs to fry

285. Issued also as Transl.Ser.Fish.Res. Board Can., (1060)(1968)

Reciprocal crosses produced hybrids which compared favourably with their parents in hatching rate and grew faster in their first year.

286. Terao, T. et al (1964)
Sci.Rep.Hokkaido Fish Hatchery, 19:43-63

290
Studies on the interspecific salmonid hybrids between chum salmon Oncorhynchus keta (Walbaum) and kokanee salmon O. nerka var. adonis (Jordan et McGregor). 2. Transplantations of salmonid hybrids to Lake Shikotsu and Lake Okotampe
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287. Terao, T. et al. (1965)
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291
Studies on the interspecific salmonid hybrids between chum salmon Oncorhynchus keta (Walbaum) and kokanee salmon Oncorhynchus nerka var. adonis (Jordan et McGregor). 3. On some external characteristics and fertility of F₁ hybrids

288. Issued also as Transl.Ser.Fish.Res. Board Can., (1073)(1968)

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- 293 Tsuyuki, H. et al. (1965) 297
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