

Distribution, Age, and Size of Tagged Adult Steelhead Trout in the Snake River Drainage

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ABSTRACT—Steelhead trout, *Salmo gairdneri*, were tagged as adults at Little Goose Dam on the Snake River during the 1972 and 1973 spawning migrations. Recovery rates of tagged fish from the recreational fishery upstream from Little Goose Dam were 21.3 percent and 13.1 percent in 1972 and 1973, respectively. A 61 km section of the lower Snake River now flooded by Lower Granite Dam produced 42.6 percent of the sport catch in 1972 and 37.9 percent in 1973. Information was also obtained on the ocean-age composition of the fish and the timing of migration and size of steelhead trout recovered in four different river areas, including the Clearwater and Salmon River systems of Idaho.

INTRODUCTION

In the past, the lower Snake River supported a high quality recreational fishery for steelhead trout, *Salmo gairdneri*, returning to spawning grounds in Idaho, Oregon, and Washington. Construction of dams has nearly eliminated this fishery because the fishing gear now used is ineffective in catching steelhead trout in the pools above dams. The recent completion of Lower Granite Dam (February 1975) has inundated a 61 km section of the lower Snake River, further reducing the area available to the fishery.

In addition to losses to the recreational fishery, dams have altered the river environment to the detriment of anadromous fish. Serious declines in the escapement of adult steelhead trout to the Snake River drainage in 1973-74 have been attributed to passage problems at these dams, particularly turbine-related mortalities

of seaward migrants (Raymond, 1974¹, and Collins et al., 1975²). Gas bubble disease, resulting from high concentrations of dissolved atmospheric gas (Ebel, 1971), has been described as an additional cause of mortality of both juvenile and adult migrants.

Since 1968, the National Marine Fisheries Service (NMFS) has been conducting experiments to determine whether transporting valuable stocks of juvenile steelhead trout and Pacific salmon, *Oncorhynchus* sp., around dams on the Snake and Columbia Rivers could increase their survival without affecting their ability to home to parent streams (Ebel et al., 1973; Slatick et al., 1975). The fish were transported in tank trucks containing oxygenated water.

Returning adult steelhead trout from these studies were captured and tagged at Little Goose Dam in 1972-73. The

object of this tagging was to determine the distribution of these steelhead trout in the Snake River drainage and to assess the relative contributions of different areas to the recreational fishery, particularly the section of river to be inundated by Lower Granite Dam. Information on the timing of migration, size, and ocean-age composition of adult steelhead trout in the Snake River was also obtained. This report describes the results obtained from the tag recoveries.

MATERIALS AND METHODS

Steelhead trout utilized in this study were the adults returning from smolt releases that were marked to evaluate the transportation experiments conducted in 1969-72 at Ice Harbor and Little Goose dams by the NMFS. These fish had been tagged as juveniles with magnetic wire tags (Jefferts et al., 1963), cold branded with liquid nitrogen (Mighell, 1969), and released near the point of capture (control condition) or below Bonneville Dam (test condition). A device to detect magnetized wire tags on adult fish and to separate these tagged fish from the untagged fish (Ebel, 1974) was installed in the fishway at Little Goose Dam in 1972.

This facility operated during the adult migration seasons of 1972-73, automatically separating steelhead trout with magnetized wire tags from the rest of the population ascending the fish ladder. Each migration season covered portions of two calendar years. For example, steelhead trout from the 1972 run were captured at Little Goose Dam from the late summer of 1972 through the spring of 1973. Steelhead trout bearing wire tags were anesthetized, examined for cold brands, weighed, measured, and externally tagged with a dart or a jaw tag³. A scale sample was also taken for use in age studies.

Most tag returns were obtained directly from anglers but a substantial number (181) were recovered at the Dworshak and Pahsimeroi fish hatcheries. A few were also incidentally recovered in a creel census by Idaho Fish and Game Department personnel.

³Dart tags were size FT-2 manufactured by the Floy Tag Company. Jaw tag sizes ranged from 12 to 28 and were manufactured by the National Band Company. Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

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¹Raymond, H. L. 1974. Snake River runs of salmon and steelhead trout: trends in abundance of adults and downstream survival of juveniles. Northwest Fisheries Center, National Marine Fisheries Service, NOAA, Seattle, Wash. Processed rep., 6 p.

²Collins, G. B., W. J. Ebel, G. E. Monan, H. L. Raymond, and G. K. Tanonaka. 1975. The Snake River salmon and steelhead crisis: its relation to dams and the national energy crisis. Northwest Fisheries Center, National Marine Fisheries Service, NOAA, Seattle, Wash. Processed rep., 30 p.

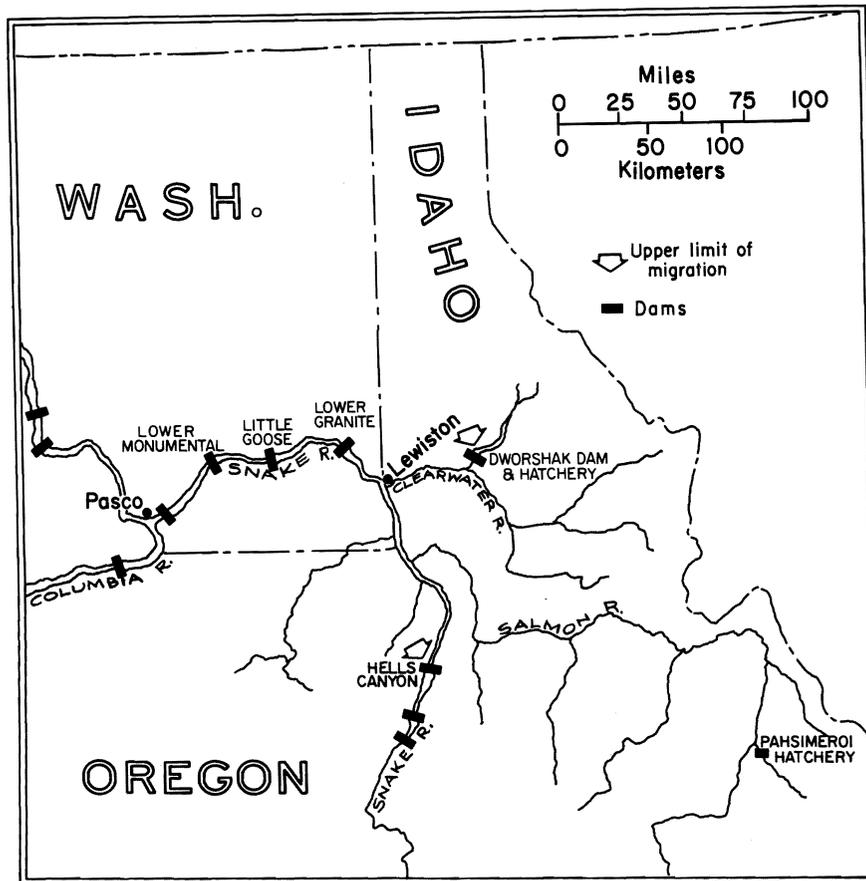


Figure 1.—Map of study areas showing the Snake River and its major tributaries.

Most tag returns from the recreational fishery were assigned to one of four major river areas (Fig. 1):

1. Lower Granite area: Lower Granite Dam to the confluence of the Snake and Clearwater Rivers at Lewiston, Idaho (about 50 km), thence upstream 10 km on the Snake River and 10 km on the Clearwater River.
2. Middle Snake River: About 160 km of the Snake River, from 10 km above Lewiston to the Hells Canyon Dam.
3. Salmon River system: The Salmon River and its tributaries.
4. Clearwater River system: The Clearwater River 10 km above its mouth and its tributaries.

The division of the river into four major segments enabled us to assess contributions to the recreational fishery from the area to be flooded by Lower Granite Dam, the mainstream Snake River, and the Salmon and Clearwater River systems.

Tag Recoveries

During tagging operations at Little Goose Dam, 696 and 1,387 adult steelhead trout were tagged in 1972 and 1973, respectively.

Tag recoveries from all sources for the 1972-73 seasons totaled 203 and 334 (29.2 and 24.1 percent), respectively. In both seasons, the ranking of areas by number of returns were: 1) Clearwater River system, 2) Lower Granite area, 3) Salmon River system, and 4) Middle Snake River. Downriver areas produced a small number of recoveries from spawned-out steelhead trout returning to the ocean, primarily during the 1972 season. The majority (21.3 percent in 1972) of the fish were recovered from the fishery. The Lower Granite area was the foremost producer, with 42.6 percent of the total recreational catch in 1972 and 37.9 percent in 1973. Recoveries from the other major areas ranged from 13.5 percent in the Middle Snake River to 20.2 percent in the Clearwater River during 1972 and from 8.8 percent in the Middle Snake River to 23.6 percent in the Clearwater River during 1973 (Fig. 2).

Timing of Recoveries

The recovery pattern by month for the four major catch areas was similar in 1972 and 1973 (Fig. 3). During both seasons, the Lower Granite and middle

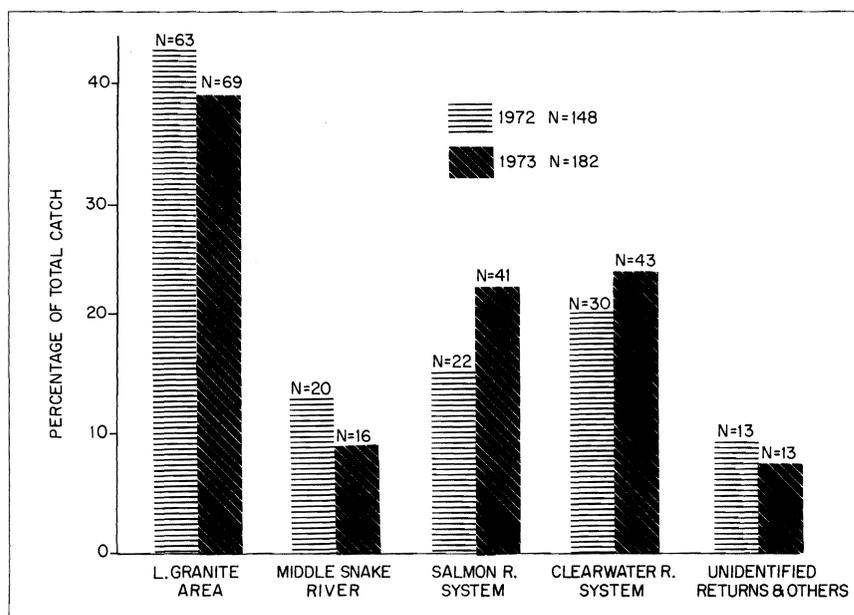
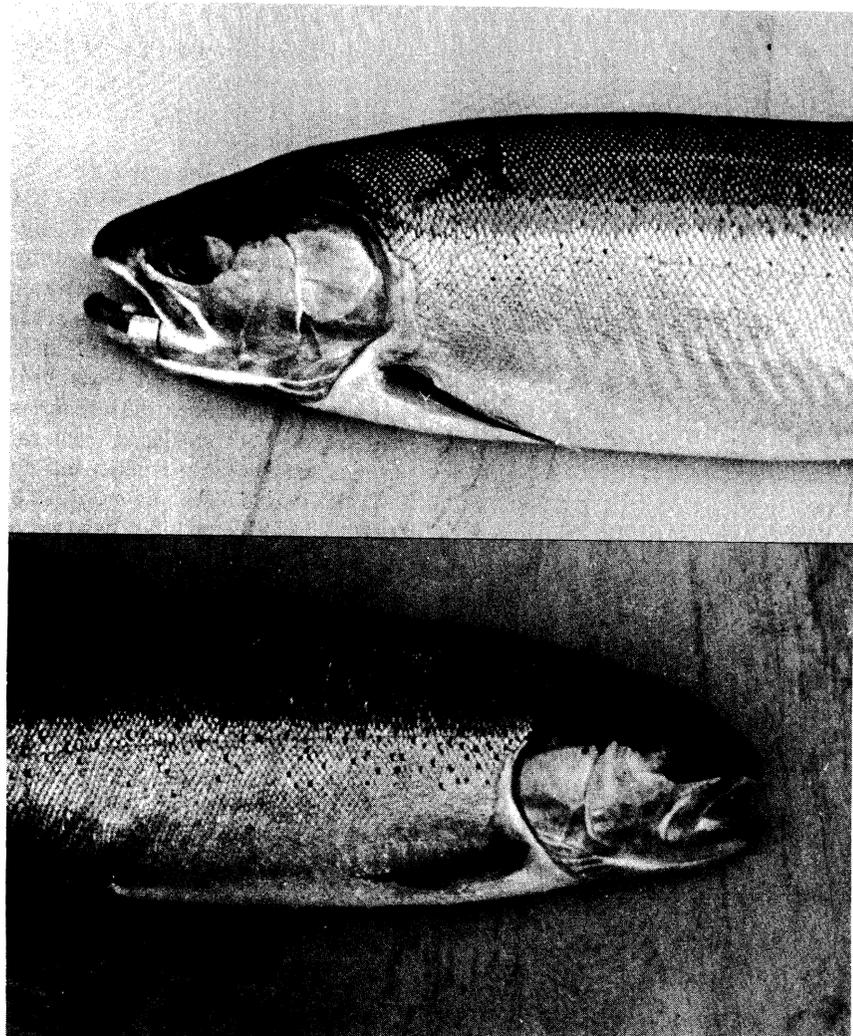


Figure 2.—Recovery (percentage of total catch and numbers of fish) of marked steelhead trout taken by recreational anglers in the different river areas, 1972-73.



Adult steelhead trout with lower jaw tag and cold brand (top) and cold brand tag (bottom).

Snake River recovery distributions were nearly identical as were the distributions from the Salmon and Clearwater River systems. From 83 to 95 percent of recoveries in the Lower Granite area and Middle Snake River areas were taken before 1 January; 48 to 65 percent of those taken in the Salmon and Clearwater River systems were recovered during the same period. A substantial percentage of recoveries from the Salmon and Clearwater systems (35-52 percent) were taken after 1 January, as opposed to only 5-17 percent taken from the Lower Granite and Middle Snake River areas. The distribution of catch by time reflects the proximity of the fish populations to the spawning ground as maturation approached.

The average days of freedom for fish taken in a given area were similar for the 1972 and 1973 seasons. Steelhead

trout recovered in the Lower Granite area averaged about 4 weeks at liberty; those in the Middle Snake River averaged nearly 6 weeks; and the Salmon and Clearwater River recoveries, about 12 weeks of freedom before capture. The first tags were recovered in the Lower Granite and Middle Snake River areas within 4 to 5 days from time of release in 1972-73. The first recovery in the Salmon and Clearwater River systems was taken in 8 days in 1973; however, the average period of freedom was more than 11 weeks for fish caught in this area.

Ocean-Age Composition

Nearly all of the steelhead trout tagged at Little Goose Dam during the 1972-73 seasons had been at sea for either 1 or 2 years. Only a small number (less than 0.5 percent of fish tagged) spent 3 years in the ocean.

The ocean-age composition of steelhead trout tagged at Little Goose Dam during the 1972 season was 54 percent 1-ocean, and 46 percent 2-ocean; for the 1973 season, the composition was 40 percent 1-ocean, and 60 percent 2-ocean. We believe the ocean-age composition noted in the 1973 season more nearly represents the usual composition of Snake River steelhead trout. The unusually large percentage of 1-ocean fish in 1972 was probably due to large numbers of smolts wire-tagged in 1971 compared to a relatively small number tagged in 1970 (2-ocean returns in 1972). Age composition among the four areas of the recreational fishery varied considerably with the Lower Granite area having the highest percentage of 2-ocean fish in both 1972 and 1973. The Middle Snake River catches had the highest percentage of 1-ocean fish in 1972; but in 1973, the Salmon River had the highest percentage of 1-ocean fish.

Length and Weight

Length of 1-ocean steelhead trout captured at Little Goose Dam during the 1972-73 seasons ranged from 48 to 75 cm (average 62 cm); weight varied from 0.9 to 4.5 kg and averaged 2.4 kg. Length of 2-ocean fish ranged from 59 to 100 cm (average 82 cm); weight ranged from 1.8 to 10.2 kg with an average of 5.6 kg. The five 3-ocean fish that were recovered ranged from 83 to

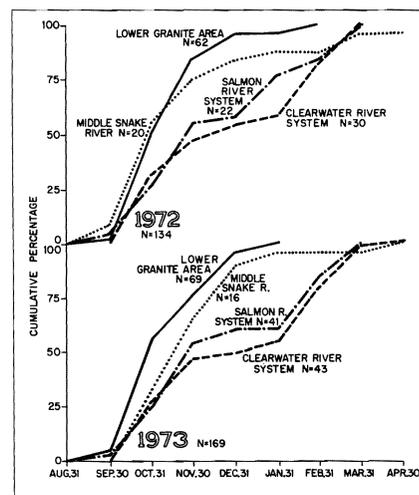
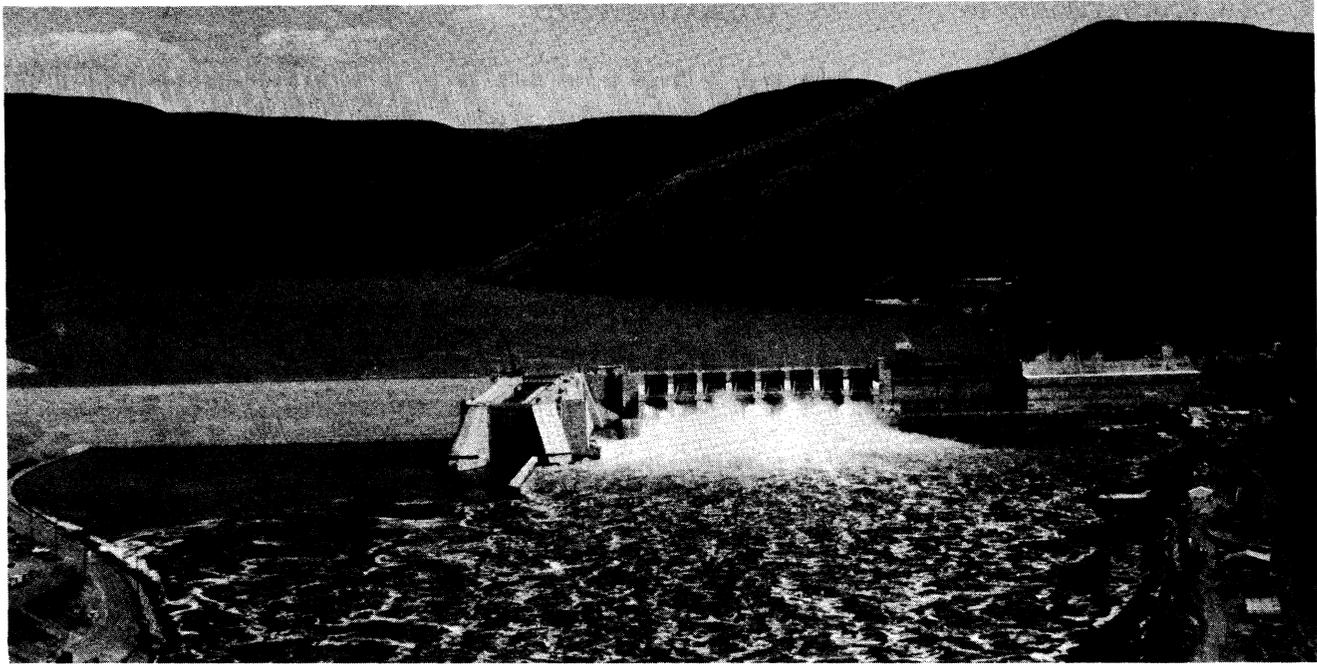


Figure 3.—Recovery (cumulative percentage) of marked steelhead trout taken by recreational fishers in the different river areas by month during 1972-73.



Lower Granite Dam

96 cm in length and weighed from 6.0 to 10.4 kg.

The size of fish taken in the sport fishery was essentially the same as that observed at Little Goose Dam. It appeared, however, that the average size for a given ocean-age group was larger in areas immediately above the dam (i.e., the Lower Granite area and Clearwater River) compared to upriver areas such as the Salmon River.

DISCUSSION

Steelhead trout ascending the Clearwater River are known to be predominantly 2-ocean age while those ascending the Salmon River are 1-ocean⁴. Tag returns during this experiment further substantiate these findings

⁴Pers. commun. with Steve Pettit, Idaho Fish and Game Department, Lewiston, Idaho.

(Table 1). There is obviously some variation in the ocean-age composition of steelhead trout ascending the Snake River from year to year. It is our opinion, however, that the percentage of 1-ocean fish we reported for 1972 was unusually high for all areas because only a small number of smolts were marked in 1970 (the 2-ocean year class). Steelhead trout recovered from the Clearwater River and the Lower Granite area were of the same general age (mostly 2-ocean), suggesting that the Lower Granite area was a major holding area for those fish destined for the Clearwater River.

A major part of the Lower Granite area is an interstate fishing area; that is, it is readily accessible and legally fished by residents of both Washington and Idaho. Fishery management problems may emerge with the virtual

removal of this section of river from the fishery. For example, it now appears that Washington anglers will not be successful (Tri-State Steelheaders Inc., 1970) in catching highly-prized Clearwater River-bound steelhead trout as in the past, because the entire Snake River downstream from the Clearwater River is now a reservoir. Assuming that fish populations are restored to pre-1973 levels, more steelhead trout will be available to anglers in both Clearwater and Salmon River drainages in Idaho. Management programs in these areas (especially the Clearwater River) may have to be modified to adjust for increased fishing pressure if the Lower Granite fishery shifts to the Clearwater River.

Tag loss from the rigors sustained by the fish during migration and the nonresponse of anglers catching tagged fish are factors affecting observed recovery rates. Butler (1962) stressed nonresponse, concluding that angler interest and recovery efforts by the tagging agency were of primary importance. Creel census effort in this study was not a factor because the majority of tags were returned voluntarily. Lacking estimates of tag loss and the factor of nonresponse in our studies, the recovery rates reported should be considered minimal.

Table 1.—Ocean-age composition of steelhead trout recovered in the different fishing areas and at the Little Goose Dam adult separator during the 1972-73 seasons.

| Recovery site | No. of fish | | Percentage 1-ocean | | Percentage 2-ocean | |
|-------------------------|-------------|-------|--------------------|------|--------------------|------|
| | 1972 | 1973 | 1972 | 1973 | 1972 | 1973 |
| Fishing areas | | | | | | |
| Lower Granite area | 62 | 69 | 47 | 22 | 53 | 78 |
| Middle Snake River | 20 | 16 | 72 | 50 | 28 | 50 |
| Salmon River system | 22 | 41 | 64 | 63 | 36 | 37 |
| Clearwater River system | 30 | 43 | 63 | 23 | 37 | 77 |
| Total | 134 | 169 | 58 | 35 | 42 | 65 |
| Little Goose Dam | 696 | 1,387 | 54 | 40 | 46 | 60 |

ACKNOWLEDGMENTS

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LITERATURE CITED

- Butler, R. L. 1962. Recognition and return of trout tags by California anglers. *Calif. Fish Game* 48:5-18.
- Ebel, W. J. 1971. Dissolved nitrogen concentrations in the Columbia and Snake Rivers in 1970 and their effect on chinook salmon and steelhead trout. U. S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-646, 7 p.
- _____. 1974. Marking fishes and invertebrates. III. Coded wire tags useful in automatic recovery of chinook salmon and steelhead trout. *Mar. Fish. Rev.* 36(7):10-13.
- Ebel, W. J., D. L. Park, and R. C. Johnsen. 1973. Effects of transportation on survival and homing of Snake River chinook salmon and steelhead trout. *Fish. Bull., U. S.* 71:549-563.
- Jefferts, K. B., P. K. Bergman, and H. F. Fiscus. 1963. A coded wire identification system for macro-organisms. *Nature (Lond.)* 198:460-462.
- Mighell, J. L. 1969. Rapid cold-branding of salmon and trout with liquid nitrogen. *J. Fish. Res. Board Can.* 26:2765-2769.
- Slatick, E., D. L. Park, and W. J. Ebel. 1975. Further studies regarding effects of transportation on survival and homing of Snake River chinook salmon and steelhead trout. *Fish. Bull., U. S.* 73:925-931.
- Tri-State Steelheaders, Inc. 1970. Steelhead fishing method study: Lake Sacajawea, Washington. Tri-State Steelheaders, Inc., Walla Walla, Wash., 57 p.

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