

Cummings

Biology of Columbia River Shad and the  
Development of Selective Commercial Fishing Gear

Progress Report

January 1969 - September 1970

by

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November 1970

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INTRODUCTION

A shad study was initiated January 1, 1969, to find ways to selectively harvest shad without jeopardizing the reduced run of summer chinook in the Columbia River and to learn more about the life history of shad so they could be managed more effectively. To accomplish these objectives, various types of gear were tested for their ability to catch shad selectively, and adult and juvenile shad from several different sources were sampled for biological information.

HISTORY OF THE RUN

Shad were introduced to the Pacific Coast from the Hudson River in 1871 by plants in the Sacramento River. Further plants were made in the Columbia River in 1885, but by that time shad derived from the previous Sacramento River plantings had already reached the Columbia River. Shad now occur from the Mexican border to Cook Inlet, Alaska, with the commercial fishery concentrated primarily between San Francisco and the Columbia River. *Cal season closed in 57*

Shad were abundant in the Columbia River as far upriver as Celilo Falls prior to the construction of Bonneville Dam. Most spawning probably occurred below the present site of Bonneville Dam as evidenced by the small numbers of shad passing Bonneville Dam upon its completion and the large commercial catches of shad (as many as 376,000 during a single season) prior to the construction of Bonneville Dam.

Figure 1 shows the dramatic increase in the shad run following the construction of The Dalles Dam in 1957 as shad extended their range far up the Columbia River and utilized the reservoirs as spawning and rearing areas.

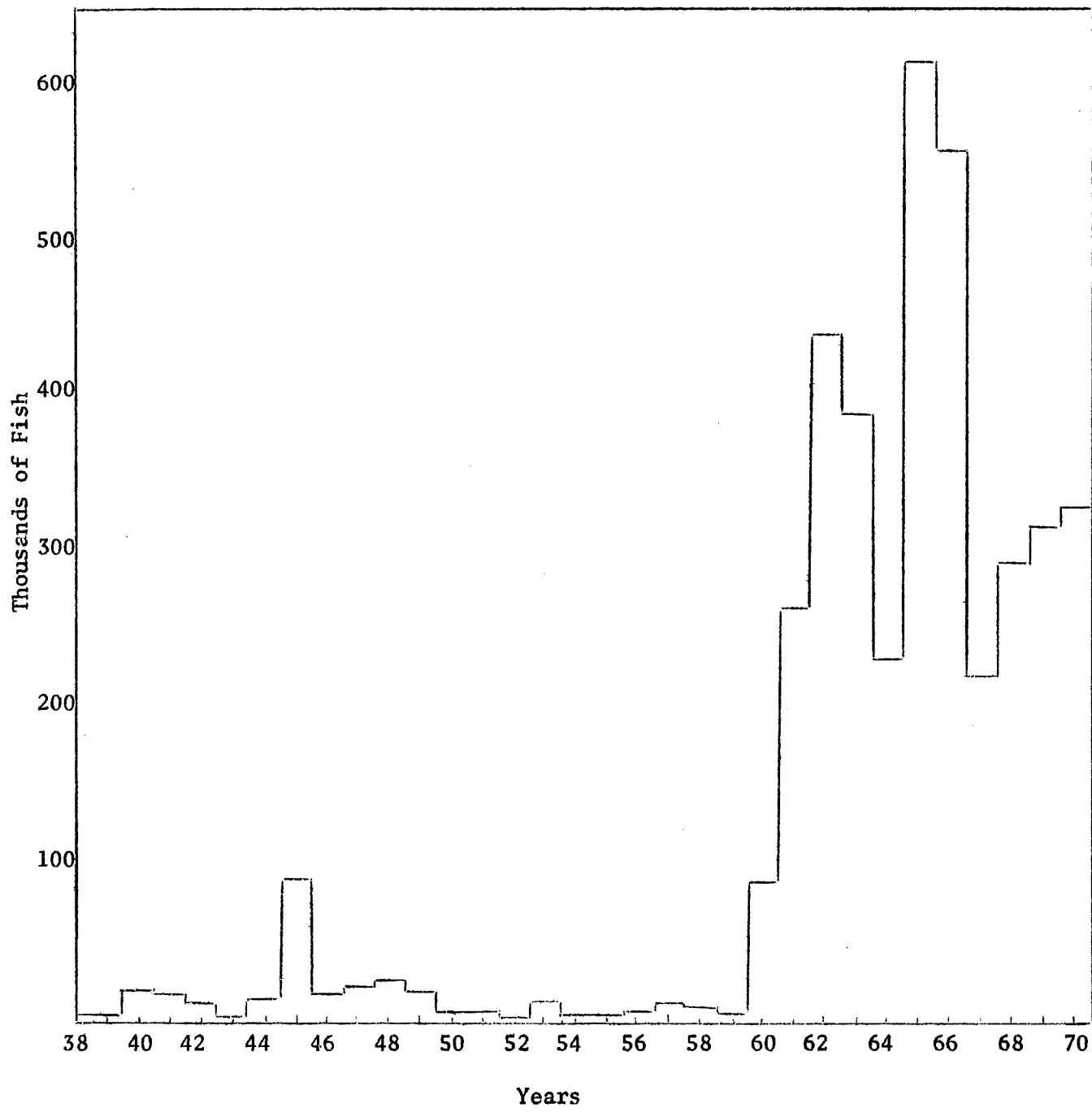


Figure 1. Annual Counts of Shad at Bonneville Dam, 1938-70

The peak count of shad at Bonneville Dam in recent years was 617,000 in 1965, with an additional 85,000 shad caught in the commercial fishery immediately below Bonneville Dam. Annual shad runs to the Columbia River average in excess of 1,000,000 fish, assuming that the lower river populations have not decreased greatly since the construction of Bonneville Dam. Of these an average of only 140,000 have been caught commercially over the last 6 years and most of those were from the upriver portion of the run.

Studies on Atlantic Coast streams indicate that a harvest of at least 50% is usual on intensively fished runs (Walberg, 1957), while a maximum harvest of about 14% is occurring in the Columbia River.

#### HISTORY OF THE FISHERY

Shad have been caught commercially in the Columbia River since 1888 with landings reflecting the price to the fisherman rather than their abundance (Figure 2). Shad are valued primarily for their roe although the flesh is considered quite palatable by some despite a profusion of small bones.

Shad were caught primarily during the summer salmon season prior to 1953, when shad fishing was conducted without season restrictions; however, mesh size restrictions were in effect during the closed period between the spring and summer salmon seasons. In 1955 the shad season was made to conform with the spring and summer salmon seasons because of the high incidental catch of salmon during the shad-only season. From 1955 to 1964 most of the shad catch was made during the summer salmon season.

With the complete closure of the summer season in 1965 to protect declining stocks of summer chinook, a shad season was allowed in the 22-mile Oneonta-Dodson area from June 20 - July 15 to harvest a part of the increasing upriver shad run. This season was considered successful because the

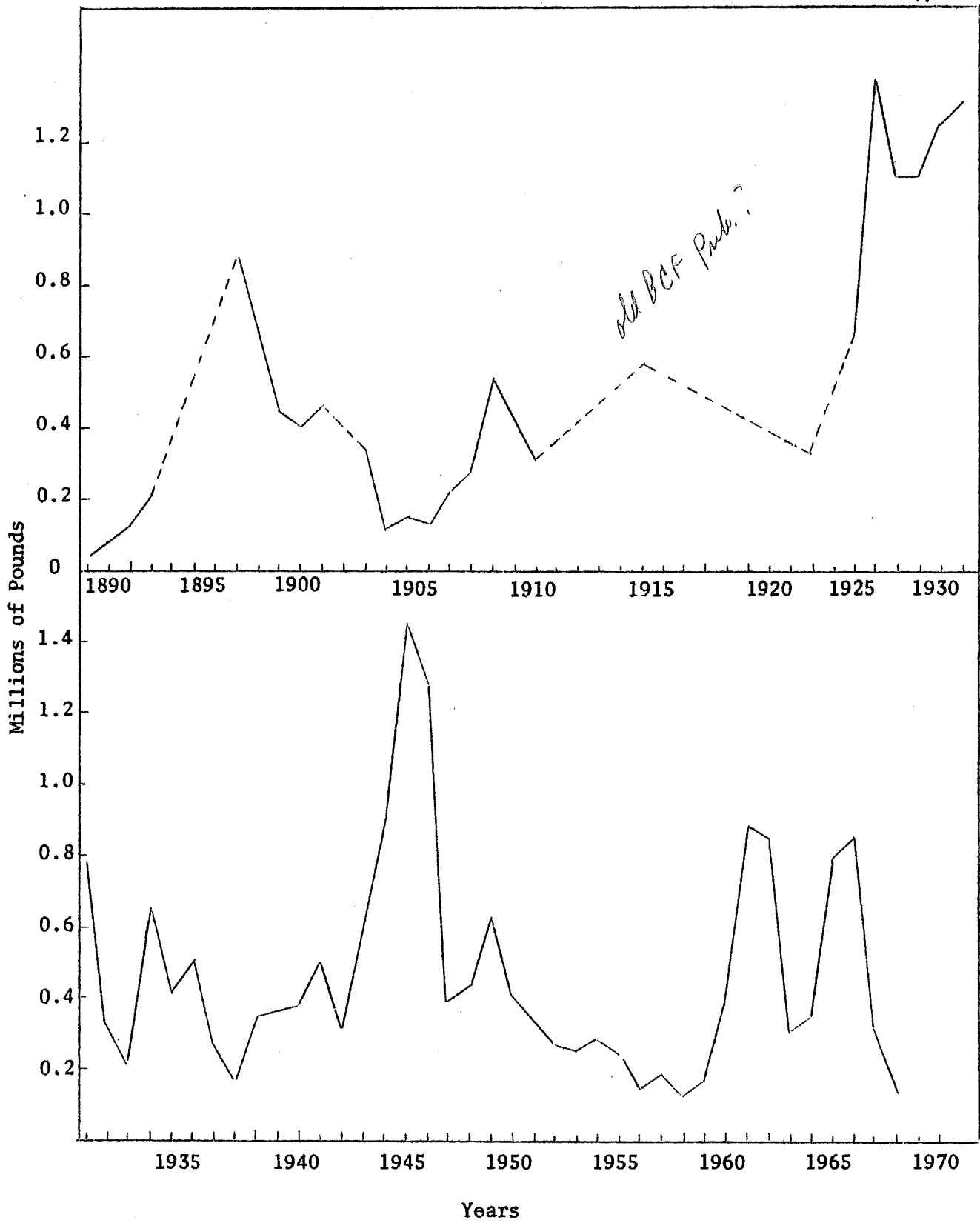


Figure 2. Annual Columbia River Shad Landings, 1889-1970 <sup>1/</sup>

<sup>1/</sup> Dashed line indicates years for which landings were not available.

salmonid catch was small as only 35 fishermen participated in the fishery. In 1966 the season was further liberalized by time and area to include a lower 38-mile area between St. Helens and Gary Island, but an unacceptable catch of summer chinook occurred because a higher proportion of the catch was chinook and fishing effort was greater than in 1965.

The fishing area remained the same in 1967 but fishing was restricted to daylight hours in an attempt to reduce the incidental salmon catch which had proved to be higher during night-time drifts in 1966. The chinook catch in 1967 was also unacceptable with an estimated 10,000 chinook handled to catch 198,000 shad.

In 1968 a 4-day experimental season was allowed in the usual shad fishing area between Gary Island and the commercial fishing deadline below Bonneville Dam to test more stringent gear restrictions recommended by fishermen and industry representatives. The additional gear restrictions did not substantially decrease the salmonid catch and the shad season was closed.

#### HARVEST METHODS TESTED

Beach seines, purse seines, and set nets were tested in an attempt to find gear that would effectively harvest shad.

##### Beach Seines

Beach seining was done with a 600' x 18' beach seine and five-man crew. The seine was too big for only five men to handle under the high flow conditions encountered during peak shad abundance. Power equipment would be required to operate a beach seine large enough to catch commercial quantities of shad.



### Purse Seines

A purse seining barge and 500' x 15' purse seine was borrowed from the National Marine Fisheries Service. Several hauls were made in the Oneonta-Dodson area but fish were caught only when the seine dragged bottom. Few shad were caught and the gear was unwieldy in the strong currents encountered.

### Set Nets

Set nets were found to be impractical in the main current of the Columbia River during the spring freshet because they quickly filled with debris and the force of the current pulled the cork line under.

### Special Fishing Areas

New fisheries were developed in 1970 in spawning areas along the lower Columbia River. Experimental set-net fisheries were allowed in the John Day, Youngs, Lewis and Clark, and Walluski rivers, and a drift net permit fishery in Taylor Slough on the Columbia River near the mouth of the Sandy River. Commercial quantities of shad were caught in all areas and we are recommending that they be continued in 1971.

## LIFE HISTORY STUDIES

### Adult Sampling

The adult shad population has been sampled for age composition, length, weight, sex and condition and weight of roe from the north shore ladder at Bonneville Dam and the commercial landings of the Washougal Reef and Dodson-Oneonta area fisheries.

Population samples were obtained from the 1969 and 1970 runs at the National Marine Fisheries Service Laboratory located along the north shore

ladder at Bonneville Dam. Samples from the population were then compared to those from the commercial fishery to determine both the effect of the fishery upon the population and the quality of the fish that were escaping the fishery. The difference in average weight and age composition between the population sample and the commercial fishery sample indicated that a considerable portion of the harvestable roe shad are not available to the commercial fishery because of their smaller size. Roe samples from shad taken from the ladder at Bonneville Dam were taken to a fish buyer who indicated that it was of superior quality to the roe taken in the commercial fishery because of its smaller size. ?

Scale analysis revealed 73% repeat spawners in shad caught from the Washougal Reef (which spawn below Bonneville Dam), while only 53% repeat spawners were found in the shad caught from the Oneonta-Dodson area fishery (which spawn above Bonneville Dam), indicating the above-Bonneville run had a higher mortality of adult shad attempting to return to the ocean after spawning.

#### Juvenile Sampling

Juvenile shad were sampled in 1969-70 from the inclined-plane trap located in the fingerling by-pass at Bonneville Dam to determine both time and size at emigration. Peak catches were made in January rather than in November as shown by previous sampling by Larson in 1961. Also the juveniles were considerably larger than in the 1961 sampling indicating more favorable rearing conditions than experienced in 1961.

Some juvenile shad have been found emigrating from the lower Columbia River in May and June rather than late fall and winter as most migrants do. Whether these fish rear in the Willamette or Columbia is not now known.

*Some in  
Will.*

In 1970 large numbers of sea gulls were observed feeding upon juvenile shad in December as they came through the turbines at both John Day and Bonneville dams. Also, reports of great numbers of juvenile shad along the Washington shore were received after a period of spill at Bonneville Dam during the peak of emigration in 1970.

#### DISCUSSION AND CONCLUSIONS

The history of the gill-net fishery for shad in the Columbia River has demonstrated that commercial quantities of shad cannot be harvested with gill nets in the main Columbia River when chinook salmon are abundant without a large catch of chinook salmon. Set nets and seines in the main Columbia River were found to be impractical in harvesting shad selectively because of the freshet conditions during peak shad abundance and the abundance of summer chinook in the same area at the same time.

Fishermen and buyers were told that they would catch more roe shad if they used smaller nets, based upon information obtained from comparing Bonneville Dam samples with commercial fishery samples, but they felt that it would not be worth doing because they would also catch more buck shad which they normally discard. *Got food?*

Small fisheries have been developed in slough and tributary waters of the Columbia River, but the landings from these areas are relatively small and shad destined for above Bonneville Dam are not harvested.

Adult shad population samples have been obtained for 2 years at Bonneville Dam and will be continued as long as is practical. They provide valuable information on the age composition and time of passage by sex and age of the population above Bonneville and are useful in determining the effect of the commercial fishery upon the population. *how*

Samples from juvenile shad have been obtained for one emigration period and are continuing for the next period. This sampling provides information that is useful in determining the time and size of the emigration of juvenile shad from the upper Columbia River.

#### RECOMMENDATIONS

In order to adequately harvest the surplus of shad in the Columbia River, I recommend the following:

1. The enhancement of the summer chinook run so that a greater incidental salmonid catch can be permitted during the shad season allowing a season to be set covering the entire period when shad are abundant in the lower Columbia River. The summer chinook run might be increased in the following ways:
  - a. Transport juveniles around dams.
  - b. Rear summer chinook in hatcheries.
  - c. Screen turbine intakes on all main stem dams.
  - d. Improve upstream passage conditions for adults.
  - e. Decrease nitrogen levels in Columbia River.
  - f. Improve natural production potential.
2. The harvest of shad from the ladders at Bonneville Dam with shad being sold by the state to the highest bidders. When Bonneville Dam is modified in the near future, it would be relatively simple to incorporate a system by which shad and salmon would sort themselves at a weir in the ladder and the surplus shad could be harvested inexpensively at that time. The quality of shad roe taken from samples at Bonneville Dam has been found to be high throughout the migration period.

A short 13-day shad season was allowed in 1970 in which fishermen were allowed to retain all species caught. A similar season is being recommended for 1971. This season does not provide for an adequate harvest of shad from the run but allows some shad to be caught without an excessive catch of summer chinook. This season differs from prior year's seasons in that it opens after the peak of the endangered Snake River segment of the summer chinook run has passed causing the summer chinook harvest to be primarily from the healthier upper Columbia River portion of the run.

I recommend that the shad study be continued. Biological information is necessary in order to manage the commercial fishery and it will be collected routinely from the fishery. Samples from the adult population at Bonneville Dam should be collected whenever it is possible to do so. Juvenile shad sampling should continue at Bonneville Dam as long as the by-pass trap is available.

Monitoring of landings from the Youngs Bay and John Day set-net fisheries, Washougal Reef and Taylor Slough drift-net fisheries should be continued, and the search continued for spawning areas in the sloughs of the Columbia where shad may be harvested without catching salmonids.

At the present level of funding and manpower, only the above-mentioned management objectives may be accomplished. In addition to these important objectives, there is much research that needs to be done:

1. A tagging study is needed to estimate the lower river population of shad. There is no way at the present time of knowing the fishing intensity on this portion of the run.
2. Research is needed to identify shad spawning areas throughout the Columbia River system.

3. Some research has been done by the National Marine Fisheries Service concerning the high mortality of adult shad in the ladders of Johh Day Dam, but more research is needed on upstream passage problems of adult shad both at Columbia River main stem dams and the new ladder at Willamette Falls which appears to be a total block to migrating adult shad possibly because of weir design.
4. Little is known about the food habits and factors important to the rearing of juvenile shad in Columbia River reservoirs and the Willamette River. We have found that the time of peak emigration has changed greatly over the passed ten years. Studies are needed to enable us to better understand this change in timing.
5. Little is known of the primary mortality factors operating on juvenile shad as they emigrate to the ocean. Reports were received in December and January of 1969-70 of large numbers of juvenile shad washed up on the shore below Bonneville Dam following the infrequent periods of spill that occur at this time of year. Research is needed to determine the precise cause of these mortalities and corrective measures which can be taken to prevent this from occurring in the future.
6. There is an emigration of relatively large juvenile shad from the lower Columbia River below the confluence of the Willamette River during late May and early June. There is no record of similar emigration in shad literature. Research is needed to determine precisely where these fish rear, what causes them to delay their emigration, and whether they survive to contribute to the fishery as adults.

## LITERATURE CITED

Walburg, Charles H. and James E. Sykes. 1957. Shad fishery of Chesapeake Bay with special emphasis on the fishery in Virginia. Fish and Wildl. Serv. Res. Rep. 48 p.

Distribution

Schoning

Kruse

Haas

Portland File - 1

Hublou

Columbia River Investigations - 10

Clackamas File - 1

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