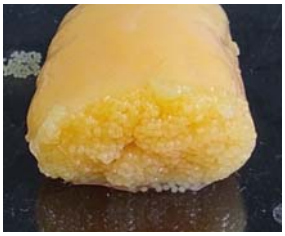
Home-Based Researchers Keep 10-Year Study Afloat During Pandemic

Rare dataset to benefit estimates of future flounder stock sizes

Even without a pandemic, figuring out the number of eggs a fish will lay during its spawning season is a difficult task. While this information is important to fishery biologists, long-term data are scarce. That hampers researchers ability to answer a fundamental question important for fishery managers: What affects the ability of marine fish, and fish populations, to replace themselves in an open ocean? The pandemic made answering this question even more difficult—but our researchers persevered.

Fertilized fish eggs like these average about 1 milimeter, or 0.039 inches, in size. Oocytes, the immature egg, are much smaller - each is about the size of a pinhead.

"Many marine fish produce hundreds of thousands to millions of eggs per female per year, the survival of which determines the future abundance of a population," said **Mark Wuenschel**, a fish biologist at the Northeast Fisheries Science Center. Wuenschel is leading a long-term study on "fecundity"—a term for reproductive potential—in two commercial flatfish species, winter flounder and yellowtail flounder. "We had to have enough samples, and we had to work out the methodology to do it."



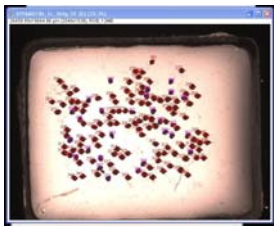
A cross section of part of a flounder ovary. Each dot is an unfertilized egg or oocyte.

Annual fecundity — in this case, measured by the number of eggs — varies and depends on the size, age, and condition of the female fish. Environmental variables, such as temperature and available prey, also affect the growth, condition, and reproduction of the females. Like many things in life, timing is everything. To study fecundity, female fish have to be collected at just the right time from the right locations, and in large numbers. Then, lots of eggs need to be counted.

Enter **Emilee Tholke** and **Yvonna Press**, both center biologists who work with Wuenschel. They were granted access to their lab one day a week under specific safety protocols. They prepared egg samples and captured images of the eggs using a high-resolution camera with a macro lens and a microscope. Images were stored on a flash drive or transferred to a shared network file.

Emilee Tholke checks image analyses on her home image processing system.

Then, working from home, each analyzed the images and entered the results into a shared database. Working from home not only kept the egg counts going, but ensured that critical sampling would continue, and prevented a back-log of sample processing work. This year's effort completes a 10-year time-series of sampling, image analysis, and fecundity estimates for winter and yellowtail flounders.



What the image analysis looks like on a computer screen. The red lines across the oocytes measure their diameter.

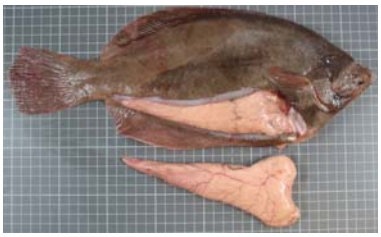
How Scientists Get to the Eggs

Once collected, all the fish are dissected and a variety of data are collected on each fish:

- Length
- Weight
- Gonad mass
- Age structures (ear stones and scales)
- Liver weight

Only fish approaching a spawning condition are used for fecundity estimations. A small sample of the ovary is saved. The oocytes — immature cells before they become eggs — are teased apart from the ovary by hand, one sample fish at a time.

Each oocyte is about the size of a pinhead, with 300 to 600 oocytes appearing in each image. For each individual fish sampled, two or three images of its oocytes are taken.



A female winter flounder showing large developing ovaries. A subsample of the ovary is collected and preserved. The oocytes, or immature eggs, in the ovary are later used for fecundity or reproduction studies.

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