

ENVIRONMENTAL TRAINING OF THE ITALIAN COAST GUARD BETWEEN TRADITION AND INNOVATION

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Abstract – The geographical structure of our country requires constant and punctual environmental protection, which must be supported by operational components capable of expressing specific skills and a widespread and qualified territorial presence. In this sector, the laws that have followed over time have identified in the Coast Guard, an operational organization committed to safeguarding the marine environment, up to the constitution, with Law n. 179 of 31.7.2002, of the Marine Environmental Department, which represents an added value to the surveillance and protection system. Environmental police duties require qualified and specialized personnel. Therefore, it is necessary to integrate the "basic" preparation, with "specialist" training in compliance with the high standards of a Q.M.S. of training (UNI EN ISO 9001: 2015), which uses teaching methods advanced, classroom and scheduled lessons (face to face and remote), case studies, simulations and exercises, but also hands-on training. The latter methodology plays an important role since learning by doing (Learning by Doing), even more than theory, guarantees the effectiveness of learning, emotional involvement and the formation of experiential memory of learners.

Introduction

The Military Order Code includes the Coast Guard among the Corps¹ of Navy, giving it a strong specialist connotation and entrusting it with public functions that take place along the coasts and in the maritime spaces of national interest, for which it exercises competences relating to the matters of the Ministry of Infrastructure and Transport for which the law and other regulatory provisions provide for their direct attribution.

The Corps is also the recipient, even exclusively, of specific functions conferred by other Departments, including the Ministry of the Environment and the Protection of the Territory and the Sea and the Ministry of Agricultural, Food and Forestry Policies.

¹ Legislative Decree no. 15 March 2010, 66, "Code of Military Order" in art. 118, sanctions the division into Corps of the officers of the Navy. The Corps of origin identifies the functions and competences as indicated in the articles: 119 for the General Staff, 120 for the Marine Engineer, 122 for the Maritime Military Healthcare, 123 for the Maritime Military Commissariat and 132 for the Harbor Master's Offices.

The tasks assigned to the Corps are mainly attributable to five macro-sectors: the "*search and rescue of human life at sea and on the major Italian lakes*"; the "*command, the governance of the ports and the performance of the functions of the Maritime Authority*"; the "*protection of the safety of navigation, traffic and maritime transport*"; the "*protection of fish stocks and supervision of fishing activities and supply chain*"; the "*safeguarding and protection of the marine and marine-coastal environment*".

The latter is a priority objective to be pursued, both for the wealth of the national natural heritage, and for the significant social and economic interests involved in the use of the related resources.

In fact, the geographical structure of our Country and the huge extension of the coastline require constant and timely protection, which must be supported by operational components capable of expressing specific skills and a widespread and qualified territorial presence. In this sector, the law provisions issued over the years have identified the Coast Guard as an operational organization committed to the protection of the marine and coastal environment, up to the constitution, formalized with Law no. 179 of 31.7.2002, of the Marine Environmental Department, which represents an added value to the surveillance and protection system.

In relation to the aforementioned functions, the Corp performs the following tasks:

1. direction, pursuant to art. 23 of Law 979/1982, of the surveillance and control activities for the prevention of pollution of marine waters by hydrocarbons and other harmful substances, as well as for the detection of infringements of the relative standards;
2. surveillance, ascertainment and prosecution, pursuant to articles 135, 2nd paragraph, and 195, 5th paragraph, of legislative decree 152/2006, of the violations regarding illegal discharges, wherever they occur, when they are liable to damage or to pose risks to damage the marine and coastal environment, as well as infringements of legislation on wastes, including the repression of illicit trafficking and illegal waste disposal;
3. surveillance, pursuant to article 19 of law 394/1991, of marine protected areas (MPAs) and marine areas already recognized eligible for protection (future MPAs);
4. exercise of environmental police activities in accordance with current legislation [4].

Training, staff training and qualification

The multiple and articulated functions carried out by the Coast Guard in the environmental field presuppose that the staff is conversant with legal and high technical-professional issues and is capable to constantly cater for the necessary cultural and professional updating, in order to be able to better address the current tasks and future challenges of this complex sector.

The aim of this work is to illustrate, through the description of a *case study*, the teaching methods followed, as well as the specialized components used in the "*environmental training*" field, which arise from the guidelines of the Ministry of the environment and protection the territory and the sea, as well as the programming and coordination of the General Command of the Coast Guard.

Having regard to this it is wise to start from basic training, which is carried out for Officers in the Naval Academy and for non-commissioned officers and graduates in the schools

of the Navy of Taranto and La Maddalena. In these Institutes Officers are provided with the knowledge and skills on the plane of education and instruction, intended, respectively, as internalization of the cardinal principles of military status and as learning of the contents of general culture and of the skills necessary to carry out effectively and efficiently the tasks that the military will be called to perform, in each role of belonging, once sent to the future service venue.

In these early stages, the search for a balance between education and instruction constitutes an important challenge for military training, although the two poles of instruction and education, concerning respectively "*knowledge-that*" and "*knowledge-how to be*", must be enriched with "*knowledge-how*". The latter is considered a student's need to "*exercise and refine the ability to think and imagine, to learn, to use knowledge and to act ...*"².

Furthermore, in parallel with the aforementioned skills, it is essential to stimulate and increase the so-called N.T.S. (*Non-Technical Skills*³) required to assume and maintain military status.

Using these precepts, the Personnel Department ("*Schools and Training*" Office) of the General Command, during the basic training activities, organizes annually, in favour of the Corps Officers (Aspiring Ensigns) attending the Naval Academy, a training campaign, with the didactic objective of introducing the basic principles of marine ecology, environmental policing and remote sensing.

These campaigns entails the carrying out of practical exercises on the monitoring and control of marine ecosystems, also envisage the collaboration of the General Command Plans and Operations Department, with the use of specialist components and scientific instrumentation in the availability of the Corps (air-naval, underwater and Mobile Environmental Laboratories⁴) [5].

² Cfr Ingrassia D. "Knowledge, Skills and Abilities" A reflection from knowledge to well-being in "Leadership & Management" online magazine of 14.02.2017.

³ N.T.S. This term refers to "cognitive, behavioral and interpersonal skills that are not specific to the technical expertise of a profession but are equally important for the success of operating practices in maximum safety". The literature identifies seven that can be summarized as follows: situational awareness, decision-making, communication, teamwork, leadership, stress management and ability to cope with fatigue.

⁴ The Ministry of the Environment and of the Protection of the Territory and the Sea, as part of the program to strengthen the operational activities for environmental surveillance, has provided the Coast Guard with two "vehicles" set up as Mobile Environmental Laboratories (LAM) and equipped with equipment for performing "chemical, chemical-physical and microbiological analyzes" on fresh, marine and "waste" water samples.

The instrumentation supplied to the L.A.M., used by highly qualified and specialized military personnel of the Corps, allows sampling, both from land and sea, in the vicinity of discharges of urban and industrial waste water streams or of water from purification plants. With regard to analytical determinations, personnel capable of detecting the chemical-physical parameters *in situ* using the multi-parameter probe supplied and the loading of nutrients by using specific kits and ultraviolet/visible spectrophotometric techniques. As far as microbiological analyzes are concerned, it is possible to evaluate the presence of the *Escherichia coli* microorganism using the filter membrane method. The scientific component of the Corps is also equipped with the fixed Environmental Analysis Laboratory named after the "CF (CP) Natale DE GRAZIA", set up with cutting-edge instrumental equipment that will also allow the qualitative and quantitative determination of metals and hydrocarbons in aqueous matrices.

Considering the peculiarity of the sector as well as the variety/complexity of the activities carried out by the scientific staff of the Corps, it was decided to implement a quality management system compliant with the requirements of the UNI EN ISO 9001 standard. The Laboratory gained the related certification in 2013 (then renewed in 2016 and 2019, in compliance with the requirements of the new edition of the standard - 9001: 2015) for the following field of application: "planning and execution of sampling

The Official students, who are supported by highly qualified and specialized teachers and tutors, coming from the Naval Academy (Remote Sensing Laboratory) and from the Environmental Training Center "*M.A.V.M. B. Gregoretti*" of Livorno⁵, are involved in carrying out "*environmental monitoring*"⁶ activities [3] aimed at detecting potential environmental offences.

This activity, carried out on the territory in "*on job training*" mode, is also liable to be enhanced up to the real operational level, as it allows the Maritime Authority responsible for the territory to participate and to gain the subsequent results. Therefore, this training methodology may turn to a relevant benefit for the Public Administration in terms of efficiency and effectiveness of its action.

Confirming the importance that the Coast Guard attaches to the education, training and qualification of personnel, the aforementioned "*Schools and Training*" Office and Specialized Training Center have been certified according to the UNI ISO 9001: 2015 standard of the quality management.

The Corps has also decided to adopt a "*Training quality policy*", identifying processes and procedures that comply with sector regulations and are suitable for ensuring training based on standards goal-oriented towards continuous improvement.

The choice of using a quality management system responds, more generally, to an increased awareness of the role that training plays in the exercise of the peculiar and multiple skills of the Corp and to the desire to make this service as efficient as possible.

For logistical, operational and environmental availability, the aforementioned monitoring activity, implemented during a training period, is carried out on Elba island, an area that falls in the jurisdiction of the Coast Guard Office of Portoferraio (the venue of the Harbour Master Head of Maritime Compartment), hierarchically dependent by the main Regional Coast Guard Office, that is the Maritime Direction of Livorno (Leghorn).

The purpose of the training period is also to know and investigate, through activities carried out directly on the territory, any environmental criticalities detected, qualitatively and/or quantitatively, by the remote sensing systems supplied to the Coast Guard air vehicles.

At the same time, a Mobile Environmental Laboratory intervenes in the territory, for the swift execution of the analyzes of the main pollutants in the aqueous matrices, together with a nucleus of underwater operators of the Corps, provided with equipment for coring and collection of sediments and/or sea water, as well as portable video-recording tools and systems, such as the ROV (*Remotely Operated Vehicle*).

The results of the investigations carried out as part of the monitoring activity are also examined by the Environmental Police Operational Unit (N.O.P.A.) of the aforementioned Harbor Master's Office which, in the event of ascertaining criminal or

activities and water analysis for the surveillance and assessment of phenomena that may cause damage or deterioration in the marine and coastal environment".

⁵ Established since 15.9.2014, it was born from the need to harmonize and implement the interdisciplinary training of staff, relating to subjects such as the environment and fishing, together with the Institute's Corps services. Logistics and teaching aids have been designed to ensure efficient lessons and effective support for theoretical and practical training programs. Since 2019, the Center has achieved ISO 9001: 2015 certification in the "planning, execution and control of specialist training activities for staff inside and outside the Coast Guard".

⁶ For the definition of "environmental monitoring", please refer to the following link of the European Environment Agency (EEA): <https://www.eea.europa.eu/help/glossary/eea-glossary/monitoring>.

administrative offenses, draws up, with the Official students, the consequent judicial police acts. These activities, carried out on a yearly basis, allow to monitor the environmental situation of the territory, in order to verify whether the surveillance action (preventive and repressive) put in place by the Coast Guard is achieving the expected result, or to measure the improvement of the environmental conditions of the controlled areas.

The "*environmental monitoring*" activity, based on the continuous improvement of the environmental quality through the exercise of the supervisory action, concretely expresses what is represented in the "*Deming cycle*" or PDCA [2]⁷ "*Plan-Do-Check-Act*". In the case in question, in fact, we consider a "*Multi loop*" process in which the output of a cycle represents the input for the next cycle in a chain of repetitions over time capable of guaranteeing, after *n* cycles, the achievement of the set goal: "*Solved!*".



Figure 1 - *Deming Multi Cycles*.

Materials and methods

The applied methodology draws inspiration from Dewey's philosophical and pedagogical thought, who considers experience a "*continuous interaction between man and the environment in which man is not a passive spectator but interacts with his surroundings both in environmental and social terms*" [1].

In relation to the "*environmental monitoring*" activity for the training of Official students, the training campaigns carried out in the years 2018 and 2019 will be taken into consideration, in order to certify the use of the "*Learning By doing*" training methodology and application of Deming's "*Multi Loop*" Process Approach.

The aforementioned campaigns were launched as part of a report submitted in June 2018 by the operators of Goletta Verde, by means of which the presence of a high bacterial load was reported, in correspondence with the Mola Wetland, located in the Municipality of Capoliveri even if very close to Porto Azzurro harbour.

The didactic/operational intervention plan provided for a remote sensing activity aimed at mapping active coastal inputs.

The group of Official students of the 3rd class of the Naval Academy, to which the training activity of the year 2018 was addressed, was composed of 14 learners, divided into

⁷Cfr Any process can be seen as a cycle that has four moments: *plan* (design, plan), *do* (act, implement), *check* (check) and *act* (stabilize or correct and restart the intervention cycle), according to the hypothesis scheme- implementation-verification-new hypothesis inherent in natural laws. The novelty of Deming's operational reflection consists in having applied the idea of the cycle (and research) to organizations, which are thus considered to be individual bodies, subjects of study and intervention.

two groups of 7 people. This division was intended to stimulate and urge the exchange of views between the members of the group, as well as between them and the *tutors*, applying the "*Learning by doing*" method with those of "*Learning by thinking*" (learning through reflection) and *cooperative learning*⁸, in order to achieve optimal and lasting training results.

The first campaign took place from 30 July to 10 August 2018 and was planned with the contribution of the learners (**PLAN**), who actively participated in the organization of the remote sensing activity, carried out on 2 August 2018 (**DO**) with the use of a Coast Guard AW 139 helicopter, equipped with a FLIR tiltable system called "Star SAFIRE III", routinely used for the census of coastal immissions⁹.

Specifically, the wide field was used in reconnaissance activity while, in the areas subject to reporting, detailed surveys were carried out with more selective fields of view.

The second training campaign took place from 1st to 19th July 2019 and involved 18 Official students, split into 3 groups of 6 people. In this case, part of the monitoring activity resulted from the results of the remote sensing carried out the previous year, which had allowed to find, in the waters in front of the port of Porto Azzurro, a widespread thermal anomaly on which it initially investigated (**ACT** phase) the staff of the local Maritime Authority.

The operational activities were carried out with the same planning (**PLAN**) and execution (**DO**) methods of the previous year, while, as regards the (**CHECK**) phase, the staff of the local maritime office of Porto Azzurro, engaged in the preliminary environmental police control activities, he was joined by the Official students employed in the training campaign.

Results and their Discussion

The results of the FLIR remote sensing activity carried out in Mola in the Municipality of Capoliveri in response to the anomaly flagged-up by Goletta Verde are reported below¹⁰.

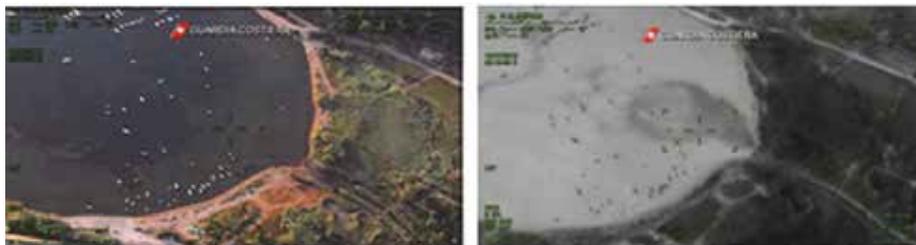


Figure 2 - Mola *Visible and Thermal Infra Red*.

⁸ Cooperative learning is based on the interaction within a group of students, with strong positive interdependence of purpose and work, who collaborate, precisely in order to achieve a common goal, through a deepening and learning work that will lead to the construction of new knowledge.

⁹ The FLIR system supplied to the Corps aircraft can only perform qualitative surveys (\pm hot and / or \pm emissive), i.e. it does not allow the "measurement" of the surface temperature of the framed areas but allows to obtain a representation of the scene framed based on the amount of energy "emitted" by the surfaces and/or objects present therein due to the temperature and/or the material of which they are made.

¹⁰ See previous paragraph.

From the analysis of the aforementioned images, namely from the Thermal Infrared band, it is apparent that there is an introduction of colder waters (darker shades) but it is not possible to identify the pipes that introduce the waste into the Mola ditch, since the same is covered by a copious vegetation (reeds) that hinders the aerial vision. Furthermore, as can be seen from the color *frame*, extracted from the aircraft's HDTV (High Definition TV Camera) subsystem, there are no anomalous colors of the waters near the mouth.

During the **CHECK** phase, the intervention of the L.A.M. for the execution of analyzes aimed at determining the presence of "*abnormal bacterial load in the water samples taken in the water body under examination*". The results of the analyzes returned values of *Escherichia coli*, expressed as UFC/100 ml (Colony Forming Units in 100 ml of filtered sample), within the limits set by the reference standard (Table 3, Annex 5, Part Three of the Legislative Decree 152/2006). Therefore, it was considered that the excessive bacterial load, reported by the staff of Goletta Verde, was occasional as shown in the ARPAT Report "*The control of bathing water - Season 2018*"¹¹.

A widespread thermal anomaly was also detected within the port of Porto Azzurro. That has triggered the ensuing investigation activity by the personnel of the Coast Guard local maritime office (**ACT** phase).



Figure 3 - Porto Azzurro Thermal anomaly.

On 05 July 2019, the Petty Officer in charge of the aforementioned Office, perceiving a bad smell coming from the water mirror in front of the port quay, near the drainage pipes of rainwater and run-off of the same quay, verified the presence of some whitish and foul-smelling streaks of probable organic nature which attracted numerous fishes.

Therefore, a timely inspection of the grids and manholes located in the public road adjacent to the quay was carried out, without however detecting any anomaly.

Subsequently, given the impossibility of reconstructing the path of the whitish substance, the intervention of the Municipality's Technical Office was requested in order to inspect the pipeline backwards and try to find out the entry point of this substance.

¹¹ See Melley A. - Arpat Report - Bathing water control - Season 2018 "*During the whole season 2018 there have been various cases of pollution omission ... For the southern and insular coast of Livorno, the main critical factor is represented by more or less intense and often localized rainfall in a small portion of the territory which causes the spillage of untreated waste into the sea, due to the incomplete separation of the white (rainwater) and black (wastewater) sewage networks*".

On July 9, in the presence of a team of the L.A.M., it was decided to carry out further checks in the area through a sampling carried out within the aforementioned pipeline, which was also actively attended by the Official students in training.



Figure 4 - *Sampling operations.*

On 11 July 2019, the intervention of a local self-purge company was requested, to carry out a video inspection of the white water pipes. This further check allowed to discover that "black" water was delivered to one of these pipes.

By using a tracer, it was possible to verify the spillage of black water into the white water due to the breakdown of the adjacent collection drain.

At the same time, the General Command's Plans and Operations Department produced the results of the analyzes carried out by the Environmental Analysis Laboratory on the sampling on 09 July. The so-called test report revealed what was found on 11 July, or "*... omitted ... it is reasonable to believe that there is infiltration of untreated waste inside the white water collection pipe*".

At the end of all the administrative and technical checks carried out, the watertight integrity of the wells was reinstated.



Figure 5 - *Infiltration point.*

Conclusions

Thanks to the various human and instrumental resources deployed by the Coast Guard, used following an *"integrated approach"* system, with these *"environmental monitoring"* activities, repeated cyclically, it was possible, first of all, to give a positive response to the criticality reported by Goletta Verde, and also to verify the possible commission of environmental offenses and to represent an effective deterrent tool for potential illegal conduct, in order to contribute to the improvement of the environmental conditions of the areas subject to verification.

In conclusion, through the description of a segment of the training activity of the staff of the Corps, it was intended to illustrate the methods of approach to the environmental inspection activity, based on the *"Deming Cycle"* or *"Plan-Do-Check-Act"* model, as well as the setting up of a learning mode based on learning by doing *"Learning by Doing"*.

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