COLLECTION METHODOLOGIES

COLLECTING BIOLOGICAL VARIABLES

Methods of sampling and storage

1. *Sampling of ichthyoplankton*

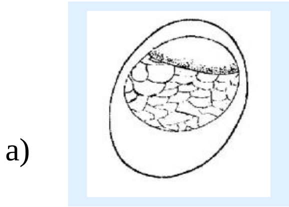
The qualitative and quantitative composition of the ichthyoplankton is determined by analyzing the samples taken from fixed stations, located on a part of the Romanian platform (up to the 70 m isobath), the methodology for collecting and processing the samples being the one unanimously accepted for the Black Sea basin (Radu E and Maximov V., 2006). The collection is usually done with the Bongo fillet with a diameter of 60 cm, with a mesh of 505 mm, equipped with a flow meter for recording the distance traveled, through oblique trajectories, for 5 minutes, at the speed of the ship of 1.5 -2 Nd (Fig. 1). For each station, the following data are recorded: the station, the date of the sample, the geographical coordinates of the station, the water depth (m), the horizon until the fill (m) was launched, the umber of rotations recorded by the flow meter.

Fig. 1 Bongo fillet for collecting ichthyoplankton samples

The ichthyoplankton samples are stored in 4% formol, and the processing is carried out in the laboratory. The laboratory analysis consists in the complete sorting under stereomicroscope of each sample taken, establishing the qualitative and quantitative structure. Once these elements are established, based on the aforementioned parameters, the density (specimens/m^2) is determined, for each species separately, making distribution maps (E. Radu, V. Maximov, 2006). The data obtained are used to calculate the abundance of the eggs, thus determining the intensity of reproduction, as a first element in characterizing the state of the population of a species of fish.

Determining the qualitative structure of ichthyoplankton and fish brood

The qualitative structure of the ichthyoplankton is determined taking into account the main distinguishing features of the pelagic ichra: the shape and the diameter of the ichel, the presence or absence of the drop of fat, the diameter and appearance of the drop of fat, the segmentation or homogeneity of the vitellus, the size of the perivitelin space (fig. 2). To determine the pelagic larvae were considered: meristic characteristics, morphometrics, pigmentation and body shape, shape of the vitelline sac, position of the anal orifice (fig. 3). The characteristics of ichthyoplankton communities are expressed through analytical ecological indicators (abundance, constancy and dominance) and synthetic ecological indicators (ecological significance indices, diversity) (Pârvu, 1999).



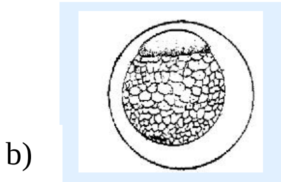


Fig. 2 Types of eggs (a = anchovy; b = sprat)

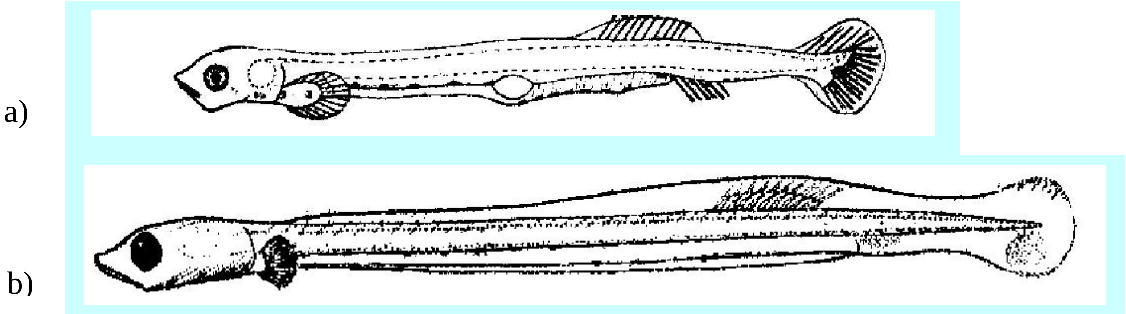


Fig. 3 Types of fish larvae (a = anchovy; b = sprat)

2. ***Collecting biological samples of juveniles/brood***

Fig. 4 Pelagic fish brood trawl

For fish brood, sampling is performed with pelagic trawl for brood, type Danielevski (Fig. 4), elaborated within the NIMRD by specialists in the field, for coastal trawler vessels of 570 hp (Nicolaev, 1988). The optimum value of the driving speed is in the range 1-1.5 Nd (Anton, 2006). Fish brood samples are analyzed qualitatively and quantitatively after each trawl or are stored in 4-5% formol and analyzed in the laboratory. The results are expressed in number of copies / m^2.

3. Sampling of biological samples for catch sampling

For the study of fish populations, the method of studying randomly extracted samples is used, which is part of the whole population, but which provides sufficient information to characterize the entire population. The catches of the industrial fishery constitute the main source of material for establishing the qualitative and quantitative structure of the fish populations, of the biological parameters, by extrapolating the results obtained to the whole population from which the analyzed specimens come. Although fisheries are already being sorted out by a fishing population, due to the selectivity of the fishing gear, however, industrial fisheries catches represent a useful source of information for population studies, as they are of particular interest to industrially exploited populations. In the Romanian marine area, commercial fishing is carried out with two types of tools: passive tools, located at depths of 5-12 m (Fig. 5) and active trawl-like tools, drawn by a ship and provided with a reinforcement system (pelagic beam, beam trawl / Fig. 6).

Fig. 5 Stationary gear (pound net)

Fig. 6 Pelagic trawl

Biological data sources

Sampling at landing/market places (fishery-dependent data);
Sampling on commercial vessel (fishery-dependent data);
Self-sampling (fishery-dependent data);
Sampling on research vessel for experimental or/and scientific survey (fishery-independent data).

a. *Sampling at landing/market places*

During sampling, it may be possible to collect a variety of information, including fishing location and depth, type and amount of gear used, species identification and biological samples (i.e. length and weight). At the landing place, fish may be found in several different ways, as a bulk of mixed species, or separated by species (in boxes), or even by size categories. In all cases, when the total landing of a given species, or a fraction of a given species (e.g. juveniles or small size fish), is too abundant, it seems reasonable to make a sufficiently representative subsample (Gulland, 1966; Cochran, 1977; Baird, 1983; Pauly, 1983; Galluci et al., 1996). To get data on the length composition of individuals in the landing, a subsample should be selected randomly from each fishing day per target species, also recording the total weight of the catch of that particular species. All the size categories of a given species should be represented in the sample (it is important not to collect biological parameters for only small or large individuals). These measurements can either be taken directly at the landing place, or the sample can be purchased in order to collect additional biological parameters, such as age, individual weight, sex and maturity stages, and assess them later in the laboratory.

Sampling mixed species – When faced with a mix of species for sampling, the first basic task is to estimate the proportions of each one in the bulk load. In this case, it will probably be necessary to take larger subsamples of fish from each location in the bulk. Each subsample should be of approximately similar size. There is no guarantee that a large load of fish will be homogeneously mixed. Ideally, sampling would give each fish in the load an equal chance of inclusion in the sample, but this is seldom achievable in practice, given restricted physical access, time and other difficulties. Therefore, to maximize the accuracy of the mean of the sample, the sample should be made up of subsamples of the species taken, for example, from several boxes. If this is impractical, collection of data should try to devise other practical ways to minimize the influence over the choice of individual species, so that all possible classes are present in the sample in roughly the same proportions as they are in the bulk. To improve accuracy further, the number of species collected in a sample should be large, but only if the species are selected independently.

Sampling single species – For species divided into size categories, following market demand, a sample should be collected from each size category. To maximize accuracy in this case, the sample should be a composite from subsamples of individuals taken from several size categories. It is essential to record the total weight of landing for that species and, if present, for each size category.

b. *Sampling on board commercial vessel*

At sea, ideally fishery observations should make a more precise record of the weight and/or number of individuals by species and per fishing hauls. Sampling on a boat poses many difficulties, apart from those associated with working on an unstable platform. On board commercial vessels, the data collectors must work in a way that will cause the least possible interference with the normal work of the crew and often, they will have a very limited time in which to obtain their samples. If it is not feasible to sample the entire fishing trip, some hauls should be taken randomly. There is no predefined list of hauls upon which one can base a random sample. The idea could be to make a kind of systematic sampling, spreading the samples equally during fishing day(s). On board, catches are often split into categories and subcategories depending on commercial values. For each main commercial species, the total weight should be collected.

c. *Self-sampling*

Self-sampling occurs when fishers themselves collect, and sometimes process, biological samples and report on these. It is a tool that has been developed recently to obtain data in an affordable manner, often producing a higher rate of coverage (in time and space). At-sea sampling of commercial fishery catches by observers could result in a relatively expensive exercise, in terms of cost and human resources. From this perspective, sampling by fishers may offer an alternative, since a larger number of trips can be sampled at a lower cost. However, a major problem with the self-sampling approach is that some scientists and/or managers consider that the data provided by fishers may not have been collected in a sufficiently rigorous manner, and they may be biased as a result (Hoare *et al*., 2011). To avoid these problems, regular and accountable training sessions for fishers can be conducted to guarantee the accuracy and reliability of data collection. In the event of self-sampling activities, countries should ensure that:

- fishers are trained;
- protocols are well developed;
- results are scrutinized for flaws, and controlled for bias.

d. *Sampling on research vessel for experimental or/and scientific survey*

Fig. 7 The research vessel „Steaua de Mare"

Besides commercial fisheries' statistics, another source of information for biological data is fishery-independent data collected by scientific survey at sea, is carried out during the research expeditions by the NIMRD "*Grigore Antipa*", specialists with the research vessel "*Steaua de Mare* 1" (Fig. 7).
Surveys provide accurate indices of species/stock abundance and distribution, though the major problem is cost.

Surveys require fishing with a standard vessel using standard fishing gear at predetermined fishing stations, selected according to a fixed-grid, fixed-site or stratified random sampling design. Such surveys provide an estimate of average fish density (e.g. per area swept by a trawl net; as fish encounters with longlines or gillnets; number of nautical miles for acoustic survey etc.) over the entire spatial range where the species might be found. It also provides mapping of the spatial distribution of density over the entire range.

Information to be collected during each sampling day at landing/market places or on board commercial vessels:

* fleet segment sampled;
* area (GSA) and time period;
* gear used;
* name of selected target species;
* length of all individuals contained in at least one sample (e.g. a single box) of the total commercial landing of that species;
* sample weight;
* total landed quantity (by weight) of the species selected for sampling;
* discarded fraction of the target species;
* total weight of all landed species.
* Incidental catch of vulnerable species

e. *Selection of species*

Usually, due to restricted funds and personnel, it is not possible to collect data (e.g. biological data, effort data etc.) from all species of commercial interest. A limited number of species (namely priority species) should be selected as representative of the entire living resources. The concept of priority species represents a key factor for the management of fisheries resources (Barone *et al*., 2006; AdriaMed, 2007; Ungaro *et al*., 2008). In the context of data collection, priority species are those for which the most complete set of data are required. Their identification has to be based on criteria relevant to the objectives of the GFCM: development, conservation and management.

According to these criteria, three different groups have been established, whereby species are listed at subregional level (GFCM subregions):

* the first group concerns the **frequency of assessments** (i.e. species that are regularly assessed);
* the second one concerns the **fishery's importance** (i.e. landing, catch and/or economic value);
* the third group is based on **conservation criteria** (i.e. endangered species) or impact of them presence on the ecosystem (i.e. non-indigenous species).

It is known that ichthyology deals with the study of fish from a morphological, systematic, physiological and ecological point of view. In systematic zoology, the fundamental element is the species, that is, the group of related individuals, with similar and stable morpho-physiological, biochemical, ecological and genetic features. Sometimes the species comprises smaller groups, subspecies, which differ in non-essential characters. Several species form a larger unit, the genus. The classification continues so that more genres form a family, and more families an order, they are grouped more into a class. Species determination is based on morphological characteristics of the collected species, using determination keys for each systematic unit. The identification of the species implies the knowledge of the morpho-anatomical particularities of the individual: shape, color, number of swimmers, number and type of radii, presence (and number) or absence of scales on the lateral line, various relationships between biometric parameters, presence of particular excrescences, such as spines gills, etc. According to Dehnic (1979), the Black Sea fishery comprises 165 species and subspecies, of which 119 are exclusively marine, 24 are anadromous or semi-marine and 22 are freshwater species. Some of the other 15 species are rarely found. According to other authors, the Ihtiofauna of the Black Sea comprises 140 species, species classified according to the systematic adopted in 19 orders, 48 families and 93 genres.

4. *Collecting material to determine length and weight*

a. length

The samples that are taken for the study of the qualitative and quantitative composition consist of several kilograms of fish taken at random from the talian catch, from the points near the institute headquarters and from the other fishery points on the coast. Also, samples are collected from the surveys carried out with industrial fishing vessels, on which research personnel activate. The samples taken for the study of the fish populations will consist of a number of 200 specimens, collected at random, from at least four lots of 50 copies from four different places of a minimum catch of 100 kg - in passive fishing and 500 kg - in active fishing. The length frequency samples will be collected and analyzed whenever the appearance of a species is changed, in terms of length, but not less than one sample for each of the main species of a catch (E. Radu and V. Maximov , 2006).

Examination of the samples involves counting, biometric measurements, gravimetry (weighing), sampling of otoliths, scales or other hard structures used at a later stage (determining age), determining the sex and degree of maturation of the gonads, determining the degree of stomach filling and fattening degree, determining the degree of infestation with parasites, etc. The characters determined by biometric studies are: plastic characters (length, mass, thickness) and meristic characters, which involve the counting of radii, scales, branchial spines. Within these analyzes, the elements necessary for the estimation of the growth parameters are pursued, firstly:

- structure by classes of lengths and ages;
- weight / weight by length and age classes;
- the sex ratio.

For the elaboration of the variation of the total length variation (Lt), the measurements are made with the ihtiometer (Fig. 8), from the end of the muzzle, to the end of the longest radius of the caudal (sprat, anchovy, whiting), or bifurcation (horse mackerel). Sometimes both lengths (total and fork) are measured to establish correlations. The ihtiometer consists of a wooden or plastic panel, graded along the longitudinal axis, with a vertical wall at the left end. The fish is placed with its longitudinal axis parallel to the axis of the ichthyometer and the muzzle (closed mouth) slightly pressed by the vertical wall. The roulette is used to measure large fish.

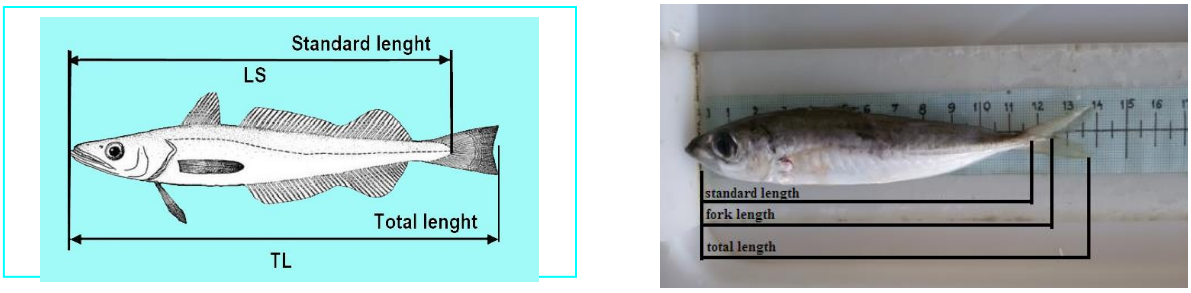


Fig. 8 Determination of length for small fish species

The main biometric measurements and the external morphology of different fish (bones, sharks, rajidae and flat fish) are presented in the following Figures 9, 10 and 11.

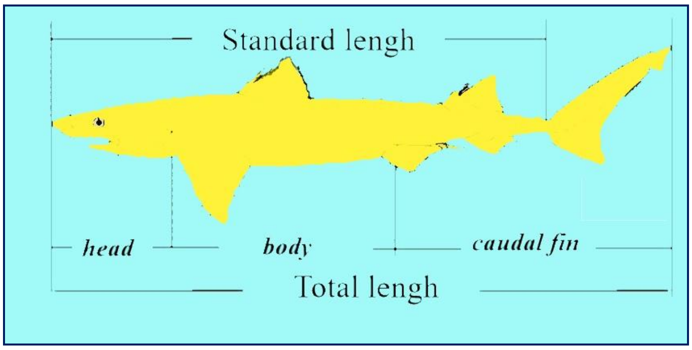


Fig. 9 Determination of length for picked dogfish species

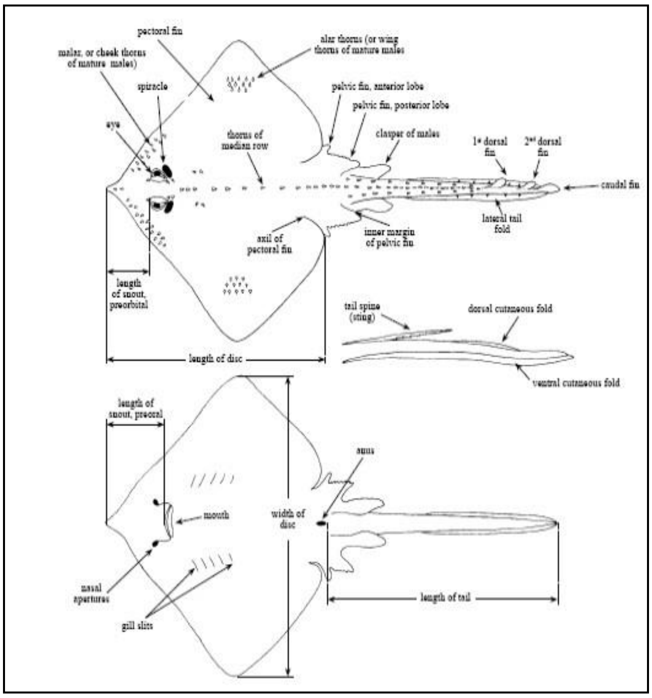


Fig. 10 Main technical terms and measurements in Rajidae

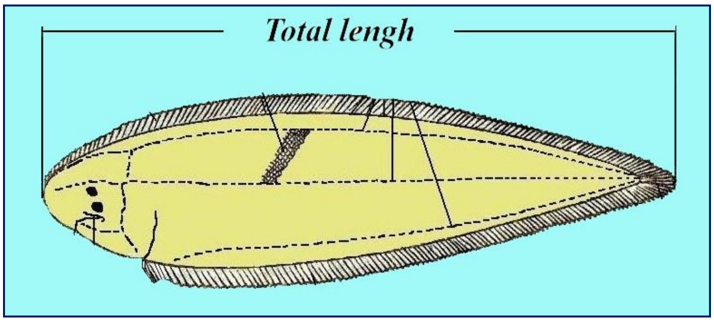


Fig. 11 The main measurements for flat fish

Marine decapods are a group of organisms of even ecological importance in some places. They serve both as direct food for many fish, locally and for humans, and indirectly through their planktonic larvae, which are the basic food for many planktonic fish. Regarding the Romanian Black Sea coast, among the most common decapods encountered here, we mention: sand shrimp, grass shrimp, stone guinea pig and grass crab. Figures 12 and 13 show the main measurements and the main morphological elements in the crustacean (Băcescu, 1967).

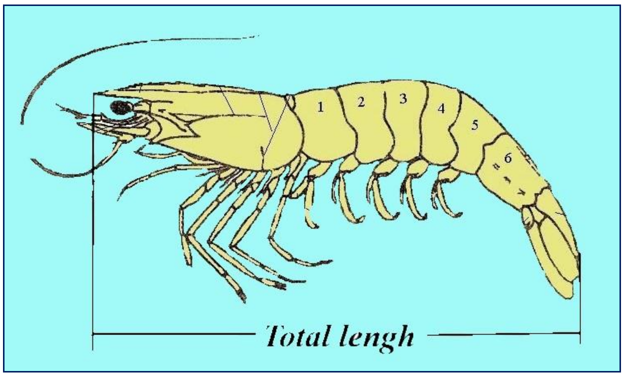


Fig. 12 Technical terms used in the description of a shrimp's body

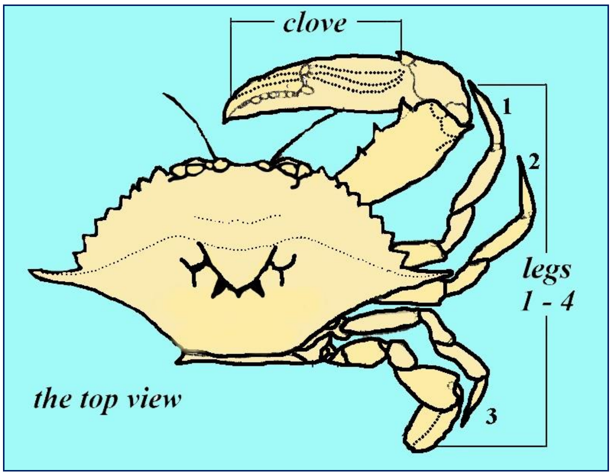
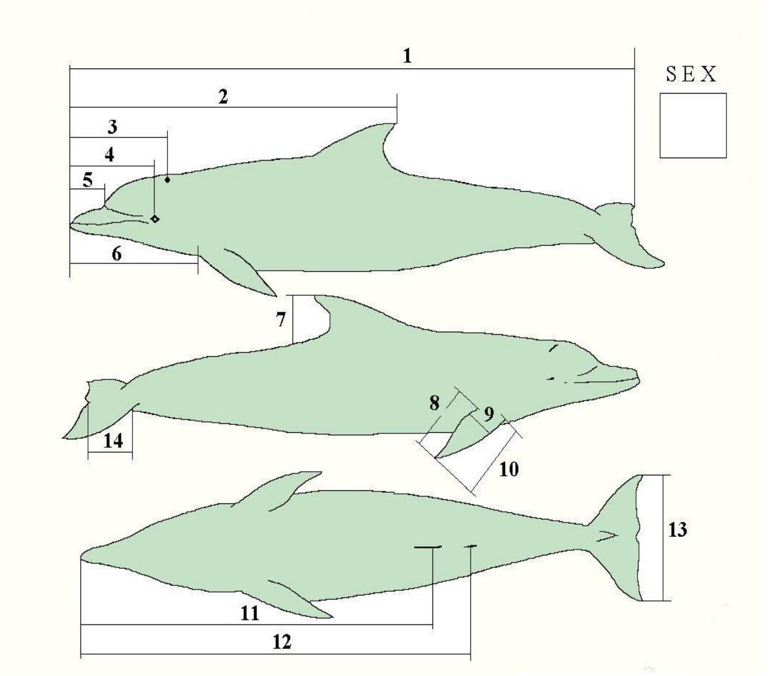


Fig. 13 Technical terms and main measurements in crabs

Cetaceans are vertebrates with a long life cycle, representing the highest part of the trophic chain, and they are also indicators of the health status of marine ecosystems. Marine mammals play a major role in the ecological balance of marine ecosystems, being very sensitive to ecological environmental conditions and in direct competition with human activities. In the Black Sea live three species belonging to the Cetaceans. The three species of dolphins in the Black Sea are: *Delphinus delphis ponticus*, the common dolphin, *Tursiops truncatus ponticus* - aphid, glass-mouthed dolphin or big-mouthed dolphin, and *Phocoena phocoena* relicta, popularly known as phoenix, sea pig or martin. The main biometric measurements of dolphins are shown in figure 14.

The total length is measured for all fish species from the Romanian coast.

For species with bilobate flow rate, it is recommended to measure the **fork length** - defined as the distance measured along the longitudinal axis of the body, from the tip of the muzzle to the tip of the "V" formed by the lobes of the bifurcated flow. It is also mandatory to measure the commercial length (**standard length**), which represents the distance from the tip of the muzzle to the completion of the solzos shell; if the fish is nude or there are small scales on the flow, the reference point is the base of the middle radii of the flow (Fig. 7.9, 7.10 and 7.11). In fish, measurements will generally be recorded at the nearest centimeter and sometimes, depending on requirements, at the lower centimeter. Often it is necessary to measure both lengths (total and fork) and both methods (at the nearest centimeter, or at the bottom centimeter) to establish correlations. These situations will be set out expressly through the work program.



1. The total length.
2. Distance from the tip of the upper jaw to the posterior edge of the dorsal fin tip.
3. Distance from the tip of the upper jaw to the center of the breathing hole.
4. Distance from the tip of the upper jaw to the center of the eye.
5. The distance from the top jaw to the front of the melon.
6. Distance from the tip of the upper jaw to the front of the base of the pectoral fin.
7. Height of the dorsal fin.
8. The posterior length of the pectoral fin.
9. The width of the chest at the base.
10. Anterior length of the pectoral.
11. The distance from the tip of the lower jaw to the center of the genital orifice.
12. Distance from the tip of the lower jaw to the center of the anal hole.
13. The distance between the tips of the lobes of the caudal fin.

Fig. 7.14 The main biometric measurements in dolphins

In the Romanian marine sector, the measurements made on fish will be recorded at the bottom centimeter.

The range between the length classes is 0.5 cm for small species: *Sprattus spratust* (sprat), *Merlangius merlangus euxinus* (whiting), *Engraulis encrasicolus* (anchovy), *Trachurus mediterraneus ponticus* (horse mackerel), *Atherina boyeri* (atherina), *Alosa caspia nordmanni* (alosa), *Clupeonella cultriventris*, *Gobiidae* (gobies) and 3 cm for large ones: *Psetta maxima maeotica* (turbot), *Squalus acanthias* (picked dogfish), *Platichthys flesus luscus* (flounder), *Acepenseridae* (sturgeons spp.)(E. Radu și V. Maximov, 2006).

The crustacean measures the length of the body from the tip of the rostrum (practically from the front of the eye) to the completion of the telson (tail). The interval between two classes of length is 0.5 cm and the recording is made at a lower centimeter (Gomoiu & Skolka, 2001). Typically, for fish whose size is greater than 30 cm, the class range of 1 cm in length is chosen, and for those under this size, an interval of 0.5 cm can be chosen (Table 1). According to this method, all lengths between 36.0 and 36.9 cm are reported to 36 cm, when using the 1 cm range. When measured in 0.5 cm units, fish between 26.0 and 26.49 cm are reported at 26 cm, and fish between 26.5 and 26.99 cm at 26.5 cm. Samples made of large specimens are analyzed by measuring each specimen, subtracting the elements required for analysis and then performing the frequency range of the lengths.

At 3-5 samples, for the frequency of the lengths, a sample for the frequency of the ages is provided, calculated, according to the stratified method, that is, by providing for each length class a constant number of age material (otoliths or scales) - about 10 copies (per as many as 5 females and 5 males).

b. ***weight***

Individual weight is important biological information, although the weighing of individuals may prove to be more complex depending on prevailing conditions in the workplace. It is essential to establish length-weight relationships for all target species, because at some stage in stock assessments, lengths of fish have to be converted to weights of fish.

The choice of weighing device (electronic balance) depends on the size of the sampling and working conditions. For fish, elasmobranch and cephalopod species, the total weight of each individual could be reported to the nearest 1 g, using an electronic balance. In the case of crustaceans, the weight should be recorded to the nearest 0.1 g. The length-weight relationship for single species requires a large set of data in order to obtain good representation of the entire "*size ranges*" of a species: from the smaller individuals to the larger ones. This will help to increase the accuracy of estimates. It is also important to stress that the length-weight relationship may vary seasonally, and between each sex.

The average mass of the specimens per each class of length is determined by the global weighting of all the specimens of a class of length, the recording of the value determined in the form, to be obtained by calculation based on all the samples. Large specimens are weighed individually. The unit of measure is the gram. Care shall be taken to remove the weighing errors by placing the scales along the axis of the ship, which balances less and adjusts whenever its horizontal conditions change. For weighing smaller fish, the analytical balance is used, the weighing being done in the laboratory. It is important to establish length-weight relationships for all species where we want to determine the status of stocks, for which we must convert lengths to weight. Equally it is recommended to establish the length-to-mass relationships seasonally because the weight of the fish may be greater during the breeding season than outside the season.

c. ***Data quality***

The quality of fisheries data is related to the precision and accuracy of measurements made on fisheries variables. It is subject to many factors, including data type, nature of fisheries and economic, social or ecological values of fisheries (Cochran 1977; FAO, 1999; Kolding & Ubal Giordano, 2002; Pennington *et al*., 2002; Vigneau & Mahevas, 2004; ICES, 2008, 2010e). All collected data contain some level of bias and random variation. Improvements needed in precision and accuracy often require greater relative expenditures on sampling and analysis.

Data quality must be ensured in all data collection phases: survey design, field and laboratory methods, data processing and transmission.

Errors deriving from different sources have different statistical characteristics: errors linked to direct measurement of fishery variables (e.g. length, weight), or to well-designed sampling programmes, are likely to be random and small. In some cases, errors associated with fisheries data can be non-random and biased, a characteristic of low-quality data.

Quality indicators such as statistical dispersion parameters are needed to perform quality controls. In the region, the definition of such indicators is in progress and needs to be agreed upon by all CPCs in order to establish control routines.

Generally, a routine quality validation/control should be performed at both internal (e.g. country) and external level (e.g. GFCM Secretariat) to quantify the accuracy and precision level and, if problems are identified, they must be solved before datasets are assembled.

Table 1

Important species fished in the Black Sea

with the indication of the samples to be collected

Scientific name	Common name	Observations		Length class (cm)	Total length	Aeging		
		optional	mandatory			scales	otoliths	
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Acipenser gueldenstaedti colchicus Marti, 1940	Danube sturgeon	+		3	+			
Acipenser stellatus Pallas, 1771	Starry sturgeon		+	3	+		+	
Alosa caspia nordmanni Antipa, 1906	Caspian shad		+	0,5	+	+		
Alosa fallax nilotica (Geoffroy, 1808)	alosa	+		1	+	+		
Alosa maeotica maeotica (Grimm, 1901)	Pontic shad		+	0,5	+	+		
Alosa pontica pontica (Eichwald, 1838)	Danube shad		+	1	+	+		
Anguilla anguilla (L., 1758)	European eel	+		3	+		+	
Atherina (Hepsetia) boyeri (Risso, 1810)	Sand smelt		+	0,5	+		+	
Belone belone euxini (Günther, 1866)	garfish	+		1	+			
Blennius sp.	blennies	+		0,5	+			
Boops boops (L., 1758)	bogue	+		0,5	+			
Caspiosoma caspium (Kessler, 1877)	gobies	+		0,5	+			
Chelon labrosus (Risso, 1826)	Grey mullet	+		0,5	+			
Clupeonella cultriventris (Nordmann, 1840)	kilka		+	0,5	+		+	
Conger conger (L., 1758)	European conger	+		3	+			
Coryphoblennius galerita (L., 1758)	blennies	+		0,5	+			
Dasyatis pastinaca (L., 1758)	Common stingray	+		3	+			
Dicentrarchus labrax (L., 1758)	European seabass	+		3	+			
Diplodus sp.	Annular seabream	+		0,5	+			
Engraulis encrasicolus (L., 1758)	anchovy		+	0,5	+	+	+	
Gaidropsarus mediterraneus (L., 1758)	Shore rockling	+		0,5	+			
Gasterosteus aculeatus L., 1758	stickleback	+		0,5	+			
Gobius sp.	gobies		+	0,5	+			
Gymnammodytes cicerellus (Rafinesque, 1810)	Sand eel	+		0,5	+			
Hippocampus guttulatus (Cuvier, 1829)	Sea horse	+		0,5	+			
Huso huso (L., 1758)	Beluga		+	3	+			
Labrus viridis L., 1758	Green wrasse	+		0,5	+			
Lithognathus mormyrus (L., 1758)	Striped seabream	+		0,5	+			
Liza sp.	Grey mullet	+		1	+			
Merlangius merlangus (Nordmann, 1840)	whiting		+	0,5	+		+	
Mesogobius batrachocephalus (Pallas, 1811)	goby		+	0,5	+		+	
Mugil cephalus (L., 1758)	Flathead mullet		+	1	+		+	
Mugil so-iuy (Basilewsky, 1855)	Mullet so-iuy		+	0,5	+		+	

0	1	2	3	4	5	6	7	8
Mullus barbatus ponticus (Essipov, 1927)	Red mullet		+	0,5	+		+	
Neogobius melanostomus (Pallas, 1811)	Round goby		+	0,5	+		+	
Neogobius sp.	goby	+		0,5	+		+	
Nerophis ophidion (L., 1758)	Pipefish	+		0,5	+			
Oblada melanura (L., 1758)	Saddled sea bream	+		0,5	+			
Ophidion rochei (Müller, 1845)	cuskeel	+		0,5	+			
Parablennius sp.	Rusty blenny	+		0,5	+			
Platichthys flesus luscus (Pallas, 1811)	European flounder		+	1	+		+	
Pomatomus saltatrix (L., 1766)	bluefish		+	1	+		+	
Psetta maxima maeotica (Pallas, 1811)	turbot		+	3	+		+	
Raja clavata (L., 1758)	Thornback ray		+	3	+		+	
Salmo trutta labrax (Pallas, 1811)	Sea trout		+	1	+		+	
Sarda sarda (Bloch, 1793)	Atlantic bnito		+	1	+		+	
Sardina pilchardus (Walbaum, 1792)	European pilchard		+	1	+	+	+	
Sarpa salpa (L., 1758)	salema	+		1	+			
Sciaena umbra (L., 1758)	Brown meagre	+		1	+			
Scomber japonicus (Houttuyn, 1780)	Spanfish mackerel	+		1	+			
Scophthalmus rhombus (L., 1758)	brill		+	1				
Scomber scombrus (L., 1758)	Atlantic mackerel		+	1	+		+	
Scorpaena sp.	Black scorpionfish	+		0,5	+			
Solea nasuta (Pallas, 1811)	Common sole		+	0,5	+		+	
Sparus aurata (L., 1758)	Gilthead seabream	+		0,5	+			
Spicara sp.	picarel	+		0,5	+			
Sprattus sprattus (L., 1758)	sprat		+	0,5	+		+	
Squalus acanthias (L., 1758)	Dog fish		+	3	+		+	
Symphodus (Crenilabrus) sp.	Grey wrasse	+		0,5	+			
Syngnathus abaster (Risso, 1826)	pipefish	+		0,5	+			
Syngnathus sp.	Great pipefsh	+		0,5	+			
Trachinus draco (L., 1758)	Greater weever	+		0,5	+			
Trachurus mediterraneus ponticus (Aleev, 1956)	Horse mackerel		+	0,5	+		+	
Trigla lucerna (L., 1758)	Tub gurnard	+		0,5	+			
Tripterygion tripteronotus (Risso, 1810)	Black Sea blenny	+		0,5	+			
Umbrina cirrosa (L., 1758)	Shi drum	+		1	+			
Uranoscopus scaber (L., 1758)	stargazer	+		0,5	+			

d. *Internal validation*

The design and implementation of statistical sampling schemes is placed under the responsibility of the each country. In order to meet fisheries data requirements in existing GFCM decisions, it may be necessary to improve, standardize and possibly modify current national data collection systems. A more efficient use of sampling resources may require the definition of best practices for sampling design and data analysis, with the aim to obtain accurate variable estimates with minimum bias and uncertainty levels.

It is fundamental that field collection, laboratory techniques and data processing be applied consistently and correctly. The integrity of the data should be also maintained and documented, from sample collection to entry in the data record. Countries are expected to keep, at the national level, standard data quality documentation as follows:

* *A standard operating procedure* which should include:

- the quantitative goals of the monitoring programme;
- the methodological details of all steps performed (e.g. fields and laboratory aspects);
- details of the procedure related to the analysis and archiving of data.

* *A quality manual* which should describe:

- the quality assurance system in place;
- the frequency at which different aspects of quality assurance should be reviewed;
- the standards that should be met;
- the actions needed if the standards are not met.

Precision, accuracy, representativeness, completeness, and comparability are all components of the quality that should be taken into account.

Precision	Measure of the proportion of agreement among replicate measurements
Accuracy	The degree to which a recorded measurement varies from a true or expected value
Representativeness	The extent to which measurements represents the true value in the population
Completeness	The proportion of valid data collected with regards the total expected
Comparability	The extent to which data from different sources can be comparable

e. External validation

This validation is performed by the JRC / GFCM Secretariat to assess the quality of data transmitted by countries. The will check:

- check the completeness of data collected;
- identify deficiencies in the data transmissions;
- check differences between countries;
- check problems connected with the quality of existing data, their completeness and the level of comparability;
- check comparability with other sources of information/reference;
- identify significant discontinuities in time of collected data;
- identify significant outcomes.

5. *Collecting material to determine age*

Determining age in fish is an important element that contributes to the study of the population dynamics of a species. It is an important parameter that helps to analyze the growth, mortality, recruitment, fundamental population parameters. In most fish species the age can be determined by analyzing the discontinuities that form in the skeletal structure. These discontinuities may occur in the skeletal structure either due to changes in the living environment (eg. temperature changes) or changes in fish physiology (eg. changes in the reproduction process). However, as in some fish specimens, living in a constant living environment, skeletal discontinuities are not visibly formed, then the age assessment for these individuals will be performed indirectly.

A knowledge of the anatomy of the vestibular apparatus and the morphology of the otoliths is important in effectively collecting the otoliths. Depending on where they are located in the inner ear, the otoliths may be: utricular, sagittal and lagenar (Stevenson & Campana, 1992). In most species of fish used in determining the age is the sagittal otolith, which is located in the sacculus component of the inner ear.

Scheme of the process of determining the age at fish by analyzing the bone structures

The samples for the determination of age will be collected according to the stratified method, ie by providing for each length class a constant number of age material - 10 copies (as many as 5 males and 5 females) in the sample for studying the frequency at length and outside. of him (chair and from other trainings until the number of 10 copies at each length class is completed). For 5 - 10 samples, a sample for the frequency of the ages should be provided for the length frequency. In this interval you can complete the number of 10 copies in each length class. The material used to determine the age in order to obtain the age frequency in the analyzed samples consists mainly of scales (Fig. 15) and otoliths (Fig. 16), being specific to each species.

The scales are collected from certain areas of the body, in order not to collect scales just formed, with the degeneration of the central part or from the lateral line, which can give rise to errors, or are ineligible. In most species, scales are collected from the area near the middle of the body, below the front of the dorsal fin. If there are a few dorsal fins, the scales are taken from under the first one, placed closer to the head. At the same time, the scales must be taken above the lateral line, but not far from it. If the fish does not have a lateral line (Clupeidae) the scales are collected from the middle of the coast, also under the dorsal fin. Quite often the first row below the side line is used. Before scraping the surface of the body with a scalpel, or knife, it is recommended to clean the collection site with a cloth and with the back of the knife to remove any foreign scales and mucus. The scales resulting from scraping are put for storage in the scales of scales, so numbered so that it can be recognized, when reading the age, the meristic elements of the collected specimen.

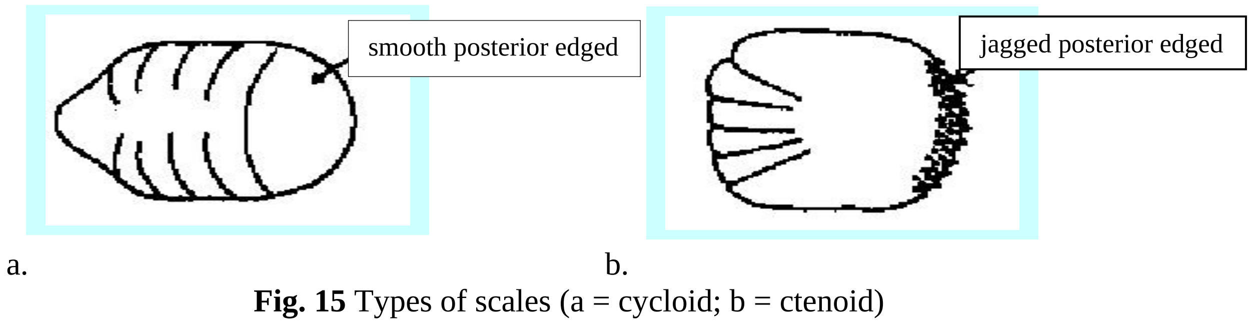


Fig. 15 Types of scales (a = cycloid; b = ctenoid)

Otoliths - are collected from the inner ear of the fish, located at the base of the skull. As a general rule, otoliths should be collected from fresh fish. They can be reached by an oblique sectioning of the head through the dorsal part, starting above the eye, at the base of the brain, or after removing the branchial arches by breaking with the tweezers of the bone base of the brain, just before the first vertebra. From the inner ear the otoliths are easily removed, without being crushed with the tweezers and placed in a drop of water on the back of the left hand to clean the blood and the transparent membrane surrounding them. The otoliths thus collected are kept in small glass tubes, envelopes, or notebooks using the same numbering system as for scales. After otoliths one can easily determine the age of anchovies, sprats, squid, gadids, pleuronectids, gobiids.

Fig. 16 Otolith of anchovy (*Engraulis encrasicolus* /*photo* by NIMRD Constanta)

The age of the fish can also be determined by the thorny radii of the fins, on the membrane whose annual layers are seen and after the opercules or preopercles, etc.

Cartilaginous fish - unlike age determination methods in bony fish, which have otoliths and scales, age determination methods in cartilaginous fish are more complex (Campana, 2014). Thus, structures suitable for reading age are vertebrae and spines.

The vertebrae are taken from the thoracic (central) area; For each sampled individual, a section of at least ten vertebrae should be extracted and then stored in the freezer (-18°C). The vertebrae contain concentric pairs of opaque and translucent bands; the pairs of bands are counted as the growth rings of a tree. In order to obtain a thin section suitable for reading, the central vertebra must be incorporated into the epoxy resin. It should then be immersed in distilled water for 30 to 45 minutes and then dried to remove excess moisture.

The cleaned central vertebra should be photographed with a stereomicroscope in the reflected light using an integrated camera. A reference should be included in the image. The main measures of the vertebrae should be recorded in the form: radius (RV, in mm) and length (LV, in mm). It can be analyzed after sectioning. To enhance the image, dye will be used.

The correct interpretation of the growth strips is of fundamental importance in estimating the age of the analyzed sample. Reading should be done along the corpus calcareum, starting with the first year after the birthmark (BM), which is sometimes associated with a variation of the corpus calcareum angle (Sulikowski et al., 2003).

The dorsal spine has growth bands, so the best approach is to capture a digital image; The growth bands are usually the clearest if the spine is held with the convex side of the curve facing upward, but slightly offset from the vertical. On the Romanian Black Sea coast, among the cartilaginous fish species is the dog fish (*Squalus acanthias*). Thus, as a method for determining age, the backbone is used, which is removed, the meat removed by boiling and then skimmed (Irvine et al., 2006).

***Mollusks /* Gastropods** – bivalves from natural populations can be analyzed by identifying the growth bands on the shell, formed at regular intervals of time. This also allows the study of the abiotic and biotic environmental factors (temperature, salinity, physical disorders) on the development of the individual (Doris et al. 2009). Also, the age of the bivalves can be identified by analyzing the growth bands on the sectioned shell. The usual age-reading procedure for Rapa welk is based on the analysis of the deposition strips that form on the shell. These bands can be counted in two ways:

* counting these strips directly from the shell surface (Fig. 17);

* counting the strips on the sectioned surface of the shell (Fig. 7.18).

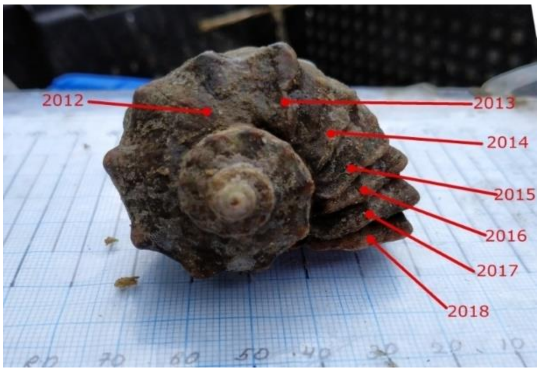


Fig. 17 Strips identification on Rapa welk shell (*photo* by Bohdan Hulak - Center YugNIRO)

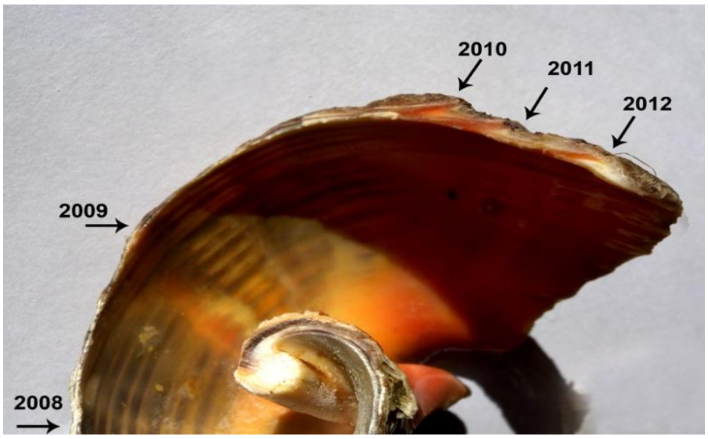


Fig. 18 Identification of strips on a Rapa welk sectioned shell (*photo* by dr. Oleg Kovtun, Center YugNIRO)

a. *Method of collecting the otoliths*

The best method for removing otolith depends on the morphology of the hearing capsule, the size of the fish and how the individual was kept. The method by which the cut is made on the head of the individual for sampling is also done according to the preference of the one who takes it. To access the cavities in which the otoliths are closed, different cutting methods can be used:

* rear section ("open hatch" method),
* cross section (guillotine method),
* longitudinal section ("right between eyes" method).

In general, the first two methods are used in demersal species. The cutting and cutting tools vary depending on the size and strength of the skull, but generally consist of razor blades, scissors and knives. The section should be done carefully to avoid damage to the inner ear or otolith (Carbonara and Pollesa, 2019). After proper cutting, the otoliths can be removed with a stainless-steel tweezers.

Fig. 19 Otoliths sampling from anchovy (photo NIMRD, Constanţa)

b. ***Method of cleaning the otoliths***

After extraction, the otoliths should be cleaned of any residual organic tissue, then washed with alcohol and dried on paper. The analysis of *scales* to determine age is also a commonly used method. Scales differ in shape and size depending on the area where they are inserted. For the age analysis, those from the upper dorsal part are used, in the area between the head and the dorsal fin. After cleaning them with alcohol, the scales are placed between two glass slides and can be analyzed in binoculars. The age is determined by counting the annual growth circles.

c. ***Method of storing the otoliths***

It is recommended to be stored in plastic tubes, these having the advantage of being rigid enough to protect them from damage due to handling. Also, when analysing a sample from which the otoliths are taken for estimating age, it is important to label the vial with other information, such as date of sampling, station, species, length and weight.

d. ***Interpretation of age***

For the interpretation process it is recommended that the otoliths be immersed in glycerin to make the rings more visible under the reflected light using a binocular (Fig. 20).

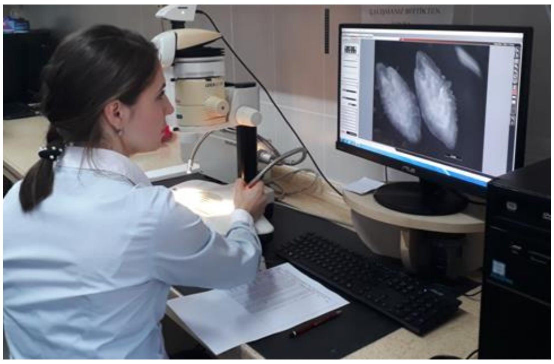


Fig. 20 Otoliths analysis on binocular with attached camera (*photo* by NIMRD)

These marks of annual deposit are formed by the growth stops at the shell level and the thickening of its edges. Pigmentation in the thickness of the shell changes during the breeding period. The first mark of deposit in the reproduction process is formed at the age of 2 years. The complete age of individuals can be determined according to dr. Chuhchin's formula:

$$(n + 2) + \qquad \text{where, } n = \text{the number of marks.}$$

e. Accuracy of interpretations

In order to minimize the risk of systematic errors due to preconditioning, readings / interpretations of calcified structures should be performed by at least two independent operators, without sample information (eg. size, gender, etc.). Moreover, the readings must be made at least twice by each reader, at an interval of 10-15 days. When readings disagree, calcified structures need to be re-analyzed (Goldman, 2005). You can also analyze the percentage of agreement (PA), calculated according to the formula:

$$PA = (\text{no agreement}) / (\text{no disagreement}) \times 100$$

Regarding the PA, the value can be considered acceptable when reaching an agreement of at least 80% with expert readers.

6. Harvesting of material to establish the gonosomatic ratio and fertility

In parallel with the usual biometric measurements, the gonads are weighed, both in males and females. It is labeled: the date, the number of the trawl, the number of the specimen in the sample from which it was taken. Formolizes in gauze bags.

a. ***Sex, stage of maturation of the gonads and fertility***

Determining sex and sexual maturity are essential in fishery biology, through their knowledge of fish stock reproduction. Equally, the information that results from these analyzes can be used to determine the age and size at which the fish reach sexual maturity, the time and place of reproduction and the duration of the cycle from the beginning of ovarian development to the spawning emission. Normally determining sex is not a difficulty. Work on samples with an established number (depending on the species, 50-60 specimens to have 40-50 specimens with gonads in stage IV-V), measuring the length and weighing each individual. An abdominal incision is made noting the sex. The gonads that are examined according to the classical criteria are taken: superficial vascularization, color, transparency of the ovary shell, consistency, volume. Knowing the proportion of the two sexes within a population allows a correct ecological characterization, constituting the expression of genetic polymorphism. The sex ratio indicates the state of the population under this aspect at one point and remains relatively stable or changes over time.

In some fish species, sex is determined by the color of the gonads, for example, atherin, the gonads in males are dark gray to black. The number of females is usually higher than that of males, though not always. Sometimes the sex ratio varies with age, in most species it is about 1:1.
The term "maturation stage" has a special meaning, but is generally accepted in fishery biology. It is used to signify the maturity of a fish's ovaries and testes. During one year the gonads go through several successive phases: the premature phase, the actual maturation phase, the tip (reproduction) phase and the atresia phase. At the same time, the term "first maturity" is used to describe a fish that breeds for the first time.

Sexual maturity in fish is of great practical importance, regardless of whether the fish becomes mature in the 2nd or 3rd year, or only in the 16th. A fish that breeds late cannot be fished intensively without its number decreasing. Generally, fish are considered to be mature when they reach half their maximum size. The slower a fish grows, the later it becomes sexually mature and vice versa. The maturity of the genital products is also related to the matabolism of the lipid substances and from this point of view we distinguish fatty and weak fish.

Fig. 21 Anchovies (*Engraulis encrasicolus*) mature sexually (female and male) photo, NIMRD

The procedure used in the NIMRD admits that, for every 10 copies analyzed to determine the frequency of ages, the sex and the degree of maturation of the gonads should be studied, in order to determine the reproduction period of the analyzed populations and the gender ratio. In order to determine the sex and degree of maturation of the gonads, the specimens taken in the study are dissected and the observations made in the age frequency form are recorded.
In order to facilitate the analysis of the biological material regarding the course of sexualmaturity and for the delimitation of the different stages of the sexual cycle, numerous maturation scales have been elaborated, applicable to different fish species. The NIMRD uses the six-stage visual appreciation scale of Nikolski (1962):

sex (I/imature, F/female, M/male)	**The reproductive apparatus aspect**	**Maturation stage** (maturation state)
I	Sex cannot be determined with the naked eye. The gonads are very small and translucent, almost transparent.	**0** (undetermined)

F	The ovary is small, rosy and translucent and shorter than ⅓ in the body cavity. Eggs are not visible to the naked eye.	**1** (immature)
M	Thin and whitish testis are shorter than ⅓ in the body cavity.	
F	The ovary is reddish pink / reddish orange, translucent and is about ½ of the body cavity. Blood vessels are visible. Eggs begin to be visible to the naked eye.	**2** (beginning of ripening)
M	The testis are whitish / pink, are more or less symmetrical and have a length of about ½ of the body cavity.	
F	The ovary is pink-yellow and has a granular appearance and a length of approximately ⅔ in the body cavity. The eggs are large, transparent, easily visible.	**3** (mature, reproductive)
M	Testiculul este alb-cremos și moale, cu o lungime de aproximativ ⅔ până la toată lungimea cavității corpului.	
F	The ovary is reddish with obvious superficial vessels, measuring from ⅔ to the full length of the body cavity. Eggs are large, transparent, clearly visible and could be expelled under a little pressure. In more advanced conditions, the eggs can be released freely.	**4** (in full reproduction activity, breeder)
M	The testicle is white and under light pressure, the spermatic material can be expelled.	
F	The reddish ovary is reduced to about ½ of the length of the body cavity. The walls of the ovary are flaccid; the ovary may contain remnants of desintegrating opaque and / or translucent eggs.	**5** (end of reproduction, spent)
M	The testis are pinkish-red and occupy up to about ½ of the length of the body cavity.	
F	The ovary is rosy and translucent, measuring approximately ⅓ length from the body cavity. Eggs begin to form but are not visible to the naked eye.	**6** (resting, recovering)
M	The testicle is whitish / pinkish, more or less symmetrical, with a length approximately ⅓ of the body cavity.	

Descriptive maturity stages on crustace:

Females:

Stage I - Telicum is undeveloped, or incompletely developed. The ovary is very small, the oocytes being small, of equal size.

Stage II - The telicum is completely formed, red. They usually carry spermatophores. The oocytes are about the same size, but larger than at stage I.

Stage III - The telicum bears spermatophores. In the center of the ovary are groups of large, opaque oocytes. Their nuclei are seen in a transparent, light-colored disc form.

Stage IV - The telomum with spermatophores, has all the large oocytes, except the marginal ones. In the central part of the ovary the oocytes are non-transparent. The nuclei of these oocytes are not seen at all.

Stage V - Telicum with spermatophores, has all opaque oocytes, their nuclei are not seen. The carapace is hollowed out.

Stage VI - Spermatophores may be missing from the telicum. The carapace is hollow but empty. The ovary is small, virtually devoid of large mate oocytes.

Males:

Stage I - Petazma is incompletely developed. Sex can only be determined upon dissection.

Stage II - Petazma does not reach the end of the internal appendix. The sperm pouch is round. The cavity is relatively large. There are no spermatophores in the semen removal vessels.

Stage III - Petazma exceeds in length the internal appendix, is weakly chitinized. The proximal branch of the internal lobe is not flattened. The spermatophore pouch is long and carries several secretions of thickened sperm. The cavity is quite small. There are no spermatophores in the sperm elimination vessels, and if they are very small.

Stage IV - Petazma is fully developed, chitinized. The proximal branch of the internal lobe is flattened. The sperm pouch is very large. The cavities are not large. Spermatophores drain easily under pressure.

To confirm the maturing stage macroscopically, a histological analysis can be performed. From the fresh gonad is taken, a piece from its central part. A methodology used for the histological analysis it can be the one described by Mazzi (1997) and by Cerri & Sasso-Cerri (2003):

- is fixed in 5% buffered formaldehyde (0.1 M, pH 7.4) for a maximum period of 48 hours and stored in 70% ethanol;
- it is dehydrated by a progressive series of alcohol concentrations (70-100%);
- it is incorporated into a synthetic resin (GMA, Technovit 7100, Bio-Optica);
- cut at 3.5 μm with a rotary microtome (LKB, Historange);
- it is covered with a different technique; to analyze the histological structure of the ovaries and oviduct glands, Gill or Carazzi hematoxylin and alcoholic eosin (H and E). Masson trichrome (MT) or toluene blue and eosin (TB and E) can be used.
- quickly dehydrated in graded ethanol (95-100%), cleaned in Histolemon and mounted in resinous environment (Eukitt).
- can be observed using an optical microscope equipped with a camera, at different magnifications.

Depending on the degree of maturation of the ovaries, the relative weight of the ovary varies during a sexual cycle. This relative weight is called a gonosomatic ratio and is used to establish prolificity. The gonosomatic ratio can be expressed by the ratio between the weight of the ovaries and the weight of the fish after the removal of the ovaries, according to Schaefer's formula (1954):

$$RGS = g \times 100 / G$$ where, g = weight of the ovaries and G = weight of the fish.

Knowing the fecundity of a species is an important factor in the rational exploitation of the fish stock and is also used in the analysis of the breeding and survival potential of the stock.

The absolute fertility can be expressed by the ratio of the weight of the fish multiplied with the gonosomatic ratio and the average weight of an egg, multiplied by 100, according to Williams's formula (1997):

$$N = p \times F / m \times 100$$ where, N = fertility;
p = gonosomatic ratio;
F = body weight (g);
m = average weight of an egg.

The installation of sexual maturity is very different depending on the species; In some cases, it is conditioned by the individual reaching certain dimensions, sometimes by environmental conditions (food, temperature). The determination of the sex ratio and of the sequence of changes in maturity stage during the year are of considerable importance in building a thorough knowledge of the general biology of an exploited stock.

Identification of sex and sexual maturity stages find their primary application in providing basic knowledge of the reproductive biology of a stock. The information derived from these analyses can be used in ascertaining the age and size at which fish attain sexual maturity, the time and place of spawning and the duration of the cycle from the beginning of the development of the ovary to the final release of eggs. Together with fecundity estimates this information can be used to calculate the size of a stock and its reproductive potential.

7. Harvesting material for the study of food

Methods of on fish are diverse but must be critically evaluated in order to properly use them to determine the importance of food. An objective analysis is one that highlights both quantitative and qualitative aspects of food. Thus, a simple way of recording data by analyzing stomach contents is to record the number of stomachs that contain one or more individuals in each food category, the number can be expressed as a percentage of the total stomachs analyzed (Hyslop, 1980).

Sikora et al. (1972) determined average dry weight in predatory species and expressed this as "biomass units". Variation in the average total weight of stomach contents relative to the size of the fish is commonly used in determining the daily rate of food behavior (Staples, 1975 Changes in the average weight of the annual gastric content indicate differences in feeding intensity. Values that incorporate body weight are probably much more useful because they are a measure of food consumption relative to the size of the fish.

a. Stages of analysis of stomach contents in fish:

- individuals of small size will be taken and placed completely in formaldehyde (4% solution) and then analyzed in the laboratory;
- from large individuals the stomach will be collected; with the help of the scissors the digestive tract will be cut to its extreme parts and then the ends will be connected and then it will be introduced into formaldehyde (4% solution);
- the meristic characteristics of the analyzed individuals, the date and the sampling station will be noted;
- the organisms present in the stomach will be identified up to the group level and, where possible up to the family level;
- depending on purpose different indicators will be calculated (frequency of occurrence, dominance, feeding coefficient, relative importance index (IRI), etc.).

Fig. 22 Stomach content analysis in turbot (INCDM photo)

Stomach content research has been an important area of activity in fisheries biology. Fish food studies cannot be treated in isolation, as they must be discussed in correlation with the whole marine environment in which fish are mere elements. For the laboratory study of the stomach contents, the establishment of trophic relations, it is necessary to collect the digestive tract. The proper collection consists in the cutting with the scissors of the digestive tube at its extreme points, the introduction at one end of a note, the number of which will indicate the meristic characteristics of the fish in the age frequency form. The digestive tubes collected and thus labeled are attached to both ends with thread, placed in a gauze bag and placed in formaldehide (4% solution) as soon as possible, to reduce as much as possible the alteration of the stomach contents.

Quantitative analysis is done by weighing method. The whole stomach content is weighed on the analytical balance as well as each element separately. In order to link these data with the individual to whom they belong, the stomach filling coefficient is calculated or as the fish feeding coefficient is also called.

Two methods are used for the determination, namely: qualitative and quantitative. The qualitative analysis consists in the complete identification of the food components present in the stomach of the fish. The quantitative method consists of numerical analysis (frequency of occurrence, dominance) and gravimetric analysis (feeding coefficient, index of relative importance (IRI). The frequency of occurrence and the numerical percentage of food components are generally calculated to characterize stomach contents (Hyslop, 1980). The frequency of occurrence (FO%) is expressed as the percentage of the total number of stomachs in which the respective species appears:

FO% = FOi/ FOt x 100 where, FOi = number of stomachs in which species I appears;

FOt = total number of stomachs

A first evaluation can be determined by determining the filling coefficient of the digestive tract or the weighting coefficient. With the help of an electric scales, the stomach and the individual are weighed before and after the stomach is taken. Regarding the calculation formula regarding the filling coefficient of the stomach (of the digestive tract) there are several variants of calculation.

A first evaluation can be determined by determining the filling coefficient of the digestive tract or the weighting coefficient. With the help of an electric balance, the stomach and the individual are weighed before and after sampling.

Regarding the formula for calculating the coefficient of filling of the stomach (digestive tract) are more alternatives:

* Schreck et al., 1990 propose the following formula:

CU = <Cs/(Gt-Cs)> x 1000 where, CU = the filling coefficient;

Cs = weight content stomach; Gt = total weight of the fish

* Porumb I., 1961, carrying out studies on the biology of horse mackerel, proposes the following calculation formula for the filling coefficient of the stomach:

CU = ms x 10000 / mp where, CU = the coefficient of filling of the digestive tract in fish;

ms - mass of stomach contents;

mp - total mass of the fish.

* Smyly (1952) working with only a small amount of stomach content calculated the average weight of the whole content:

total stomach content / total weight of fish x 100

However, a realistic assessment is based on combining several values. One such indicator is the " index of relative importance " (IRI) in the formula Pinkas et al, 1971 Prince 1975:

IRI = (%N + % V) x %F

where, N% = number in percent,

V = volume;

F = frequency of occurrence.

This index is an integration of the measurement of the number, volume and frequency of occurrence to help evaluate the relationship between the different types of food identified in the stomach.

a. Index of relative importance (IRI)

This index is an integration of the measurement of the number, volume and frequency of occurrence to help evaluate the relationship between the different types of food found in the stomach. It is calculated by summing the numerical and volumetric percentage values and multiplying by the frequency of the occurrence percentage (Pinkas et al., 1971).

IRIi = (% Ni +% Vi) *% FOi

If Ni, Vi and FOi represent percentages of the number, volume and frequency of occurrence of the species, to estimate comparisons between species, the IRI was standardized to% IRI (Cortés, 1997).

COLLECTING TRAVERSAL VARIABLES

Given that the long-term sustainable use of fishery resources is the main object of conservation and management, the authorities involved in fisheries management must take measures based on competent scientific data, which will allow:

* avoiding the establishment of excess fishing capacity;
* preventing excessive fishing situations with unfavorable implications by sizing the fishing

effort and ensuring the selective nature of the fishing based on the assessment of the allowable catches;

* the development and use of cost-effective selective-non-destructive fishing gear and techniques that respect the environment and protect living marine resources.

In this sense, in order to ensure an efficient conservation and protection of the living marine resources from the Romanian coast, it was necessary to develop a system of monitoring and control of the catches of targeted and unvisited species, of the fishing capacities and effort.

1. *Catch*

Knowledge of the biomass removed from the ecosystem by fishing operations is fundamental so as to monitor the status of stocks, as well as the impact of fishing on fish populations.

Landing data - the total amount of landing. The total amount of all landed species, in weight (tonnes) by fleet segment, together with the total number of active fishing vessels, should be reported by country and area (GSA). Total landing figures can be obtained from different sources (e.g. logbooks, sales notes, sampling and interviews).

Catch data per species - the main commercial species, identified at national level, information on the total catches by area and fleet segment. Total catch should be considered as the weight of the total annual catches, including the retained catches (landings) and the discarded fraction (discardes).

**** Incidental catch of vulnerable species*** - refers to the specific reporting of incidental catch of seabirds, sea turtles, seals, cetaceans, sharks and ray's species. It is important to collect existing data and identify additional / alternative sources of information to guide any possible revision of monitoring schemes. Data on the number of individuals taken, as well as fleet segments and gear types (if available) should be reported. Appropriate methods for recording by-catches include, for example, on-board observers and / or automatic sampling.

2. *Fishing fleet*

The general objective is to provide information on the fleet operating, in order to compile reliable statisctics on fishing capacity for regional and sub-regional management purposes. Information will be collected on all vessels, boats, vessels or other national vessels that are equipped and used for commercial fishing purposes in the fishing area. Special attention should be paid to small-scale vessels.

3. *Fishing effort*

Fishing effort is a measure of the amount of fishing activity deployed. It can be calculated through a combination of inputs related to capacity, gear and time. Effort information is needed to analyse changes in the amount of catch and it is crucial for developing multiannual management plans. Usually, fishing effort is calculated by multiplying the fishing capacity deployed (i.e. total GT or power, number of hooks in longlines) by the period of time (number of hours or days spent fishing) and can be obtained through various sources (logbooks, sampling, census, port surveys, etc.). Also, effort is combined with catch to estimate the rate of catch per unit effort. The catch per unit of fishing effort (CPUE) is a relative measure of fish stock abundance and can be used to estimate absolute abundance; it could be an indicator of fishing efficiency, both in terms of abundance and economic value. In its basic form, the CPUE could be expressed as the captured biomass for each unit of effort applied to species/stock (e.g. total catch of a species divided by the total fishing: kg/number of fish per longline hook days). Declining trends of this estimator could indicate overexploitation, while unchanging value could indicate sustainable fishing.

a. The structure of the data to be collected

In order to obtain the information regarding the situation of fishing capacities and effort, of the total catch and landed in tonnes respectively the value of the catch landed in euros, it is necessary to collect the following tranversal variables:

* *Number of vessels;*
* *GT, kW, Vessel Age;*
* *Days at sea;*
* *Hours at sea:*
* *Fishing days;*
* *Hours fished;*
* *kW - Fishing Days;*
* *GT - Fishing days;*
* *Number of trips;*
* *Number of fishing operations;*
* *Number of fishing tools;*
* *Live Weight of landings*
* *Value of landings total and per commercial species*
* *Prices by commercial species.*

The variables mentioned above are in line with those required in table 4 of Decision (EU) 1251/2016 and their analysis is performed according to the level of the requirements set out in tables 1A, 2, 5B and 5C (the existence of a strict correlation between catches and the effort of area fishing, vessel length classes, gears and fishing techniques). The Romanian fishing vessels operate only in a single superregion / region, in accordance with Table 5C of the Union's multiannual program [Decision (EU) 2016/1251] - Mediterranean and Black Sea. In the case of Romania, the ships are segmented on 5 length classes:

- < 6 m;
- 6 - <12 m;
- 12 - <18 m;
- 18 - <24 m;
- 24 - <40 m.

The fishing gear used on board the vessels are: OTM, TBB, GNS, FPO, LHP, LLS, SB. Depending on the fishing gear used, the ship segments are grouped on 2 fishing techniques:

* PG (length classes 0 - <6 m; 6 - <12 m);
* PMP (length classes 6 - <12 m; 12 - <18 m; 18 - <24 m; 24 - <40 m).

b. ***Data collection sources***

The main sources of collection of the transversal variables are the following documents: the questionnaire, the Black Sea fishing journal and of the coastal areas, the fleet register, the sales notes and the transport notes.

a. The questionnaire is the source of information on fishing capacities (vessel name, registration number, GT, kW, length and age) [according to the requirements of table 4 of Decision (EU) 1251/2016]. The elaboration of the content of the Questionnaire is carried out by the research staff of INCDM "Grigore Antipa" in collaboration with the ANPA staff, with strict compliance with all the data requirements (tranversal, economic and social variables) required in Decision (EU) 1251/2016. After elaborating the final form of the questionnaire, it is distributed to each economic agent who has the obligation to complete all the available data, depending on the complexity of the activities carried out (according to Chapter 10 of the Emergency Ordinance no. 23/2008 on fisheries and aquaculture).

b. The Black Sea and coastal areas fishing log is the source of information on fishing effort (no sea trips, fishing days, sea days, fishing and sea hours, no. of fishermen, no. of fishing operations). fishing, the duration of fishing operations, number of gears and their type respectively the value of catches per species in kg (total / landed / discharged) per vessel (according to the requirements of Table 4 of Decision (EU) 1251/2016).

c. The Fishing Fleet Register is a document that contains information on the technical characteristics of each fishing vessel (active or inactive) (vessel name, registration no., GT, kW, length and age) [according to the requirements in Table 4 of the Decision (EU) 1251/2016].

d. The sales notes are the documents that contains data on the catch landed per species in kg, respectively the price per species landed.

In addition to the ones mentioned above, the collection activity also includes: field surveys through the network of data collectors used in sample surveys, interviews with fishermen, cross-checking with information reported in logbooks, data recorded by the Monitoring System Vessels (VMS), respectively comparisons with previous fleet structures. The basic and periodic checks are implemented during the fishing operations on all types of gear used, respectively species caught and landed.

Also, the VMS information regarding the geographical location of the fishing vessel are well established, so, in addition to providing effort distribution information, they are used as a control tool for each activity, by intersecting with the statements of the marine and coastal fishing logs, respectively probation surveys. They can also provide information about the tools used by ships during their activities.

c. Method of data collection

The data is collected monthly, with the support of NAFA, from all economic operators, from the sources mentioned above. Also, the economic agents are regularly checked during the fishing activities, the landing points and the first sale centers. The collection method in this case is exhaustive and provides 100% coverage of the population, respectively the highest level of quality. The essential advantage of the census collection method is that estimates are known with certainty.

d. The quality of data collected

In order to verify the correctness of the fishing capacities and of the effort, it is possible to cross-validate the capacity and effort data mentioned in the questionnaires, respectively the Journals of marine and coastal fishing by each economic agent (according to the provisions of the origin and the results of the activities carried out), with the existing ones in RFP and registered by VMS (Ship Monitoring System).

Regarding the verification of the accuracy of the data regarding the landing situations, there is the possibility to re-validate the data sheets with the sales notes and the transport notes. The estimation of the average price for each commercial species is made by calculating the weighted average based on the prices recorded in the sales notes issued by the first sale centers for each landing made by the economic agents.

Periodic presence of research personnel on board vessels, tracking of fishing activities with all types of gear, recording the duration of fishing operations performed both in the case of trailed and fixed fishing gear under different conditions (hydro-meteorological conditions, water depth, vessel type, level of mechanization, type of fishing gear, stc.) allowed to obtain norms regarding the level of fishing effort for different situations encountered in the fishing process, which can be taken as a comparative unit in cross-checking the data quality.

After a thorough verification, the data is centralized and processed according to the requirements of the external users and uploaded to their platforms, in the requested formats, according to the chedules.

COLLECTING ECONOMIC VARIABLES

The objective of this task is to collect information in order to monitor the economic status of the fishing sector. Data collected under this task is needed to develop appropriate policies and strategies, especially in relation to promoting the long-term sustainability of resources and fleets. Economic data can help to explain fisher behavior and the overexploitation of fisheries resources. The species that fishers target, the level of exploitation, and the gear that they use are all influenced by the benefits they receive (i.e. the revenue) and the costs they incur.

The systematic collection of economic data is necessary so as to assess the economic consequences of different management options on the varying groups, based on the incentives that these create. Economics provide a framework for the optimal allocation of marine resources for the benefit of society. It provides an approach to valuing the different activities, allowing trade-offs between activities to be assessed and impacts to be measured in a consistent manner.

Economic information should be collected by area (GSA) and by fleet segment. Economic and social data are generally collected through sampling surveys using questionnaires, but for some fleet segments and some variables, other data sources could be used (e.g. administrative records, auction sales, and census).

Data collected under this task will help to obtain:

* trends in economic performance indicators;
* time series analysis of average annual prices for commercial species;
* analysis of the profitability of fleets (income, gross value added, operating cash flow);
* an accurate source of statistical data for landing values and prices;
* a better knowledge of fleet costs and their breakdown in different categories;
* a complete picture of regional, subregional and national employment in the fishery sector.

In order to highlight the level of efficiency of a fishing fleet, it is necessary to have the basic calculation elements (economic variables) that through a detailed analysis / processing will reveal whether the activity of the fishing fleet or a segment of a fleet is profitable or not.

a. ***The structure of the data to be collected***

In order to obtain information on the diversity of economic indicators, such as: income, expenditure, subsidies, investments, labor, etc., it is necessary to collect the following economic variables (table 2):

* Gross value of landings;
* Income from leasing out quota or other fishing rights;
* Other income;
* Personnel costs;
* Value of unpaid labour;
* Energy costs;
* Repair and maintenance costs;
* Variable costs;
* Non-variable costs;
* Lease/rental payments for quota or other fishing rights;
* Operating subsidies;
* Subsidies on investments;
* Consumption of fixed capital;
* Value of physical capital;
* Value of quota and other fishing rights;

* Investments in tangible assets, net;
* Long / short Debt;
* Total assets;
* Engaged crew;
* Unpaid labour;
* Total hours worked per year;
* Number of fishing enterprises/units;
* Value of landings per species.

Table 2 Socio-economics: Economic and social data; Operating costs; Species value; Other economic aspects - Mandatory data (on annual basis)

FIELDS		*DEFINITION OF VARIABLES*
Fleet segment		*The fleet segment code or the code corresponding to the merged fleet segments*
Number of vessels		*The corresponding number of all active fishing vessels (by GSA) operating in the identified fleet segment, during the reference year*
	Valută	*The currency (Euro or US dollar) in which the total value of landing is reported*
	Valoare	*The total value of landing of all active fishing vessels belonging to that fleet segment*
Personnel costs		*Crew wages, including social security costs and imputed value of unpaid labour (for example, the vessel owner's own labour)*
Capacity (gross tonnage)		*The total capacity, expressed as gross tonnage (GT), of all active fishing vessels18 belonging to that fleet segment*
Capacity (engine power)		*The total capacity, expressed as engine power (kW), of all active fishing vessels14 belonging to that fleet segment*
Consum de combustibil		*Consumption in litres of fuel (regardless of fuel type)*
Fuel consumption		*Average price of fuel in the reference year (regardless of fuel type) in local currency per liter*
Total fuel cost		*Total amount paid for fuel in local currency. These data should be transmitted if no data for "Fuel consumption" or "Fuel price" are available*
Repair and maintenance costs		*Costs for maintenance and repairs of fishing equipment, gear and vessel parts*
Commercial costs		*Costs related to sales of vessel output. This includes fish market or wholesaler's fees, transportation of production, purchasing of ice, boxes and packaging*
Other variable costs		*All purchased inputs (good and services) related directly or indirectly to fishing effort (for example, bait, food consumed during the fishing operation) plus the purchase of components of assets (gear or vessel), but only if these do not improve the lifetime of the asset itself (consumed within the given year)*
Capital costs		*Depreciation costs plus Opportunity costs. Depreciation costs: consumption of fixed capital; this represents the reduction in value of the fixed assets used in production during the accounting period resulting from physical deterioration, normal obsolescence or normal accidental damage. Opportunity costs: the capital value is related to the opportunity cost of capital, or the required rate of return that is the rate of return that a company would otherwise be able to earn at the same risk level as the investment that has been selected. The opportunity cost of production is the value of the firm's best alternative use of its resources.*
Value of physical capital		*Value of the vessel, i.e., the hull, engine, all on board equipment and gear. The capital stock must be valued at the prices of the current year and should be depreciated*

Fixed costs	*The costs not directly connected with the operational activities (i.e. effort and catch/landing), which could include bookkeeping, vessel insurance, legal and/or bank expenses, annual quota for fishers' associations, dock expenses, renewal of fishing licences, etc.*
Employment	*The number of persons working on the active fishing vessels, both on a part-time and full-time basis*
Currency	*The currency (Euro or US dollar) in which the operating costs are reported*
Species	*The 3-alpha code identifying the species*
Total landing volume	*The total landing (tonnes) of the species mentioned for that fleet segment*
Total landing value	*The total value of the landing (currency unit, for example, euro), for the species mentioned, of all active fishing vessels belonging to that fleet segment*
Prices by commercial species	*The average value of species' prices during the reference year*
Operating subsidies	*Includes direct payments, e.g. compensation for halting fishing, refunds of fuel duty or similar lump sum compensation payments. Excludes social benefit payments, indirect subsidies, e.g. reduced duty on inputs such as fuel, investment subsidies*
Investments in physical capital Improvements	*Improvements to existing vessel/gear during the given year. These investments aim to improve the lifetime of the assets and are not consumed within the given year*
Other income	*Includes other income from use of the vessel, e.g. recreational fishing, tourism, oil rig duty, etc. Also, insurance payments for damage/loss of gear/vessel*

The variables mentioned above are in line with those required in table 5A of Decision (EU) 1251/2016 and their analysis is performed according to the level of the requirements set out in tables 1A, 2, 4, 5B and 5C (the existence of a close correlation between economic indicators, catches made on each class of vessel lengths, fishing effort by area, fishing gear and techniques, etc.). The Romanian fishing vessels operate only in a single superregion / region, in accordance with Table 5C of the Union's multiannual program [Decision (EU) 2016 / 1251- Mediterranean and Black Sea.

As with the transversal variables, the analysis of the economic variables is performed on the same segmentation of the ships (lengths 0- <6 m; 6- <12 m; 12- <18 m; 18- <24 m; 24- <40 m), fishing gear (OTM, TBB, GNS, FPO, LHP, LLS, SB) and fishing techniques [PG (length classes 0- <6 m; 6- <12 m) and PMP (length classes 6 - <12 m; 12- <18 m; 18- <24 m; 24- <40 m)].

b. ***Data collection sources***

As in the previous case, the main sources of collection of economic variables are the following documents: the questionnaire, the Black Sea fishing journal and of the coastal areas, the fleet register, the sales notes and the transport notes, respectively information from the economic agents' balance

sheet. on the website of the Ministry of Public Finance.

a. The questionnaire is the source of information about all groups of variables (Income, Labor costs, Energy costs, Repair and maintenance costs, Other operating expenses, Subsidies, Capital costs, Capital value, Investments, Financial position, Employment, Fleet, Effort, Number of enterprises / units in fisheries, Production value by species) [according to the requirements of table 5A of Decision (EU) 910/2019].

As mentioned above, the elaboration of the Content of the Questionnaire is carried out by the INCDM research staff "Grigore Antipa" in collaboration with the ANPA staff, with strict compliance with all the economic data requirements required in Decision (EU) 910/2019.

After elaborating the final form of the questionnaire, it is distributed to each economic agent who has the obligation to complete, after the balance sheet, all the available data, depending on the complexity of the activities carried out (according to Chapter 10 of the "Emergency Ordinance no. 23/2008 regarding fishing and aquaculture").

b. The Fishing Journal of the Black Sea and coastal source that provides information on fishing effort (no. days at sea), number of enterprises / unit's fisheries employment (no. fisherman total hours worked per year). [according to the requirements of table 5A of Decision (EU) 910/2019].

c. The Fishing Fleet Register (RFP) is a document that contains information on the number of fishing companies, respectively the technical characteristics for each fishing vessel (active or inactive) (vessel name, registration no., GT, kW, length and age). [according to the requirements of Table 5 of Decision (EU) 910/2019]. For the active vessels, all the economic variables mentioned in point 1 will be collected and for the inactive vessels only the value of the physical capital and the consumption of fixed capital.

d. The sales notes are the documents that contain data on the catch landed per species in kg, respectively the price per species landed (according to the requirements of table 5A of Decision (EU) 910/2019).

e. The Ministry of Public Finance website is a source from which information can be obtained from the balance sheets submitted by the economic agents that carry out fishing activities in the Romanian Black Sea sector.

c. ***Method of data collection***

The economic data is collected annually, with the support of NAFA, from all economic operators, from the sources mentioned above. Completion of the questionnaires is carried out by the accountants in the case of the companies that file the balance sheet or by the administrators of the income statements, expenses, etc., in the case of the Individual Companies and the Authorized Individuals who carry out fishing activities on vessels of 0- <6 m; and 6- <12 m.

Preventive, the accountants and the administrators of the economic agents are information, in advance, about what economic indicators they must provide for the economic analysis of the fishing activity of the companies they represent.

In accordance with the obligations regarding different data that should be reported to other bodies in the EC, e.g. Eurostat (the annual methodological report on data collection and management of statistics on national fisheries), will apply the exhaustive method covering 100% of the vessels registered in the FRF for all segments of the fleet.

d. ***Quality of data collected***

The questionnaires completed with the requested economic data are analyzed by the INCDM specialists, by groups of variables, reporting from a percentage point of view the expenses at the level of the income obtained by each economic agent, respectively their comparative reporting at the level of the expense / income ratio obtained in the previous years with the strict observance of the correlation of the economic variables in table 5A by ship segments and fishing techniques, fishing effort, etc.

Thus, the process of controlling the primary data will consist of the following stages: identification of the extreme values from the absolute values; identification of extreme values from average values; cost structure evaluation and comparison with baseline data.

The primary economic data provided by the economic operators through questionnaires can be cross-checked with other sources of activity-related data, VMS, balance sheet data or balance sheet data submitted by them on the website of the Ministry of Public Finance.

In the event that there are any uncertainties regarding the value of some economic indicators, the data providers (accountants or administrators of the economic agents) are contacted in order to make clarifications or corrections if necessary.

Regarding the verification of the accuracy of the data regarding the landing situations, there is the possibility to re-validate the data sheets with the sales notes and the transport notes.

The estimation of the average price for each commercial species is made by calculating the weighted average based on the prices recorded in the sales notes issued by the first sale centers for each landing made by the economic agents.

After a thorough verification, the data is centralized and processed according to the requirements of the external users and uploaded on their platforms, in the requested formats, according to the schedules.

COLLECTING SOCIAL VARIABLES

The objective of this task is to collect information in order to monitor the social status of the fishing sector. Data collected under this task is needed to develop appropriate policies and strategies, especially in relation to promoting the long-term sustainability of resources and fleets. Social data can help to explain fisher behaviour and the overexploitation of fisheries resources. The species that fishers target, the level of exploitation, and the gear that they use are all influenced by the benefits they receive (i.e. the revenue) and the costs they incur.

The systematic collection of socio data is necessary so as to assess the social consequences of different management options on the varying groups, based on the incentives that these create. Social provide a framework for the optimal allocation of marine resources for the benefit of society. It provides an approach to valuing the different activities, allowing trade-offs between activities to be assessed and impacts to be measured in a consistent manner.

Social information should be collected by area (GSA) and by fleet segment. Social data are generally collected through sampling surveys using questionnaires, but for some fleet segments and some variables, other data sources could be used (e.g. administrative records, auction sales, and census).

Data collected under this task will help to obtain:

* trends in economic performance and social indicators;
* time series analysis of average annual prices for commercial species;
* analysis of the profitability of fleets (income, gross value added, operating cash flow);
* an accurate source of statistical data for landing values and prices;
* a better knowledge of fleet costs and their breakdown in different categories;
* a complete picture of regional, subregional and national employment in the fishery sector.

Social indicators are instruments that allow the measurement of social performance for the purpose of quantitative and qualitative knowledge of social phenomena and processes, making time comparability possible by referring to the concept of quality. For these reasons, collecting these data will facilitate the assessment of the level of social progress in fishing activities, the sustainable management of natural resources and the quality of life.

a. *The structure of the data to be collected*

In order to obtain information regarding the structure of the workforce divided by sex, age, level of education, nationality and professional status, respectively equivalent to full time (FTE) by sex and national level, it is necessary to collect the following social variables (Table 3):

* Employment by gender

* FTE by gender.
* Unpaid labour by gender.
* Employment by age.
* Employment by education level.
* Employment by nationality.
* Employment by employment status
* FTE National.

Table 3 Socio-economics: social data; Other economic aspects - Mandatory data (on annual basis)

FIELDS	*DEFINITION OF VARIABLES*
Personnel costs	Crew wages, including social security costs and imputed value of unpaid labour (for example, the vessel owner's own labour)
Employment	*The number of persons working on the active fishing vessels, both on a part-time and full-time basis*
Full-time equivalent (FTE)	*Full-time equivalent employment, which equals the number of full-time equivalent jobs, is defined as total hours worked divided by the average annual number of hours worked in full-time jobs*
Number of persons in the crew < 25 years-old	*For that fleet segment, the total number of persons in the crew who are younger than 25*
Number of persons in the crew 25-40 years-old	*For that fleet segment, the total number of persons in the crew who are between 25 and 40 years-old*
Number of persons in the crew > 40 years-old	*For that fleet segment, the total number of persons in the crew who are older than 40*
Currency	*The currency (Euro or US dollar) in which these economic aspects are reported*

The variables mentioned above are in line with those required in table 6 of Decision (EU) 910/2019 and their analysis is performed according to the level of the requirements set out in tables 2, 5B and 5C [the existence of a strict correlation between the personnel engaged in fishing activities, ship segments, fishing techniques (PG and PMP) and fishing effort (fishing hours)]. The Romanian fishing vessels operate only in a single superregion / region, in accordance with Table 5C of the Union's multiannual program [Decision (EU) 2019/910] - Mediterranean and Black Sea.

And in this case, the analysis of the social variables is performed on the same segmentation of the ships (lengths 0- <6 m; 6- <12 m; 12- <18 m; 18- <24 m; 24- <40 m), tools fishing (OTM, TBB, GNS, FPO, LHP, LLS, SB) and fishing techniques [PG (length classes 0- <6 m; 6- <12 m) and PMP (length classes 6- <12 m; 12- <18 m; 18- <24 m; 24- <40 m)].

b. *Data collection sources*

As with economic variables, the main sources for collecting social variables are the following documents: the questionnaire, the Black Sea fishing log and of the coastal areas and fishing authorizations. The questionnaire is the source of information on all the social variables (employment broken down by gender, FTE broken down by gender, unpaid work broken down by gender, employment broken down by age, employment broken down by level of studies, employment broken down by nationality, employment broken down by professional status, national FTE) according to the requirements of table 6 of Decision (EU) 910//2019.

a. The content of the questionnaire was elaborated by the research staff of INCDM "*Grigore Antipa*" in collaboration with the NAFA staff, with strict compliance with all the requirements regarding the complexity of the social indicators provided in Decision (EU) 910/2019. After completing the final form of the questionnaire, it was distributed by the NAFA inspectors to each economic agent who had the task of completing all the available data, depending on the complexity of the activities carried out after the preparation of the balance sheet (according to Chapter 10 of the “Emergency Ordinance no. 23/2008 on fisheries and aquaculture”).

b. The Black Sea fishing and coastal areas are the source of information on the number of crew members, number of hours spent in fishing activities or at sea (according to the requirements of table 6 of Decision (EU) 910/2019).

c. The fishing authorization is a document containing information about the number of fishermen engaged in fishing activities (according to the requirements of table 6 of Decision (EU) 910/2019).

d. Periodic field surveys

c. ***Method of data collection***

The economic data is collected annually, with the support of NAFA, from all economic operators, from the sources mentioned above.

In addition, data and information are also obtained through periodic field surveys through the network of collectors (registration of fishermen at fishing points in the case of stationary or on board vessels in the case of expeditionary fishing), interviews with fishermen, basic and periodic checks are carried out during fishing operations on all types of gear used, respectively during landing. In both individual and group interviews, the interviewer's role is to moderate the discussion and to create a framework in which participants feel encouraged to participate in the discussion.

In accordance with the obligations regarding different data that should be reported to other bodies in the EC, e.g. Eurostat (the annual methodological report on data collection and management of statistics on national fisheries), will apply the exhaustive method covering 100% of the vessels registered in the FRF for all segments of the fleet.

d. ***Quality of data collected***

After completing the questionnaires by each economic operator, they are taken over with the support of NAFA by NIMRD "*Grigore Antipa*" who after a thorough verification of the data [cross-comparison of the data from the questionnaire with those from other sources of collection / information such as the logs of coastal and marine fisheries, fishing authorizations, interviews with fishermen on the ground (fishing points or in fishing areas)], proceed to the next stage of analysis / processing with strict observance of the correlation of each social variable by segment of vessel and fishing techniques.

If questions arise about the value of social indicators are contact data providers (administrators economic) in view of clarifications or corrections if necessary.

After a thorough verification, the data is centralized and processed according to the requirements of the external users and uploaded on their platforms, in the requested formats, according to the schedules.