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NOTES ON THE LIFE-HISTORY OF SQUALUS SUCKLII GIRARD

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The study of the life-history of Squalus sucklii Girard was commenced

at the University of British Columbia in the winter of 1928; continued at

the Pacific Biological Station at Departure Bay the summer of 1929 where

material was obtained from the Recreation Point of Esquimalt and from set-lines

in the vicinity of Departure Bay; and again continued at the University of

British Columbia in the same winter. Further material was collected during

the summer of 1930 at the Pacific Biological Station.

(a) Period of Gestation.

General collections of embryos were made in the summer of 1927 from

May 15 to August 1, at the beginning of the year 1928 from January 1 to March

15 and from May 30 to August 14. It was found that small gestational discs were

obtained over a period of three months, usually, January, February and March.

There is the possibility that this period may be as long as that of Squalus

scutiger recorded by E. Ford, page 503, who says that "newly formed embryos

were obtained from November until the middle of May".

At the same time, January to March, embryos of 16 to 17 cm. were also

obtained. Similarly embryos of the same size were obtained in the summer col-

lections, the smaller ranging from 2 to 4 cm., the larger from 17 to 22 cm.

In the fall of 1914 Dr. G. Nelson Fraser took some measurements of embryos.

With these results it was seen that the period of gestation extended over a

space of about 23 to 24 months. This is illustrated in the following graph.

Notes on the Life-History of Squalus sucklii Girard

(b) Comparison of the life-history of Squalus sucklii and Squalus acanthias.

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The study of the life-history of Squalus sucklii Girard was commenced at the University of British Columbia in the winter of 1928, continued at the Pacific Biological Station at Departure Bay the summer of 1929 where material was obtained from the Reduction Plant at Nanaimo and from set-lines in the vicinity of Departure Bay; and again continued at the University of British Columbia in the same winter. Further material was collected during the summer of 1930 at the Pacific Biological Station.

(a) Period of Gestation.

General collections of embryos were made in the summer of 1929 from May 15 to August 1, at the beginning of the year 1930 from January 1 to March 15 and from May 30 to August 14. It was found that small germinal discs were obtained over a period of three months, namely, January, February and March. There is the possibility that this period may be as long as that of Squalus acanthias recorded by E. Ford, page 503, who says that "newly formed embryos were obtained from November until the middle of May".

At the same time, January to March, embryos of 16 to 17 cm. were also obtained. Similarly embryos of two sizes were obtained in the summer collections, the smaller ranging from 2 to 4 cm., the larger from 17 to 22 cm. In the fall of 1914 Dr. C. McLean Fraser took some measurements of embryos. With these results it was seen that the period of gestation extended over a space of about 23 to 24 months. This is illustrated in the following graph.

(b) Comparison of the Life-history of Squalus sucklii and Squalus acanthias.

In general these observations coincide with those of E. Ford (Plymouth Biological Station) on the life-history of Squalus acanthias but there are some points of difference. I shall give below the parts of the summary of his paper which deal with the early stages of development and segregation of sexes and shall discuss each part as to the differences and similarities of the two species.

This shows also that, as the total volume of the two oviducts are almost equal, the female, before becoming sexually mature, undergoes an extended adolescent period during which the initial set of ovarian eggs are maturing. ones than the other oviduct with more embryos.

It was noticed that in some females bearing embryos of the second year cycle there were maturing eggs which measured 2.5 to 2.8 cm. in diameter in January, 3.2 to 3.4 cm. in May, and 3.6 to 3.8 cm. in July while those bearing embryos of the first year cycle had very small ovarian eggs. This shows that on the length of the parent, for the largest number of embryos were found in as the embryos are developing in the oviduct there are eggs maturing in the ovaries at such a rate as to be ready for fertilization at the beginning of the largest fish.

In Squalus sucklii the observed average is eight to ten in larger fish and five to six in the smaller, the range being from four to thirteen. In the third year cycle.

"3. In a pregnant female the embryos are of the same general size, similarly fact there were no females caught in which there were less than four embryos the ovarian eggs."

and three developing ovarian eggs. There may be only a tenth of a centimeter difference in the embryos from one female.

"4. Males and females are equally represented in the embryos and may occur together in the same uterus; they do not differ in size at any corresponding stage of embryonic development."

A typical example of this is shown in the embryos from a female caught on June 22, 1929.

There has never been observed any remains of the egg-capsule in the oviducts of S. sucklii after it has become ruptured. This may be explained that, because of the membranous structure of the capsule it may be absorbed or it may pass out of the uterus more easily than our the hard horny one of S. acanthias. Ford does not give the time of the cycle when the egg-capsule is ruptured. It has also been observed that of the capsule would be absorbed and passed

	<u>Length of embryo</u>	<u>Sex</u>
leaving the developing embryos free in the oviduct. This evidently occurs	21.6 cm.	♂
sometimes in the fall	21.6 "	♀
capsule while those in	21.6 "	♂
	20.9 "	♂

It has been noted	21.6 cm.	♀
membrane other than a	21.6 "	♀
the albumen. It may be	20.9 "	♂
	20.3 "	♀

This shows also that, as the total volume of the two oviducts are almost the same, the oviduct which has the fewer number of embryos will have larger ones than the other oviduct with more embryos.

*5. The number of embryos carried by one fish, if the length of the parent is ignored, is most frequently from three to four in an observed range from one to eleven. It may be possible, however, that the number of embryos is dependent on the length of the parent, for the largest number of embryos were found in the largest fish.

In Squalus sucklii the observed average is eight to ten in larger fish and five to six in the smaller, the range being from four to thirteen. In fact there were no females caught in which there were less than four embryos and three developing ovarian eggs.

*6. The remains of the egg-capsule in which the earlier developmental stages are undergone may continue in the uterus until the embryos are ready for birth.

There has never been observed any remains of the egg-capsule in the oviducts of S. sucklii after it has become ruptured. This may be explained that, because of the membranous structure of the capsule it may be absorbed or it may pass out of the uterus more easily than can the hard horny one of

S. acanthias. Ford does not give the time of the cycle when the egg-capsule is ruptured. It has also been observed that of the dogfish caught on set-lines the immature

males and females are in shallow water while the mature ones are in deep leaving the developing embryos free in the oviduct. This evidently occurs water, usually at the bottom of the vertical line, sometime in the fall of the first year cycle as embryos in August have a capsule while those in November have none.

It has been noted by Balfour that Elasmobranch eggs possess no yolk membrane other than a surface tension one at the interfaces of the yolk and the albumen. It may be that the egg-capsule is used to form a protecting surface about these. As the blastoderm grows it spreads over the yolk forming a yolk membrane which eventually surrounds the whole yolk. When this stage is reached the egg-capsule is no longer required and it is perhaps then that it is passed off allowing more space and freer movement for the developing embryos.

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This has been discussed above.

"12. The constitution of the shoals of adult fishes is governed by the factors of size and sexual condition."

As all observations were made on fish caught by set-lines only the larger fish were observed, but it was noticed that among these catches there was a definite segregation according to size and sex. One scow-load brought into the Reduction Plant at Nanaimo, B.C. consisted of two catches from the mouth of the Fraser River, about seventy percent of which were large mature males, the other thirty percent made up evenly of immature males and females of the same size. The same day, May 20, 1929, a catch from Snake Island near Nanaimo from shallow water consisted of large females carrying embryos. Another catch brought in pregnant females and a small amount of immature males and females. This tends to show that the immature males and females have a wider range of occurrence, the mature males and pregnant females keeping in definite shoals. It has also been observed that of the dogfish caught on set-lines the immature

males and females are in shallow water while the mature ones are in deep water, usually at the bottom of the vertical line.

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PERIOD OF GESTATION.

