

T1.3.1 Specification for the new gears



EUROPEAN UNION























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1. Context

Within the framework of Work Package 2 of the INdIGO project, two biodegradable materials will be developed, one for use in a fishing net, one for a mussel aquaculture net. The first step of the research and development work is to define the specification, describing the two studied gears and the expected characteristics for each.

2. Objectives

The aim is to develop two innovative gears that are both functional and that biodegrade in the marine environment.

- **Functional** fishing gears must be efficient for fishing (for fine net) or for keeping shellfish in place (for the aquaculture net).
- **Biodegradable** fishing gears must be sufficient for the task they are designed for (strong, durable, etc) for their lifetime, and then biodegrade in sea water without any toxic impact on the marine environment in case of abandonment or loss.

3. Description of selected gears

3.1 Definitions

Monofilament, multifilament, multi-monofilament

There are three types of filaments that are being considered, these are defined in Figure 1.



a. Monofilament	b. Multifilament	c. Multi-monofilament
A single strand of man-made fibre	A thread comprising several filaments (x72, x144)	A number of monofilaments combined (x6, x10)
0.1 mm < <mark>Diameter</mark> of 1 strand < 0.9 mm	Mean diameter of 1 strand = 0.35 μm	Minimal diameter of 1 strand = 0.1 mm







According to Gérard Duchamps (in "Les Fillets maillants", edited in 2009 by Quae), definitions of filaments are as follow:

- a. Monofilament: a filament made of synthetic textile obtained by extrusion, with a diameter greater than 0.1 mm (below, we use the term "continuous filament").
- b. Multifilament: a thread made of continuous filaments put together, then cabled or braided.
- c. **Multi-mono**filament: a thread made of several monofilaments put together by twisting, eventually cabled or braided.

Gear (French: "engin"): all types of products used by commercial fishers to catch marine species e.g. gillnets, trawl nets, pots, mussel ropes.

Net (French: "filet"): the assembled product as used by the fisher including peripheral components e.g. ropes, floats, weights.

Mesh (French: "nappe"): the fabric of the net with uniform aperture (in the case of trammel net, several "meshes" are used).

Mesh aperture (French: "dimension de maille"): the opening in the mesh of a defined size.

3.2 Selection of prototypes

After discussion between partnership, Filt, SMEL, UBS and NaturePlast, two prototypes were selected within the framework of the project. The first prototype is a fishing net used in the fishing sector, made of monofilament and featuring a slow rate of degradation. The second prototype is an aquaculture net used in the mussel aquaculture sector, made of multifilament and featuring a relatively faster rate of degradation.

The lifespan associated with each net will be discussed later in this document. Figure 2 summarizes the main characteristics for each selected prototype:



Figure 2 : The main characteristics of the two prototypes

<u>Note</u>: after initial discussions with commercial fishermen, a third prototype (for fishing net) may also be produced, made of multi-monofilament, which would combine flexibility of multifilament and resistance of monofilament.





3.3 Description of prototype 1: fishing net (for fishing sector)

The first fishing gear studied within the framework of the project is a fishing net. There are two main categories:

- Gill net (see Figure 3) made of only one sheet of mesh. It is produced with monofilaments. This type of net will be produced first during the project.

- Trammel net (see Figure 4) composed of three layers of netting. Two outer layers of large mesh with a sheet of fine small mesh sandwiched between them. It can be produced with multifilament, monofilament or multi-monofilament depending on the fishing area and targeted species. The working principle is detailed on Figure 5.



Figure 5 : How a trammel net works (<u>www.seafish.org</u>)

The basic unit of net is mesh: one piece of net featuring similar mesh aperture (varying according to targeted species). Various lengths and heights are possible. Most common lengths are 25, 50 and 100 meters.

The frequency of renewal of nets depends on the type of fishing activity (full time or part time gillnetter), the target species (fish, shellfish), the environment (ground type) and the type of net used. Full time netters, on average replaced trammel nets every 2 or 3 months, and gill net every 1.5 months (replacement frequency studied in previous projects, e.g. SEAPLAST project report). The high





frequency of renewal is due to the presence of crabs, brittle stars on the fishing grounds, causing premature wear of the nets.

Part time netters, fishing seasonally at the coast (spring/summer) and using 1 to 2 km of net replace nets once or twice a year. For spider crab fishing, nets are replaced with each neap tide, every 2 to 4 weeks.

In France, commercial fishermen tend to use different types of net according to the fishing ground and targeted species. For example:

- At Lorient: nets are made of monofilament.
- In Normandy: nets are made of multi-monofilament, made of polyethylene (PE).
- At Boulogne: nets are made of 2 threads of multifilament, made of polyamide (PA), very flexible and very resistant, ideal for hard ground.

<u>Note:</u> for testing in real conditions, the choice of net should be made in accordance with the specific habits of the commercial fishermen.

3.4 Description of prototype 2: aquaculture net (for mussel farming sector)

The second gear studied within the framework of the project is an aquaculture net used in the mussel aquaculture sector and produced with multi-filaments.

During the growth of mussels, several nets are installed on the mussels to provide support and consolidate the clusters of mussels, and thus avoid losses due to gales and spring tides. In specific areas where winds and hydrodynamic exposure are intense, farmers can use up to six nets during production cycle (see. Figure 6). The choice of net type and farming practices differ according to the aquaculture professionals and on the farm's location (i.e., whether the location is sheltered or not).



Figure 6 : Production cycle of mussel farm (pictures from Comité National de la Conchyliculture)





Nets are first cut from the spool to the length of the stake. A knot is made at one end of the net, to hold it at the head of the stake. The net is then threaded onto a tool (catinage guiding tool, see figure 7 and 8), then put around the stake so that the knotted part is at the head of the stake. The guiding tool is driven into the water until the entire length of the net is fitted, which releases the guiding tool.



Figure 7 : Fitting of a net (<u>www.breizh-coquillages.fr</u>)



Figure 8 : Fitting of a net – an alternative type of guiding tool (<u>www.lesplaisanciersdenezveur.fr</u>)

The operation is repeated for the following stacks (see figure 9). The length of the net should be enough to cover all mussels, but no longer than the height of the stake to allow the guiding tool to be released. A rubber band can be added at the bottom of the stake, to secure the net grip and prevent it from touching the ground (to avoid predators like crabs using the net to access the mussels. When the mussels are mature, they are removed from the stake, together with all the support nets, using a tool as showed on figure 10.



Figure 9 : Mussels on a stake within a support net



Figure 10 : Mussel harvesting using specialist tool





4. List of requirements

The main functions of the two prototypes are detailed in paragraphs 4.1 and 4.2. These elements may be completed and amended as a result of the conclusion of the fishermen's surveys and following the in-situ tests made with the first prototypes (continuous improvement process).

4.1 Functions of prototype 1 (fishing net)

The main steps of the production process of the fishing net are described on the graph below:



The main characteristics of fishing net can be divided according to three main functions:

- **Processability**: Production of the prototype does not require any significant modification of conventional production lines.

- **Properties in use**: The prototype must be able to replace conventional nets without modification of fishing practices (use, repair, etc). Properties of the nets must meet fishermen's' needs during working lifetime of the product.

- **Durability and end of life**: Loss of properties during period of use shall not affect performance. In case of abandonment or loss of the net, biodegradation in sea water must occur efficiently and without toxicity to the marine environment.

4.2 Functions of prototype 2 (aquaculture net)

The main steps of the production process of the net are described on the graph below:



The main characteristics of net can be divided according to three main functions:

- **Processability**: Production of the prototype does not require any significant modifications of conventional production lines.

- **Properties in use**: The prototype must be able to replace conventional nets without modification of mussel farmers' practices. The properties of the nets must meet mussel farmers' requirements during the working lifetime of the product (mechanical strength for a minimum of 6 months for nets fitted in October.

- **Durability and end of life**: Loss of properties during period of use shall not affect performance. In case of abandonment or loss of the net, biodegradation in sea water must occur efficiently and without toxicity to the marine environment.