

OBSERVATIONS ON AGGRESSIVENESS IN SOCKEYE SALMON SMOLTS.—Juvenile sockeye salmon are usually strongly schooling fish (Hoar, 1954, Jour. Fish. Res. Bd. Canada, 11(1): 72). However, during laboratory observations on the behavior of juvenile salmon, aggressiveness in sockeye smolts was noted on several occasions. Hoar observed this too (*op. cit.*), stating that nipping by sockeye smolts does not have the vicious appearance of coho nipping and never elicits a retaliation.

In the Fish Behavior Laboratory, United States Fish and Wildlife Service, Seattle, Washington, we conducted tests which confirm this observation and suggest that this behavior is defense of territory.

Three individuals were removed from a group of schooling sockeye smolts and placed in a three-chambered tank. They were allowed to adjust over night, then a fourth individual was introduced. There was no immediate response, but soon one of the "resident" fish cautiously approached the newcomer, then swam away. This took place several times until the newcomer turned away. The resident fish renewed his motions which then began to have a menacing air. Usually the newcomer took flight and chase was given by the aggressor. The chase was of short duration and seldom, if ever, seemed to involve any bodily contact. On one occasion, however, with some very silvery smolts, there was biting

or nipping and numerous scales were observed floating in the water.

The unwelcome stranger was usually displaced over a sill into another chamber where the process was repeated. The initial resident was not always successful; at times the intruder also made menacing moves and in some instances drove out the resident.

Fish which have been engaged in this chasing activity, when transferred to a larger, undivided tank containing several other fish, again schooled. Therefore, spatial relationships, container size, and numbers of fish appear to influence this behavior.

Having repeated this with young sockeye which had varying lengths of time in "residence" in the experimental tank, we believe that the aggressiveness is reinforced with more time in the chamber. Fish that were in the chambered tank for three days actually made bodily contact and produced abrasion, while other groups that were acclimatized either over night or for a few hours prior to adding the extra fish usually just chased the intruder.

Behavior of this type is of more than passing interest and must be taken into account when designing experiments which utilize small sized samples of fish. A sequence of this behavior has been filmed for future reference and study.—H. WILLIAM NEWMAN, *United States Fish and Wildlife Service, Bureau of Commercial Fisheries, Seattle, Washington.*