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Oscar Bos	Draft version based on self-written texts and contributions of other authors.		15 Sept 2015
Adriaan Rijnsdorp	Final check		7 Oct 2015
Oscar Bos	Final version, after review of texts		7 Oct 2015
Adriaan Rijnsdorp	Corrections Table of contents		15 March 2016

SUMMARY

This newsletter deliverable contains a collection of news items that have been, or will be published individually on the BENTHIS website (www.benthis.eu) and/or on social media such as Facebook (https://www.facebook.com/Benthis-405411256222122/timeline/, during the year 2015. These news items will also be bundled into an online news letter by February 2016.

Previous newsletters online:

News letter 2014: http://www.benthis.eu/en/benthis/show/BENTHIS-Newsletter-February-2015.htm
News letter 2013: http://www.benthis.eu/en/benthis/show/BENTHIS-Newsletter-March-2014.htm

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INTRODUCTION

This newsletter deliverable contains a collection of news items that have been, or will be published individually on the BENTHIS website (www.benthis.eu) and/or on social media such as Facebook (https://www.facebook.com/Benthis-405411256222122/timeline/ and Twitter, during the year 2015. These news items will also be bundled into an online news letter by February 2016.

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1 BENTHIC ECOSYSTEM (WP3)

Impact of fisheries on sea floor food webs

Contact: Tobias van Kooten (tobias.vankooten@wur.nl) *(to be published)*

How do the different types of fisheries impact the sea floor food web? BENTHIS researcher Van Kooten and his team used a functional group approach to tackle this problem. Based on their traits, the species within the food web were assigned to one of three groups. Animals that enjoy feeding on other animals (dead or alive), such as crabs and sea stars, are classified as *scavenger/predators*. A second group consists of for example bivalves and tube worms, characterized by *filter feeding*. These animals pump water through their bodies to collect food particles. Finally, there are the *deposit feeders* such as worms that feed on organic matter in and on the seabed. On top of that, fish that prey on each of these groups are included in the model. These groups are all affected to a certain extent by the various types of fishery, but also eat each other and compete with each other. These ecological interactions can complicate, or even reverse the net effect of fisheries on these groups.

The impact per fishing technique depends on the characteristics of the fishing gear. A traditional beam trawl will plough through the seafloor with heavy tickler chains, removing fish and damaging everything on and in the top layers of the seafloor. A scallop dredge may have similar effects on the seafloor, but does not remove fish, whereas an otter trawl has less impact on the seafloor, but does remove fish. Given these kinds of relationships, the researchers have assessed the net effects of a number of fishing gears (beam trawl, otter trawl, dredge, shrimp and pulse trawl) on the abundance of each of the functional groups. Including ecological interactions in assessing the effects of different fishing gears has led to some surprising results.

Van Kooten: “We find that, independent of the fishing gear, both deposit feeders and filter feeders actually increase at high fishing intensity”. At high fishing intensity, fish abundance is greatly reduced.
The increase or decrease of each functional group with increasing fishing intensity is shown in the figure. The lines show the equilibrium dynamics. Beyond a certain intensity of fishing pressure, at the right hand side of the graphs, coexistence of all three groups is no longer possible. Here, according to the model, scavengers are lost from the benthic ecosystem.

“At high fishing intensity, the indirect positive effect of reduced predation by fish appears to be substantially stronger than the direct mortality of the gear on the filter and deposit feeders, resulting, counterintuitively, in a net increase of them”, explains van Kooten. By changing the parameter values, the model can be applied to different regions. The model will be useful to fisheries managers to estimate food web effects of increased fishing intensity, or for example a change of the type of fishing gear used.

The work described in this text will be published as a scientific article in the near future, and will also become available as BENTHIS Deliverable 4.6.

FIGURE 1. Crabs spend their time wandering around on the seafloor, and get excited when smelling dead meat.

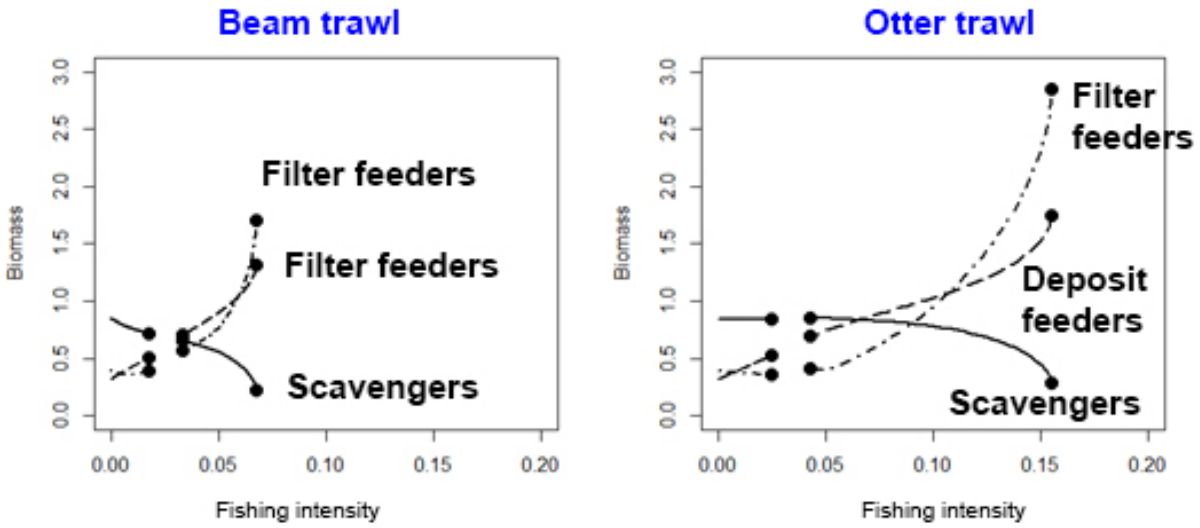

FIGURE 2. Biomass of each functional group at increasing fishing intensities: beam trawl and otter trawl.

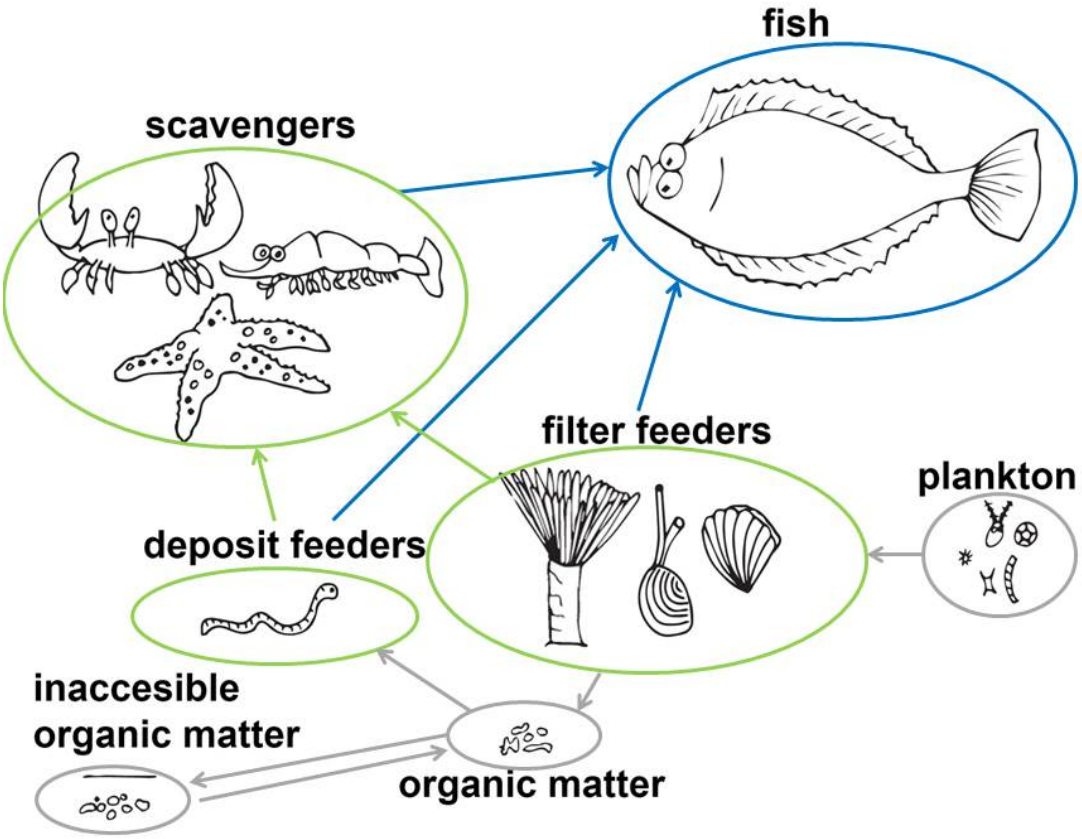

FIGURE 3. Simplified functional food web model

2 FISHING IMPACT (WP4)

BENTHIS paper on physical impact pulse fisheries

Contact: Jochen Depestele <jochen.depestele@ilvo.vlaanderen.be>

(published 13 April 2015, 1111 people reached on Facebook)

Is pulse fishery causing less disturbance to the seafloor than traditional beam trawling? BENTHIS just published a new paper on this topic. To quantify seabed alteration, BENTHIS researchers conducted an experiment in the Southern North Sea, just off the Dutch coast (15–22 m depth). Fishing was conducted with a commercial 4-m tickler chain beam trawl and a 4-m pulse beam trawl in different experimental plots.

Equipped with a very accurate multi-beam echo sounder, the BENTHIS researchers on board the RV Simon Stevin were able to measure the change of the seafloor bathymetry. In general, bathymetrical changes were between 1-2 cm after a single trawl and increased with increasing trawl passages. Numerical modelling revealed that tickler chains had a penetration depth of about twice that of the electrodes. The amount of sediment stirred up did not differ between both gears.

Jochen Depestele: “The results are the first step in understanding the impact of innovative pulse gears versus traditional ground fisheries on the seafloor ecology. Now we can start linking this to biological traits, such as the burying depth of vulnerable shellfish species, so that we can model the impact of new gears on the benthic community.”

Article:
http://icesjms.oxfordjournals.org/content/early/2015/04/06/icesjms.fsv056.full.pdf+html

More information on the fieldwork in 2013:
http://www.benthis.eu/en/benthis/show/BENTHIS-North-Sea-case-study-First-campaign-completed.htm?utm_source=Measuremail&utm_medium=Email&utm_campaign=Template+BENTHIS+(CC-877)

Evolution of bottom trawling

(published 19 May 2015, 233 people reached on Facebook)

This week BENTHIS coordinator Adriaan Rijnsdorp presented his work on The evolution of bottom trawling impact in a keynote lecture on the Oceans Past V Conference in Tallinn, Estonia.

http://ices.dk/news-and-events/news-archive/news/Pages/%E2%80%98The-evolution-of-bottom-trawling-impact-on-demersal-fish-populations-and-the-benthic-ecosystem.aspx

Findings on pulse fisheries presented in France

(published on the BENTHIS website and on Facebook, 3 April 2015, 587 people reached on Facebook)

In France the pulse trawl fisheries is currently viewed with suspicion. The Dutch flatfish fleet however has good experiences with this innovation and the majority of the fishermen have switched from traditional beam trawl to pulse trawl, although the EU only allows this by exception.

Hans Polet (ILVO) and Adriaan Rijnsdorp (IMARES) therefore presented the BENTHIS findings on pulse trawl yesterday in a meeting in Duinkerke, France. The meeting was attended by representatives of the French and Dutch fishing industry, regional authorities such as Aires Marines Protégées and marine scientists from IFREMER and Universities.

The BENTHIS scientists showed how the pulse trawl compared to traditional trawl in term of catch efficiency, selectivity and impact on the seafloor. In addition, results of experiments carried out by IMARES and ILVO were presented. Polet: “In our field experiment the pulse fisheries showed a 60% reduction of bycatch. This means that many benthic invertebrates such as hermit crabs, brittle stars and shellfish can escape with this technique”.

Rijnsdorp also provided an outlook to the broader goals of the project. “We want to assess the impacts of different fisheries in Europe. For that, we are now assessing the relationships between the foot print of a gear, the natural versus fishery induced disturbance and the impact of the gear on species and the ecosystem. In this way, we should be able to compare the impact of pulse fisheries with that of any other bottom gear.”

The meeting was organised by Pieter Kuyt, representative of the Dutch fisheries. You may download the presentation here.

PDF:http://www.benthis.eu/upload_mm/7/1/4/4e030007-3ab2-4b2a-b225-82bc654019ca_BENTHIS_Duinkerken_1April2015.pdf

"Frequent trawling leads to skinnier fish"

Contact: Andrew Frederick Johnson <anj016@ucsd.edu>

"Trawling is arguably one of the most destructive human practices. Removing fish from the sea for an ever-hungry, growing human population has consequences that include reducing fish populations and messing with the natural balance of the ocean's food webs. In the last two decades, the secondary impacts, including reduction in species diversity and flattening of complex seafloor habitats, have started receiving more and more attention...."[continue]

Andrew wrote a great article for the general public:
https://theconversation.com/frequent-trawling-leads-to-skinnier-fish-35356

3 FISHERIES MANAGEMENT (WP6)

"Smart fishing" to conserve the seafloor: dream or future?

Contact: Ger Jan Piet (IMARES) gerjan.piet@wur.nl *(to be published)*

Technical fishing gear innovations appear to be the solution toward sustainable fisheries. But what can be done from a management perspective? Marine protected areas often evoke a lot of resistance. In the BENTHIS project, marine ecologist Gerjan Piet and his team are now developing a decision support tool that appears to have high potential. Piet explains: "We wondered if it would be possible to reduce the impact to the seafloor without extra costs, by influencing the fishermen's behaviour. The idea is that they are provided with accurate maps of vulnerable habitats, so they can avoid sensitive areas."

As a first step in the development of this tool, the researchers reconstructed the distribution of the fishermen over the North Sea, to back-calculate their impact on the bottom fauna. They used data of approximately 300 fishing vessels, covering the period 2010-2012 and about 14.000 trips (30.000.000 kWdays). For each vessel, the fishing locations were known, based on VMS satellite data.

Next they divided the North Sea into grid cells, and estimated habitat quality per grid cell which determines the vulnerability to fisheries. A habitat which has been trawled in the previous year will have a lower quality and is less vulnerable. This vulnerability then determines the impact of any new fishing activities. This impact is determined by the type of gear and the sensitivity of the habitat. For example, a grid cell with predominantly hard substrate covered by e.g. soft corals will suffer a bigger impact than one with a sandy seafloor. Fishing impact is expressed as the amount of time it would take to recover to the state prior to impact.

By combining the fished routes with the vulnerability data, Piet and co-workers observed a huge difference between fishing trips depending on the strategy of the fishermen: some fishermen are more conservative and go to the same patches every year, others display more exploratory behaviour and go to new areas that have never been fished and thus suffer from a bigger impact. The most striking result, however, was that the CPUE (catch per swept area) of the conservative fishermen was higher, even more so if the amount of catch was compared to the actual damage caused to the seafloor.

It appears that smarter fishing using spatial information on the vulnerability of the seafloor can reduce the impact on the seafloor by a factor 5-10 without compromising the catch opportunities. Piet: "This proves smarter fishing has the potential to conserve the seafloor and should therefore be considered as part of ecosystem based fisheries management." The next step will be taken later this year, when Piet and others will discuss these results with a group of fishermen as part of the ICES WGMARS, to discuss these results and the possibilities for application as part of their regular fishing practices.

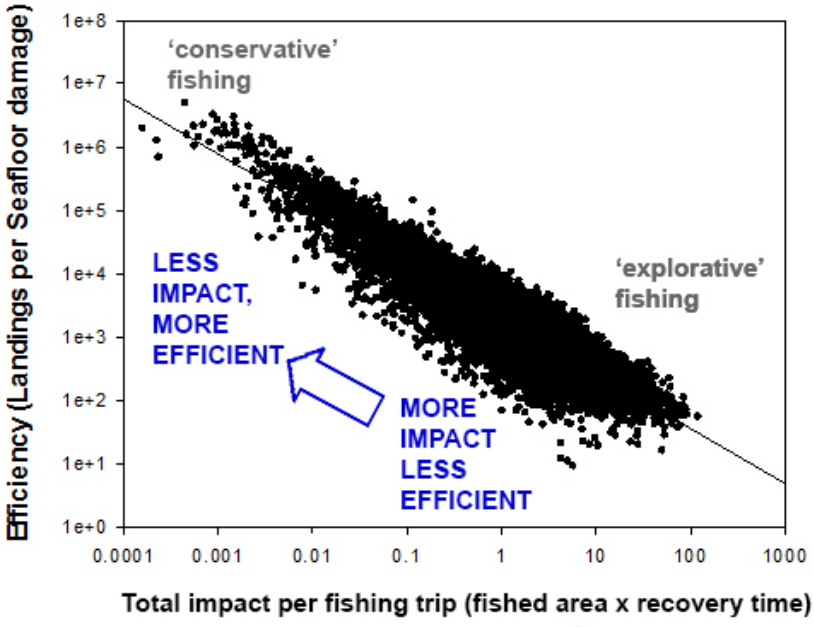

Figure: Impact per fishing trip, based on 14.000 fishing trips combined with data on seafloor vulnerability.

4 CASE STUDIES (WP7)

Modified beam trawl reduces fuel costs in the Samsun Shelf Area, Black Sea, Turkey

Contact: Aysun Gumus (aysung@omu.edu.tr) or Mustafa Zengin (muze5961@gmail.com) *(to be published)*

In the Black Sea, BENTHIS focusses on the beam trawl fishery for rapa whelks (Rapana venosa) in the littoral zone of the southern Black Sea. Researchers test the performance of the traditional fishing gear against innovative fishing gear, in order to reduce fuel costs.

The traditional fishing gear (algarna trawl) consists of a beam with two shoes and a steel rope between the shoes. The major modifications in the innovative trawl were the use of sledges instead of traditional shoes and the removal of the steel rope between the shoes.

By doing this, the researchers observed a 4-5 % reduction in fuel consumption by the modified gear. Camera footage showed that the modified gear fished just as well as the traditional one. The results also indicated that the steel rope between the shoes does not penetrate into the sea bottom contrary to the researchers' previous assumptions.

Both trawl types were also tested in terms of resistance of the fishing gear against the sea bottom by using a digital force gauge meter. The trials were repeated in different types of substrates such as sand, sandy mud and muddy sand. All operations were supported by underwater video camera shots (GoPro Hero 4) to observe the functionality of modified fishing gear.

Juvenile fish were mostly able to escape from the gear except some small flatfish species such as scaldback (*Arnoglossus kessleri*) and some pipefish species (*Syngnathus sp*). Besides the target species *Rapana venosa,* the main bycatch species were common bivalves *Anadara cornea* and striped venus (*Chamelea gallina*) and crustaceans such as the arch-fronted swimming crab (*Liocarcinus navigator*) blue-leg swimming-crab (*L. depurator*) in the Samsun Shelf Area.

Figure: the fieldwork team

Figure: equipment to measure the fuel consumption and the resistance of the seafloor to trawling

The innovative fishing gear with sledges

The innovative fishing gear without the steel rope

Fishing for food and food for fish!

Contact: Hans Polet <hans.polet@ilvo.vlaanderen.be> (to be published)

'Bottom trawling enhances fish production'. That's what fishermen have long claimed, because trawling would increases food availability for the target fish species. Theoretical studies illustrate that this may or may not be the case, depending on the fishes' diet, the sediments that their prey species inhabit and the characteristics of the prey species. But can this be measured in practice, and how does pulse trawling, with less physical impact, compare to traditional trawling?

A team of BENTHIS researchers tried to assess the mortality of organisms living in or on the seafloor caused by beam versus pulse trawling in two experiments. These BACI (Before After Control Impact) experiments were carried out in 2013 and 2014 in the North Sea at contrasting sites. One site was near the Belgian coast (coarse sand), the other in the Frisian Front (fine sand/muddy).

The results were a bit disappointing at first sight. Project leader Hans Polet: "It was difficult to detect and quantify mortality rates, because of the high variability of the numbers of animals within the samples." A closer look at the species caught revealed that the majority of these species could be classified as resistant to trawling impacts. Polet: "We think that due to the history of trawling in these areas, vulnerable species are already difficult to find and that mortality rates of resistant species are too low to detect, given the number of samples taken."

Although little could be concluded on the effect on mortality of benthic species, the seabed habitat itself was clearly more altered following beam trawling then following pulse trawling. Such a disturbance may alter the availability of food for scavenging flatfish. During the 2014 trials in the Frisian Front in the North Sea, stomachs of plaice (*Pleuronectes platessa*) were collected for diet studies . The diet consisted of large numbers of the polychaete worm *Scalibregma inflatum*, but was dominated in terms of weight by sea urchins (*Echinocardium sp*.), bivalves (*Nucula nitidosa*) and the masked crab.

Interestingly, plaice increased their feeding activity after trawling, as was shown by significantly higher stomach fullness. Beam trawling resulted in more plaice feeding around than pulse trawling. Moreover, the plaice's diet after tickler chain beam trawling was dominated by the polychaete worms *Scalibregma inflatum*, indicating that these worms were indeed made available to the plaice by the deeper trawling. So what does this mean? Hans Polet: "We now have proof that the tickler chains of the traditional beam trawl have a more profound effect on the diet of plaice than pulse trawling has. We also have evidence that the benthic impact of trawling goes beyond the physical changes, and indeed directly affects the biological component of the habitat. "

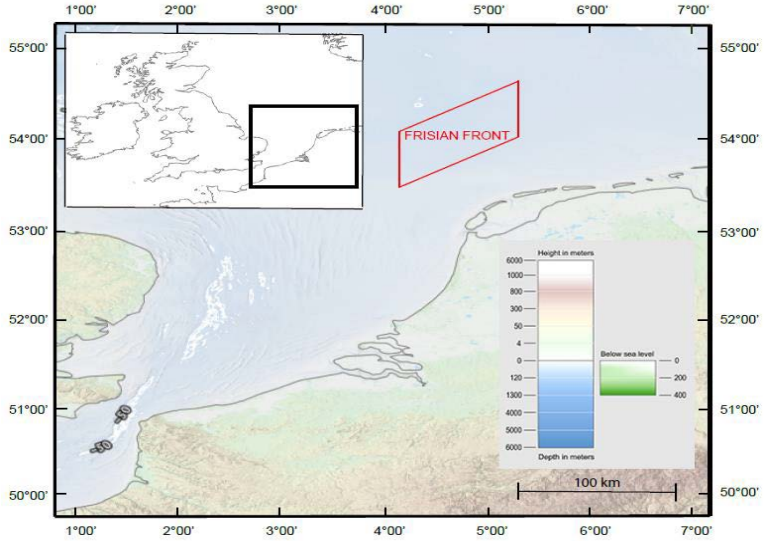

Figure: study area

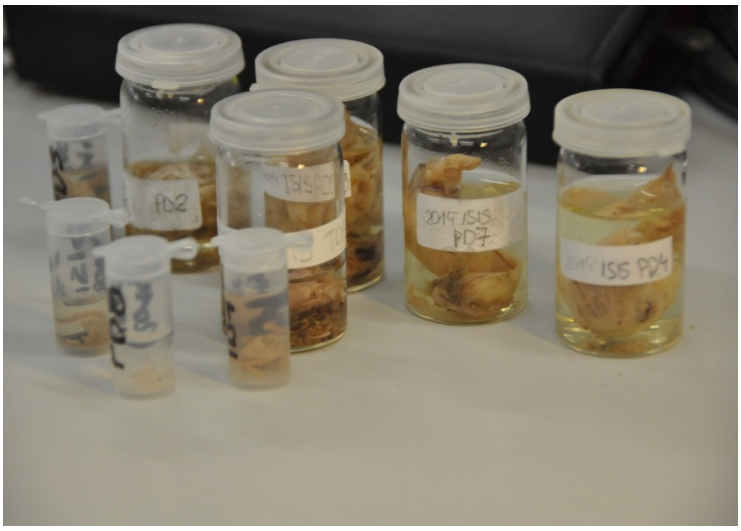
Figure: stomach contents of plaice

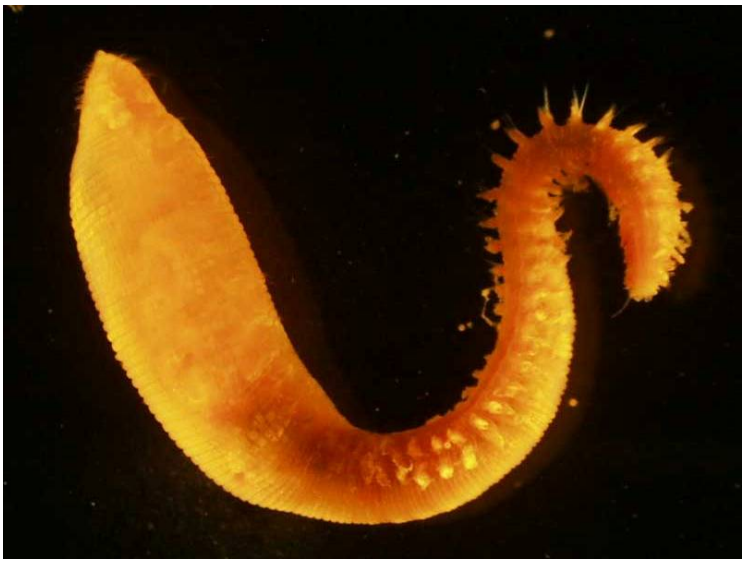
Figure: polychaete worms *Scalibregma inflatum* © Hilmar Hinz

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FIELDWORK BLOGS 2015

In 2015, two fieldwork blogs were written on Facebook, one on board the RV Philae, to cover the Greek fieldwork in May 2015 on the comparison between traditional fisheries with trawls versus innovative fisheries with traps in the Aegean Sea. The second blog covered the fieldwork on board the RV Simon Stevin in June 2015 during the fieldwork on the comparison between the traditional beam and innovative pulse fisheries on shrimp in Belgian waters. The blogs reached between 300-1200 people and consisted of photos with some texts. (https://www.facebook.com/Benthis-405411256222122/timeline/)

Blog BENTHIS Fieldwork in Greece, Crete

(published in May 2015)

DAY 1. SUNDAY 3 May 2015
An exciting journey started today: the BENTHIS fieldwork in Crete. The aim: comparing passive fishery methods (traps) to traditional active fishing (trawling). We left the harbour of Heraklion, Crete, at 8:00 am on board the RV Philia. The aim of today: setting out 4 different types of traps, baited with mackerel, which we will pick up tomorrow again. Water depth: 74 meters. In addition, we conducted one trawl to estimate the fish abundance present: lots of benthic diversity and some smaller fish.

DAY 2. MONDAY 4 May 2015
Day 2 of the fieldwork. Today we went back to check the traps. The catch is almost zero: a moray eel, some smaller fish, predatory snails and squid eggs. Chris is moderately happy with the low catches, but hey, that's what happens in science. 13:00 h: Stress levels rise, the traps are stuck! 70 meter below us, the traps are caught on the seafloor, including one with an expensive GoPro cam with a deep sea housing. The crew is working on them frantically. 14:00 h RV Philia's brute force releases all traps but one. This left us with time for only one more trawl.

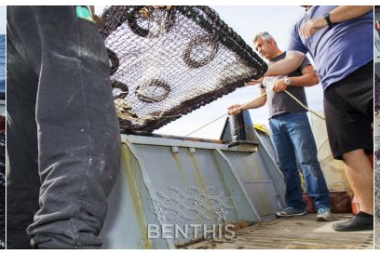
DAY 3. TUESDAY 5 May 2015:
At 9:00h a 1.5 m swordfish surprised Voula by jumping three times! Today, we moved the traps from the 70 m deep area and transferred them to shallower waters (40 m), to test them in a slightly different habitat. The trawling is also done in shallower waters for comparison. 14:00 h: the captain reports a loggerhead sea turtle swimming by. The trawls today: full with life from the shallower part with lots of algae and different fish species.

DAY 4. WEDNESDAY 6 May 2015
Today's program includes no jumping wildlife, but instead a lot of different fish. Since temperatures are rising, the need for Greek iced coffee has become increasingly important, hence a small coffee making workshop was organised by Charis. Thanks! Today, the black cages caught 1 muray eel, an octopus and hands full of fire worms. These guys can really sting, so we treat them with caution (205 people reached).

DAY 5. THURSDAY 7 MAY 2015
Today we shift from the shallow waters near the coast to deeper water. A few crew members went to the hairdresser, suggesting that exposing scientific cruises to Facebook is good for the beauty industry. Weather forecast: hot. In the morning we lift the traps again, only an octopus and fireworms. The fish that were caught yesterday are transformed in a nice meal by the cook. 15:40 h: the temperature has risen to 33 degrees in the shadow. Suddenly a small boat approaches: ice creams are handed over, a perfectly timed action by Dimitri for the crew to cool down a bit. The deep water trawl (200 m) indeed show a lot of

other species than the previous days. This was the last blog, the crew is continuing with the experiments until Sunday 10 May, but for the photos it ends here (517 people reached)







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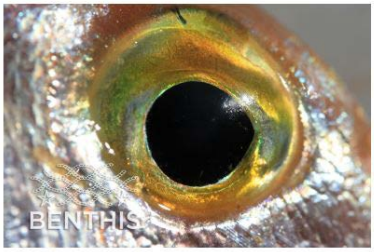
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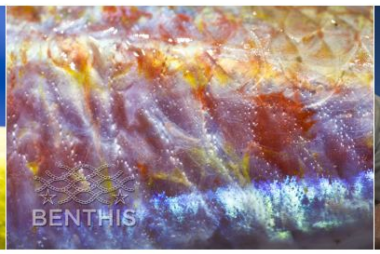



Blog BENTHIS Fieldwork in the North Sea

(published in June 2015)

DAY 1.
The BENTHIS North Sea fieldwork continues with trip #3! This time off the Belgian coast, where we are enjoying the beautiful weather. Besides that, researchers are using a combination of sediment profile images, box cores and multibeam measurements to study the impact of traditional vs pulse shrimp trawls.

DAY 2.
Day two at the Simon Stevin: last night the areas were experimentally trawled by a shrimp vessel, so we woke up early this morning to photograph the sediment profile and collect cores again to compare the areas before and after trawling. In addition, we collected the stomachs of plaice and dab to assess whether fish actively forage on prey items that have become available following trawling. This weekend we take a break, so more photos on Monday!

DAY 3.
After a weekend break, everyone is ready to continue the fieldwork. Last week, we tested the effect of pulse trawling, so on Monday we started off with investigating the effect of a traditional beam trawl. Unfortunately, the wind picked up in the afternoon, which made it difficult to deploy the equipment. Since the weather forecast is not optimal, we have to improvise. On Thursday 3 am, we'll set sail again.

DAY 4.
To catch up the weather delay, today the schedule looked like this:
3 am Departure Oostende haven
4 am Sediment profile imaging area pulse t0, reference t0 and traditional t0
8 am Box core area pulse t0, reference t0 and traditional t0
12 pm Experimental fishing with pulse gear
2 pm Sediment profile imaging area pulse t1 and reference t1
3 pm Box core area pulse t1 and reference t1
7 pm Collecting benthos and fish area pulse t1
10 pm Sampling fish stomachs
1 am Taking a shower and getting ready for the 6 am alarm


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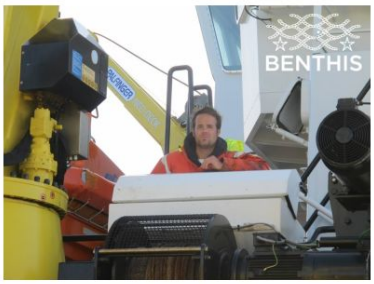
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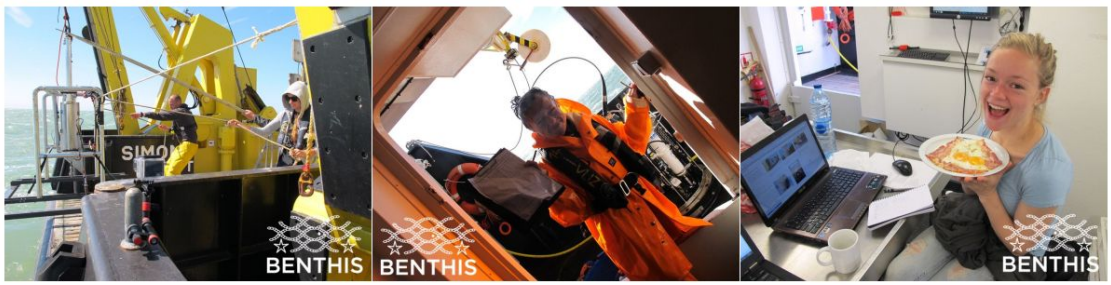
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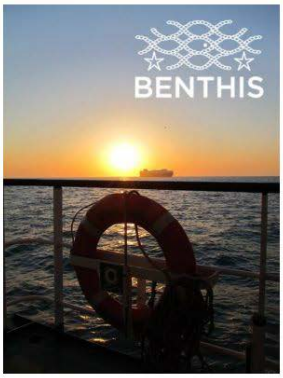
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