Anaesthetizing Experiments of Chum Salmon Fry with Tricaine Methanesulfonate (M. S. 222)*

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For the purpose to immobilize salmon fry for marking, tricaine methanesulfonate (M. S. 222) has been used instead of ethyl carbamate (urethane) because the latter seems to have some harmful effects. According to Eisler and Backiel (1960), 14 species of fish were used to be anaesthetized with the M. S. 222 in various concentration by different authors. In general, anaesthetizing condition varies with the species, size of fish, duration of anaesthesia, concentration and temperature of the solution.

The present experiment was undertaken to determine available concentration and duration of anaesthesia by this new anaesthetic for chum salmon fry (*Oncorhynchus keta*). The latent effect for the fry which recovered from anaesthesia was not observed.

Materials and Methods

Salmon fry used were progeny of the parents which were caught at Abashiri River in December, 1960, and then transferred to Chitose Hatchery at eyed egg's stage. Then the fry were reared in rearing pond after hatched out in January, 1961. Fork length of the fry at the time of experiments, 24 May 1961, was 34.8 mm (50 fish) in average.

The anaesthetic was prepared in 1 litre solution (9.5°C) with 9 lots of concentrations from 1 : 10,000 to 1 : 33,300. The observation was made for 5 minutes after the fry were exposed to each solution. In the lot in which the fry were anaesthetized within 5 minutes the fry were left for certain times in the solution and then they were removed into running water (9.5°C) to examine their recovery procedure. Anaesthetized fish in this paper means a fish which sinks to the bottom of the container and lays on the side without moving body parts except the gill cover. Recovery was considered when the fish takes back normal swimming action. In each experiment fresh fry were used.

Experimental Results and Conclusion

Experiment 1 Concentration 1 : 10,000

1) Anaesthetizing (10 fish)

Time duration (min.)	1	2	3
Number of fish anaesthetized	3	8	all fish

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2) Recovering

Remaining time[1] (min.)	2	8	12
Number of fish used	10	10	10
Progressed time[2] (min.)	5	9	–
Number of fish recovered	all fish	6	–
Number of fish died	–	4	all fish

Experiment 2 Concentration 1 : 15,000

1) Anaesthetizing (34 fish)

Time duration (min.)	4
Number of fish anaesthetized	all fish

2) Recovering

Remaining time (min.)	5	10	15	20
Number of fish used	6	6	6	10
Progressed time (min.)	5	7	12	–
Number of fish recovered	all fish	all fish	1	–
Number of fish died	–	–	5	all fish

Experiment 3 Concentration 1 : 17,500

1) Anaesthetizing (21 fish)

Time duration (min.)	2	3	5
Number of fish anaesthetized	5	15	all fish

2) Recovering

Remaining time (min.)	5	10	15	20
Number of fish used	5	5	5	6
Progressed time (min.)	5	7	8	8
Number of fish recovered	all fish	all fish	4	all fish
Number of fish died	–	–	1	–

Experiment 4 Concentration 1 : 20,000

1) Anaesthetizing (20 fish)

Time duration (min.)	2	3	4	5
Number of fish anaesthetized	1	4	8	all fish

2) Recovering

Remaining tim (min.)	5	10	15	20
Number of fish used	5	5	5	5
Progressed time (min.)	4	9	7	6
Number of fish recovered	all fish	all fish	all fish	all fish
Number of fish died	–	–	–	–

1 The remaining time, in minutes, means that the fry were left for such duration in the solution just after all fish were anaesthetized, and so on.

2 The time, in minutes, means the observation time which was made on fry removed from the solution and permitted to recover in running water at such time, and so on.

Experiment 5 Concentration 1 : 22, 500

1) Anaesthetizing (12 fish)				
Time duration (min.)	3	4	5	
Number of fish anaesthetized	1	4	all fish	
2) Recovering				
Remaining time (min.)	10	20	30	
Number of fish used	5	5	5	
Progressed tim (min.)	5	5	6	
Number of fish recovered	all fish	all fish	all fish	
Number of fish died	-	-	-	

Experiment 6 Concentration 1 : 25, 000

Anaesthetizing (12 fish)				
Time duration	5	7	9	10
Number of fish anaesthetized	1	7	10	all fish

Experiment 7 Concentration 1 : 27, 500

Anaestheting (12 fish)				
Time duratizion (min.)	5	7	10	12
Number of fish anaesthetized	none	3	8	all fish

Experiment 8 Concentration 1 : 30, 000

Anaesthetizing (12 fish)				
Time duration (min.)	5	9	17	20
Number of fish anaesthetized	none	2	6	8

Experiment 9 Concentration 1 : 33, 300

Anaesthetizing (10 fish)		
Time duration (min.)	5	10
Number of fish anaesthetized	none	none

In the practical works for marking salmon fry, the time requiring to anaesthetize the fish shall not exceed 5 minutes. The concentrations of 1 : 25, 000 (Experiment 6) and 1 : 27, 500 (Experiment 7) of the solution appear too weak for anaesthetizing the fish ; in both lots the anaesthesia time was prolonged for 12 minutes after the fish were exposed to the solution. The fish were not anaesthetized in the solution less than 1 : 30, 000 (Experiment 8) in concentration after 20 minutes exposure. The concentrations over 1 : 22, 500 (Experiment 5) appear to be applied for this purpose. With the concentrations of 1 : 15, 000 (Experiment 2) and 1 : 10, 000 (Experiment 1), all fish were anaesthetized within 2. 5 minutes in the former and in 4 minutes in the latter, producing some dead fish due to prolonged anaesthetizing.

It is not frequent that the fry anaesthetized are left as they are in the solution for more than 10 minutes in the usual work of marking. However, considering the individual differences in the time of anaesthetizing in the same container and the time needed for marking, the concentrations of over 1 : 15, 000 (Experiment 2) seem to be injurious for the

fish. Eisler and Backiel (1960) state that the available concentration is 1 : 33, 000 (95°F) for anaesthetize chinook salmon (3.5 inches long) and the immersion time is to be at most for 5 minutes. Adequate concentration of anaesthetic, however, varies according to the species, size of fish and other circumstantial situations.

So far as the present experiment is concerned taking into consideration the size of fish and water temperature, the concentrations from 1 : 22, 500 to 1 : 17, 500 seem to be most reasonable for the purpose.

References

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要　　約

Tricaine methanesulfonate (M. S. 222) は魚類，両棲類などの麻酔剤として最近広く用いられるようになつた。さけ稚魚の標識に当つての麻酔剤として，従来は ethyl carbamate (urethane) が用いられているが，このものは繰返し使用するときは人体に有害であることが分つた。しかし我国ではこの M. S. 222 を鮭鱒稚魚の麻酔に用いた記録はないので，この薬品をさけ稚魚の標識の際の麻酔に用いるにあたつて，どれ位の濃度のものが適当かを実験した。

使用したさけは，網走事業場で採卵し千歳支場に移殖したものの稚魚で，実験時のフオークレングスは 34.8 粍。また実験時の水温は 9.5 °C であつた。液の濃度は 1：10,000 から 1：33,300 までの 9 種類とし，稚魚がこの中で 5 分以内に麻酔し，更に麻酔液の中に多少の時間放置しても斃死魚を生ずることのないところの濃度を求めた。

実験の結果は (1) 1：25,000 以下の濃度では淡すぎて，麻酔の目的には用いられない。(2) また 1：15,000 以上の濃度では麻酔液の中に放置される時間によつては斃死魚を生ずることがある。(3) けつきよく，1：17,500 から 1：22,500 の範囲がこの場合もつとも適当な濃度である。