

## “SIDS”

### Improving Determination Tools for more Efficient Stock Assessment and Implementation of Control Measures

*The Mediterranean marine fishery for the Swordfish (*Xiphias gladius*) is a large, socio-economically important sector that accounts for a yearly financial turnover of well over 300 million Euro within the combined fisheries of the EU. To keep swordfish populations from being overfished, a controlled regulation of this fishery, based on the determination of sex and sexual maturity of the fishes at capture, is necessary. In many cases however, this cannot be done due to the lack of external sexual dimorphisms between the sexes, or because the catch is gutted at sea, making determination at landing impossible.*

In the search of a more efficient and cost effective method for the **assessment of sex and sexual maturity in swordfish populations** in the eastern, central and western Mediterranean seas, the **SIDS project** was developed. The project was carried out over two fishing seasons, the second season (2001 – 2002) serving as market testing. In the first season (2000 – 2001) the objectives were to determine the stability of the sampling methods and to develop the necessary methods for determining steroid hormone and vitellogenin concentrations in swordfish plasma and muscle, thus for determining sex and sexual maturity. Consequently the results would be compared with histological studies made at the same time and used as a calibration to evolve a muscle biopsy test for standard determination of sex and maturity from single muscle samples.

During the **first fishing season** over 400 swordfish were sampled and plasma, muscle and gonad samples were taken (when possible). A stability protocol, which certified the use of the sampling method as being adequate for steroid measurement storage at 10°C and room temperature, was set up. A standard ELISA test to determine vitellogenin levels in plasma and

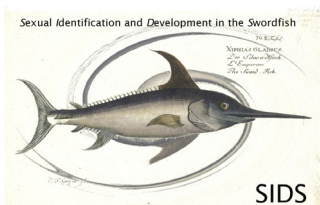
muscle for the swordfish was established, steroid tests were applied successfully to both plasma and muscle tissue and gonad histology was carried out.

In the **second season** another 700 swordfish were sampled, histological analysis was performed and steroid tests were carried out. Next to that, the samples from the first season were assessed for vitellogenin using the newly established ELISA test.



SWORDFISH BOAT RETURNING TO HARBOUR. SOURCE: C. BRIDGES.

From the **steroid** study it was concluded that it is not possible to use steroid concentrations in muscle tissue of the swordfish as a means of determining sexual status of the species. **Vitellogenin** on the other hand has provided clear evidence for the discrimination of sex in plasma samples. Direct correlations with increasing Lower Jaw Fork Length (LJFL), Season, Gonadosomatic Index (GSI) – which is assumed to be a good measure of sexual development –, Maturity Stage



**Project acronym:**

SIDS

**Full title of Project:**

Sexual Identification and Development in the Swordfish.

**EU contract number:**

QLK1-CT-2000-01017

**Web-site:**

<http://www.uni-duesseldorf.de/WWW/MathNat/Zoophys/bridges/swordfish.htm>

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and plasma levels of vitellogenin have been found in female fish.

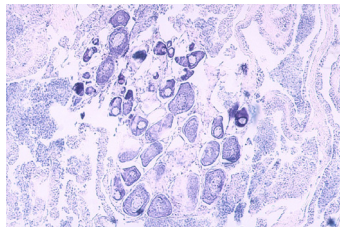
However, only a poor correlation was found between plasma and muscle values in the same fish, probably due to inadequate extraction procedures, which has made it impossible to develop a muscle biopsy test. Subsequently in further trials with Bluefin Tuna a "Hot-Blot" test has been derived based on a modified western Blot analysis which allows sex determination to be made from muscle or mucus samples. This test uses vitellogenin and Zona radiate antibodies and can be carried out within 1-2 hours after sampling.

In addition to this, the research showed that swordfish not only suffer from overfishing, but also from pollution. Results from both seasons pointed out that some male swordfish had levels of the female enzyme vitellogenin in

their plasma. Moreover, in the second season, histological analysis of testes led to the identification of a high percentage of intersex (25%), showing the presence of oocytes inside the testicular tissue. This confirmed the theory of "endocrine disruption" occurring in the Mediterranean Sea as a consequence of the accumulation of toxic compounds in organisms.

In the short term the use of Vitellogenin will enable a much more accurate assessment of the sex and reproductive status of captured swordfish in different areas of the Mediterranean, and will therefore provide essential data for the management of a vital economic resource to member states bordering the Sea. It will also provide in the long term a very valuable basis for similar studies on other commercial species of economic importance to the EU (such as the Bluefin Tuna) which are similarly threatened by pollution and overfishing.

**“THE USE OF VITELLOGENIN FOR THE ASSESSMENT OF THE SEX AND REPRODUCTIVE STATUS OF CAPTURED SWORDFISH IN DIFFERENT AREAS OF THE MEDITERRANEAN WILL PROVIDE ESSENTIAL DATA FOR THE MANAGEMENT OF A VITAL ECONOMIC RESOURCE TO MEMBER STATES BORDERING THE SEA“**



EVIDENCE OF ENDOCRINE DISRUPTION: OVI-TESTES IN MALE SWORDFISH. SOURCE: DE METRIO ET AL., 2002.

LARGE SWORDFISH. SOURCE: C. BRIDGES.

