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THIRD REPORT ON TESTS WITH AMYTAL SODIUM AND  
SECONAL SODIUM IN TRANSPORTATION OF TROUT

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By

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Another series of tests using Amytal Sodium and Seconal Sodium for transportation of trout was made at Grayling hatchery on October 7 and 8, and at Harrietta hatchery on October 18, 1954, in tanks used by the hatcheries for transporting trout. The purpose of these tests was to determine whether one drug was more satisfactory than the other for carrying double the normal load of rainbow trout measuring from five to ten inches long; whether water introduced to the tanks by spray had any advantage over the customary introduction by jet; whether the drugs would be as effective when oxygen was used instead of recirculation for aeration; and to look for the factor(s) that limits the length of time fish can be held in the tanks. In previous tests it was found that a mortality occurred in the tanks after a certain length of time although oxygen was still present in amounts of 5 p.p.m. or more.

First Test:

At Grayling on October 7, each of four tanks was loaded with 250 pounds of rainbow trout measuring five to eight inches in length. These fish had been starved for 72 hours. The tanks were in two series, one fitted with jets and one with sprays. Seconal Sodium was used in this test. The initial

temperature in both series of tanks was 42° F. After one hour and 30 minutes, temperature rose to 46° F. in the jet tanks and to 49° F. in the spray tanks. The test in the jet tanks was terminated at this time because of failure of the pump motor. The test in the spray tanks was stopped after four and one-half hours at which time the fish were still in good condition. Table 1 gives the results.

#### Second Test:

On October 8, Amytal Sodium was used in a test on legal-sized rainbow trout that had been starved for 72 hours. Two spray tanks and two jet tanks were loaded with 250 pounds (double load) of fish. The test was started at 10:00 a.m. At 11:30 a.m., to facilitate taking samples, the spray in one tank was turned off. Unfortunately, the spray was not turned on again until 11:50 a.m. By this time the fish in both spray tanks were in poor condition. Because the same water was recirculated through both tanks of each series, one spray did not supply adequate oxygen for the fish in two tanks. They seemed to revive when the spray was turned on, but by 12:50 p.m. they were still in poor condition and were hastily removed from the spray tanks. A water sample was taken at that time. Since there appeared to be some loss in the jet tanks at 1:00 p.m., the jet test was terminated. The results are given in Table 2.

#### Discussion

Because the motor for the jet tanks stopped early in the first test, and the spray was inadvertently turned off early in the second test, no comparison is possible between spray and jet tanks. The incidents also prevent comparison between the drugs Amytal Sodium and Seconal Sodium. However, some useful information was gained.

*Dose? - what chemical?*

Table 1

Time	Oxygen, p.p.m.		Ammonia, p.p.m.		Carbon dioxide, p.p.m.		Temperature		Remarks
	Spray	Jet	Spray	Jet	Spray	Jet	Spray	Jet	
10:00 a.m.	12.2	13.0	0.52	0.36	0.0	0.0	42° F.	42° F.	
10:30 a.m.									Fish put into tanks.
11:40 a.m.	6.5	6.8	3.28	2.65	16.0	17.0	49° F.	46° F.	
12:00 m.									Motor stopped in jet tanks. Removed fish. Loss, 62 fish.
1:20 p.m.	6.6	...	6.8	...	12.0	...	47° F.	...	
3:10 p.m.	6.4	...	7.9	...	12.0	...	50° F.	...	Loss in spray tanks---0.

*Dose? what chemical*

Table 2

Time	Oxygen, p.p.m.		Ammonia, p.p.m.		Carbon dioxide, p.p.m.		Temperature		Remarks
	Spray	Jet	Spray	Jet	Spray	Jet	Spray	Jet	
10:00 a.m.	12.2	13.0	0.54	0.33	14.0	16.0	46° F.	46° F.	Fish put into tanks.
11:30 a.m.	7.4	6.4	3.78	2.2	11.0	12.0	47° F.	46° F.	
12:50 p.m.	9.6	...	6.1	...	13.0	...	45° F.	...	Fish were removed from spray tanks. Loss 435 fish.
1:00 p.m.	...	8.2	...	4.08	...	14.0	...	42° F.	Fish were removed from jet tanks. Loss 141 fish.

A double load of sublegal rainbow trout was successfully held in the spray tank for four and one-half hours by using Seconal Sodium in the recommended dose of 1/4 grain per gallon of water at temperatures ranging from 43° F. to 50° F.

Using the jet, and Amytal Sodium as recommended (1/2 grain per gallon), a double load of rainbow trout held for three hours sustained a loss of 141 fish.

Previous to these tests it was thought that introducing recirculated water into the tanks by spray instead of jet would permit gases, such as ammonia, to escape more readily and prevent their accumulation to a lethal concentration. In these tests, however, more ammonia remained in the spray tanks than in the jet tanks. Further tests are planned in which various types of sprays will be used. It was noted that the jet caused much more foaming in the drugged water than did the spray. Whether this behavior was responsible for the difference in ammonia is not known. There appears to be a difference of opinion among reported studies as to the amount of ammonia that is lethal to fish. In the present tests, although the ammonia increased from 0.52 p.p.m. to 7.9 p.p.m. (see Table 1) fish were not adversely affected.

#### Third Test:

A test was made at Harrietta hatchery on October 18, 1954, in which Amytal Sodium and Seconal Sodium were used on double loads of rainbow trout in tanks aerated by oxygen instead of by water recirculation. Four tanks were set up, two with rainbow trout up to six inches long and two with legal-sized rainbow trout. As before, the fish had been starved for 72 hours. One tank of each size of fish was used for control and had no drug introduced. Seconal Sodium was used on the smaller fish and Amytal Sodium on the larger fish. Because of the low air temperature, water temperatures in these tests were lower than in previous tests, ranging from 38° F. to 39° F.

The oxygen flow to the tanks was set up by men who had had experience in transporting fish across the Straits of Mackinaw, where oxygen is used while aboard the car-ferry. Aerators used were the perforated rubber tubes commonly employed at the Harrietta hatchery. The usual variation in discharge characteristic of this type of aerator occurred during these tests. This results in a difference in the amount of oxygen introduced into each tank so that the oxygen content of the water in the various tanks does not reflect oxygen consumption by the fish. Oxygen content of the water was recorded in these tests only to indicate an oxygen deficiency. When a double load of fish is carried, oxygen depletion may occur very rapidly. By checking the oxygen at intervals, the fish can be quickly moved to fresh water before depletion occurs.

Equipment for making analyses for ammonia was not available during these tests.

All fish were in the tanks by 9:50 a.m. Oxygen analyses are given in Table 3.

#### Discussion

The sub-legal control fish appeared to be in poor condition after two hours in the tank and were removed to a cement tank in the hatchery building for observation. About one hour later, the sublegal secondal fish were removed for the same reason and put into another cement tank in the hatchery. Both groups were observed for about two hours before being returned to the ponds. Twenty-three of the control fish died, whereas only one of the secondal fish was observed dead in the cement tanks. However, after transfer to the pond, an additional 28 fish died. Apparently some factor in the transfer was responsible. Although both groups were in a very weakened condition when removed from the transporting unit, only a very small mortality actually occurred.

Table 3

Time	Oxygen, p.p.m.		Temperature	Oxygen, p.p.m.		Remarks
	Sub-legal trout			Legal trout		
	Seconal Sodium	Control		Amytal Sodium	Control	
9:50 a.m.	15.3	13.1	38° F.	22.0	18.5	Fish put into tanks.
10:15 a.m.	11.1	6.4		19.4	15.7	
10:50 a.m.	13.8	6.3	38° F.	...	...	
11:50 a.m.	15.7	7.8	38° F.	...	...	Removed sublegal controls.
12:50 p.m.	14.9	...	39° F.	...	...	Removed sublegal seconal fish.
1:10 p.m.	...	...	...	...	21.6	Removed legal controls.
1:50 p.m.	...	...	39° F.	20.3	...	Removed legal amytal fish.

At 1:10 p.m. the legal-sized control fish were in poor condition and were transferred directly to the raceway. Many fish laid on their sides on the bottom of the raceway for about 45 minutes, but all except four recovered. The legal-sized, amytal fish were transferred to the raceway at 1:50 p.m., having remained in the transporting unit for four hours. Many of these fish were helpless when returned to the raceway, but all recovered within half an hour.

In these tests, the fact that oxygen values were variable, and some very high, may have influenced the results to some extent. However, both Amytal Sodium and Seconal Sodium permitted the fish to be held for a longer period than the control fish, although the difference in time was not great.

#### Conclusions

Our conclusions in regard to the series of tests made this summer (1954) using Amytal Sodium and Seconal Sodium for transporting trout are not as complete as we would like them to be because of the unpredictable incidents that occurred. However, certain statements may be made.

1. Seconal Sodium, 1/4 grain per gallon of water, and Amytal Sodium, 1/2 grain per gallon of water, can be used to transport double the normal load of sublegal and legal rainbow trout, respectively, for about five hours, using a recirculation system, provided that the water temperature remains below 50° F. and the fish have been starved for about 72 hours.

2. Actual transfers, supervised by Mr. Hammond (and described in I. F. R. Report No. 1435), of sub-legal rainbow trout in which double the normal load of fish was carried were successfully made in water containing 1/4 grain of Seconal Sodium per gallon and at a temperature below 50° F.

3. The recirculation system of aeration appears to be better than aeration by oxygen when using the drugs. There is considerable room for

improvement in our system of using oxygen. The principal fault is in the uneven discharge of oxygen from the rubber tubing liberators in the tanks. This results in great variation of oxygen supply to the individual tanks on a transporting unit.

4. Based on the evidence from these tests, introduction of water to the tanks by jet is somewhat more effective in removing ammonia than introduction by spray. Modification of the type of spray might render it more effective.

5. Some factor, or factors, other than temperature, accumulation of ammonia, and depletion of oxygen, is responsible for limiting the time trout can be carried in a transporting unit. In some tests, with temperature controlled and adequate oxygen, ammonia accumulated to 7.9 p.p.m. with no detrimental effects. In other tests, with temperature controlled and adequate oxygen, fish died when ammonia had accumulated to only 4.08 p.p.m.

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