SOS for little sardine

The impact of climate change on sardine growth

Type of pedagogical project, activity, action, accompanying	**Activity on exploring and discussing the impacts of climate change on living conditions in the sea**
Key words of relevant disciplines/ Pedagogical content	Sardine, growth changes of the organism, adjustment on living conditions
Problematic	**Why are the current sardines smaller than before?**
Thematic	Biodiversity
Disciplines (sciences, geography)	*Mother tongue, Science*
Pedagogical Objectives/New targeted skills	**The students will be able to:** **-** understand and explain the influence of thermal energy on chemical processes - understand and explain the causes of reduced growth and shorter lifetime of sardines - explain the influence of raised sea temperature on evolution and life of sardines - predict and write the possible evolution of the situation in the future - suggest measures for the recovery of sardines - increase awareness on climate change in a local environment
Public target(s) (age, requested skills…)	13-15 years old
Description (step by step)	**Step 1)** On the previous lesson students did a research about squids decrease. During the conversation, the students recall the conclusions about the reasons for the reduced catch of squids on the coast of the Adriatic Sea. *An interview with local citizens and fishermen was conducted a week before this lesson. Students will come up with local problematic. **Step 2)** After the interview, students had to point one main problematic. They have

	realized that caught sardines are essentially smaller than the ones that were caught twenty years ago. The teacher raises a problematic issue: “Why sardines don’t reach the size they used to?" Students offer a variety of answers. **Step 3)** A new task is announced: "By using chemistry knowledge we will explore and find out why the current sardines are smaller than before." In this part of the activity students work in groups (4 or 5), they solve worksheet 1, review the chemistry knowledge needed to solve the announced problem. *Worksheet number 1.* a) *Briefly describe the chemical evolution whose consequence is the emergence of more complex molecules from the atom.* b) *What are the sources of heat energy obtained through chemical processes in chemical evolution?* The teacher asks students what they think - how this knowledge could help to solve the problematic issue that was set up at the beginning of the activity. Students come to the conclusion that in both cases (chemical evolution and global warming) the temperature changes. **Step 4)** Students work again in groups on a new task (linked to the knowledge sheet). *What is happening to organisms if the temperature rises?* To help students and lead a discussion, the teacher gives a few key words and asks some leading questions. **Step 5)** At the end of the group work, after a discussion, students come up with a conclusion: *In the conditions of raised temperature, the organisms are rapidly developing, aging, and finally die.* The teacher discusses with the students the connection of sexual maturity of

	species and their growth (link to the knowledge sheet). Through the establishment of causal relationships, the students come to the scientifically confirmed results. **Step 6)** After solving the task, the teacher gives a new one. They have to think about the following question: *How can we influence these changes?* On the next class (IT or mathematics), they are writing suggestions. Students have to produce a graphic presentation of their ideas.
Place (meeting room, outside space, …)	Classroom
Individual and / or collective actions	Collective and individual
Material needed	Board, chalk, working sheets
Duration of pedagogical project or activity	**2 hours**
Evaluation of the new acquired skills	After a discussion and a work with prepared worksheets, students will be able to understand the connection of climate change (raising the temperature) with the development of sea organisms.
Eco-citizen adaptation, knowledge enhancement and links to other topics	**Link to:** **Activity sheets: Exploring the consequences of climate change in our environment / Reactions of eco-system to climate changes / The impacts of Climate change in your region / Experiment about the ice melting impacts on the sea level** **Knowledge sheet: Marine environment and Climate change** **Croatian:** • https://www.hgk.hr/documents/vukovar2011-b001-vukovar-prez5b1672a9ac01c.pdf • https://www.theguardian.com/environment/2014/jan/28/warmer-seas-are-making-fish-smaller-water-temperatures **Greek:**

	• https://climefish.eu/2019/04/10/greek-aquaculture/ • https://gr.euronews.com/2019/04/29/climefish-ena-programma-gia-thn-epidrash-ths-klimatikhs-allaghs-sthn-alieia **Italian:** • http://www.greenreport.it/news/clima/pesci-piu-piccoli-cerca-ossigeno-calda-lacqua-calda-del-cambiamento-climatico/ **French:** • http://theconversation.com/surpeche-et-changement-climatique-la-mediterranee-et-la-mer-noire-en-premiere-ligne-111688
Observations	**The Chemistry lesson was realized after the Biology lesson where students had already learned about the problem of missing squids near the coast. In the Chemistry lesson they were very motivated and were concluding quickly and accurately. Holistic access to education has improved the teaching process and has brought students to consciousness about the issue of climate change. As individuals, they realized that everyone has to be involved in problem solving and that it has to start immediately.**