Behaviour and habitat of *Neohela monstrosa* (Boeck, 1861) (Amphipoda: Corophiida) in Norwegian Sea deep water

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**ABSTRACT**

There are few in situ observations of deep-sea macrofauna, due to the remoteness of this ecosystem. Visual surveys conducted for marine management by MAREANO, (marine area database for Norwegian waters) and the petroleum industry (by SERPENTS, scientific and environmental remotely operated vehicle partnership using existing industrial technology) have provided unique material of visual information from large areas in the Norwegian Sea. The distribution, density and behaviour of the deep-sea amphipod *Neohela monstrosa* (Boeck, 1861) is described based on videos and samples from the Norwegian Sea. This amphipod is common on mud bottoms at 200–2181 m depth in the area. Dense communities were found in stands of the arctic sea pen *Umbellula encrinus* at more than 1000 m depth where temperatures were below 0° C. The mean density of *N. monstrosa* observed for larger areas was 4/100 m\(^2\) but densities of 15–36 individuals per m\(^2\) were found in local patches. It is domicolous which is characteristic of the superfamily Corophiida and digs burrows in soft muddy bottoms primarily by using large shovel-like gnathopods to scoop the sediment out. The amphipod was observed pushing and rolling sediment balls out of its burrow, which were probably held together with amphipod silk. It digs out an upper 3 to 4 cm wide burrow with a horizontal side burrow a couple of centimetres down. *Neohela monstrosa* appears to feeds on newly settled detritus that it collects from the surface sediment through the use of its long antennae while the burrow is mainly used for protection against predators such as demersal fish. Newly released juveniles are probably kept in the burrow for protection. Based on the local high density of *N. monstrosa* together with its habit of making long burrows, we suggest that there is significant bioturbation associated with the presence of *N. monstrosa* in deep sedimentary habitats of the Norwegian Sea, which likely provides an important ecosystem function.

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**Introduction**

The amphipod *Neohela monstrosa* (Boeck, 1861) belongs to the family Uncioliidae within the infraorder Corophiida (suborder Senticaudata). This species has an arctic–boreal
distribution and has been documented from arctic and subarctic parts of the Northwest Atlantic, southwards to the Gulf of St. Lawrence to the south of New England; Greenland; and the Northeast Atlantic from Svalbard to the Kattegat (Stephensen 1933; Enequist 1949; Udekem d’Acoz 2007). In the Fram Strait it has been registered from 2470 m (Bergmann et al. 2011), and Sars (1895) reports it from 300–600 m depth off western and northern Norway where it occurs both in fjords and on the shelf and slope (Buhl-Jensen 1986; Enequist 1949; Buhl-Mortensen 1996). It is also frequent in Skagerrak and in Swedish fjords (Enequist 1949; Miskov-Nodland et al. 1999).

**Neohela monstrosa** is a large amphipod; the adult female is typically 25 mm and the male 28 mm (Sars 1895). It has a very distinct morphology, and Sars (1895) notes that this peculiar-looking species cannot be confused with other amphipods due to the long and slender body, and extremely elongated antennae and legs (Figure 1). Enequist (1949) suggests that its long antennae and legs are an adaption to the loose sediments of its habitat, with the long legs keeping it on top of a watery sediment and the antennae adapted to collect fine particles.

It is a poor swimmer that lives mainly endobenthically, belonging to what Sainte-Marie and Brunel (1985) define as the ‘lowermost supra benthos’, defined by the swimming activity of amphipods swimming away from the bottom. It is presumed to feed mainly on detritus. When dividing Skagerrak amphipods into “food-ecological” groups, Enequist (1949, p. 429) positioned *N. monstrosa* in group IV, A, 2 which is ‘Burrowing forms exclusively utilizing the detritus occurring in the bottom material underneath the surface’ (group IV), ‘Forms ingesting the detritus uniformly distributed in the bottom substrate’ (A) and ‘Forms digging hollows, burrows or tunnels in the material’ (2).

In general, detailed information on habitat, density of occurrence and behaviour is lacking for most deep-sea organisms. Soft-bottom amphipods mostly feed on detritus and live more or less buried in the sediment (Lincoln 1979). Due to their small size and remote habitat, there are few in situ studies of deep-sea amphipods. However, Enequist (1949) provides detailed observations from aquarium studies for several amphipod species including *N. monstrosa* (Figure 2). For most of these species, studies on behaviour have not been pursued, and field studies on habitat, population density and behaviour are lacking. Recent technological development has strongly improved the ability for visual inspection of deep-sea habitats, and *in situ* observations of their inhabitants are rapidly accumulating (e.g. Mortensen et al. 2008; Buhl-Mortensen et al. 2010; Purser et al. 2013). In this paper we use video records, supplemented by grab, trawl and sled samples, to describe the habitat, density and behaviour of *N. monstrosa* in the Norwegian Sea (221–2167 m depth).

**Materials and method**

The material for this study was collected as part of the Norwegian national mapping programme MAREANO (marine area database for Norwegian waters; www.mareano.no), supplemented by remotely operated vehicle (ROV) observations at Norwegian hydrocarbon exploration wells made available through the SERPENT Project (scientific and environmental ROV partnership using existing industrial technology; www.serpentproject.com).
Samples and observations from the MAREANO mapping programme

*Neohela monstrosa* was recorded from 22 stations in the area mapped by MAREANO in the period 2006–2009 (Figure 3; Table 1) as part of wider surveys of the deep-sea habitats and benthic fauna. It was recorded on video at 13 stations, in beam trawls at five stations, by
epibenthic sled at three stations and in seven grab samples. This material was used to estimate the density of *N. monstrosa* both in larger areas and in densely populated smaller patches. Observations of behaviour were from close-up video records.

At each site, seabed video was recorded with a high-definition video camera along 700-m-long transects using the towed video platform ‘CAMPOD’. It was towed behind the survey vessel at a speed of 0.7 knots with a near-constant altitude of 1.5 m above the seabed, controlled by a winch operator. Geopositioning for the video data was provided by a hydroacoustic positioning system (Simrad HIPAP and Eiva Navipac software) with a transponder mounted on CAMPOD, giving a position accurate to 2% of water depth. All organisms were identified to the lowest possible taxon and counted, or quantified as % seabed coverage following the method described by Mortensen and Buhl-Mortensen (2005). Abundance data (the number of organisms counted divided by the area observed) were standardised as the number of individuals per 100 m² (Mortensen et al. 2009; Dolan et al. 2009).

*Neohela monstrosa* specimens were collected as part of samples for documentation of the infauna using a large Van Veen grab (0.2 or 0.25 m³). Samples were gently washed over a 1-mm sieve. Epifauna was sampled by beam trawl (mesh size 2 mm, 2 m opening width, 5 min hauls; see Bergman et al. 2009 for gear description) and

*Figure 3.* Position of localities where *Neohela monstrosa* was sampled or observed in the material from MAREANO (marine area database for Norwegian waters), period 2006–2009 (for detailed information see Table 1).
hyperfauna was sampled with an Rothlisberg and Pearcy-sled (mesh size 0.5 mm, 1 m opening width, 10 min hauls; see Rothlisberg and Pearcy 1977 and Buhl-Jensen 1986 for a description). Sampled fauna was fixed in 5% buffered formalin until sorting and identification in the laboratory.

**Observations from the SERPENT project**

Additional video data were available south of the MAREANO survey area through the SERPENT Project. Video transect surveys were carried out using ROVs (Oceaneering Magnum) launched from drilling rigs at five hydrocarbon exploration locations in the Norwegian Sea between 1250 and 1730 m depth (Table 1). Video-transect surveys comprised eight transects of 100–200 m in length radiating from the well centre and recorded in standard definition. The locations of these surveys were disturbed by drill cuttings (Gates and Jones 2012). The standard-definition video data were of insufficient quality to confidently calculate the density of *N. monstrosa* from the SERPENT ROV video transects, but estimates of abundance of burrows were determined. At each location, high-resolution digital stills photography (Kongsberg OE14–208) was used to document benthic megafauna (Jones and Gates 2010). These images were collected opportunistically during ROV operations.

**Table 1.** Information on video from MAREANO and SERPENT, and samples from MAREANO including station number or name, position, depth and bottom temperature.

| Station | Equipment | Longitude | Latitude | Depth (m) | Temp (°C) |
|---------|-----------|-----------|----------|-----------|-----------|
| MAREANO | BT        | 15.7340   | 69.3834  | 891       | −0.8      |
| 311     | BT        | 12.6728   | 68.9004  | 1316      | 4.5       |
| 14      | Grab      | 21.7435   | 71.1135  | 186       | 5.7       |
| 397     | Grab      | 15.9409   | 72.2476  | 637       | 6.5       |
| 111     | Grab, BT  | 17.6254   | 69.7966  | 367       | 6.5       |
| 351     | Grab, BT  | 13.0950   | 68.8436  | 805       | 6.5       |
| 488     | Grab, BT  | 15.1901   | 69.7131  | 2192      | −0.9      |
| 3       | Sled      | 22.4142   | 71.3312  | 421       | 5.0       |
| 259     | Sled      | 13.9750   | 69.1841  | 1912      | 5.0       |
| 404     | Sled      | 15.7689   | 71.9213  | 624       | 4.8       |
| 100     | Video     | 18.0215   | 70.1548  | 317       | 7.0       |
| 112     | Video     | 17.4278   | 69.8177  | 409       |           |
| 212     | Video     | 16.1393   | 69.9174  | 1817      |           |
| 278     | Video     | 10.8435   | 68.5245  | 1587      |           |
| 279     | Video     | 10.6814   | 68.5494  | 2044      |           |
| 302     | Video     | 11.1126   | 68.6330  | 1903      |           |
| 309     | Video     | 12.3040   | 68.9213  | 1950      |           |
| 324     | Video     | 17.0874   | 70.1421  | 583       |           |
| 328     | Video     | 16.4802   | 69.7389  | 872       |           |
| 345     | Video     | 15.5777   | 69.5622  | 1850      |           |
| 490     | Video     | 15.8957   | 69.8457  | 2181      |           |
| 301     | Video, grab | 11.6165   | 68.7126  | 1919      |           |
| 322     | Video, grab | 16.1762   | 70.2048  | 2008      |           |
| SERPENT | Asterix   | Video     | 5.29     | 67.02     | 1340      | −0.84     |
| Gro     | Video     | 3.94      | 66.15    | 1380      | −0.95     |
| Dalsnuten| Video    | 3.54      | 66.67    | 1452      | −0.83     |
| Edvarda | Video     | 4         | 64.2     | 1730      | −0.5      |
| Haklang | Video     | 7.059     | 67.047   | 1250      | −0.94     |

Note: BT, beam trawl; MAREANO, marine area database for Norwegian waters; SERPENT, scientific and environmental ROV partnership using existing industrial technology.
The movements of the antennae of *N. monstrosa* were observed on 5 minutes long standard definition video clip recorded at 1340 m depth at the Asterix exploration drilling site in the Norwegian Sea in an area disturbed by drill cuttings.

**Results**

The *Neohela* species group is under taxonomic revision and a new species has recently been described Udekem d’Acoz (2007). Udekem d’Acoz (2007, p. 33) states that ‘In literature, *N. monstrosa* has been recorded down to 2222 m (Sars 1895) but all records below 700 m should be considered as very suspect and could refer to *N. lamia* sp. nov. or even additional new species’.

**Habitat**

Within the study area, *N. monstrosa* has a depth range from 22 to 2167 m in arctic–boreal waters (bottom temperatures varying between $-0.94$ and $+6.95^\circ C$), and the substratum is dominated by mud or sandy mud (Tables 2 and 3). On the slope at 700–1000 m depth it co-occurs with the sea pen *Umbellulla encrinus* Linnaeus, 1758 (Cnidaria: Pennatulacea), forming a sea pen and burrowing fauna habitat resembling the shallower *Funiculina* Lamarck, 1816 – *Nephrops* Leach, 1814 habitat, a common variety of the habitat ‘seapen and burrowing megafauna communities’ listed as one of the threatened and/or declining habitats by Oslo-Paris (OSPAR) convention (OSPAR Commission 2008).

**Table 2.** Densities of *Neohela monstrosa* per 100 m$^2$ from video observations, together with depth and sediment quality. Percentage of surface cover is estimated from video.

| Video Transect station | Neohela ind/100 m$^2$ | Depth (m) | Surface sediment composition (%) | Mud and sandy mud | Sand | Pebble | Cobble | Boulder | Bedrock |
|------------------------|-----------------------|-----------|---------------------------------|-------------------|------|--------|--------|---------|---------|
| **MAREANO**            |                       |           |                                 |                   |      |        |        |         |         |
| 100                    | 0.2                   | 317       | 15.0                            | 85.0              |      |        |        |         |         |
| 112                    | 0.5                   | 409       | 60.0                            | 40.0              |      |        |        |         |         |
| 324                    | 0.2                   | 583       | 11.6                            | 74.1              |      |        |        |         | 13.8    | 0.4     |
| 328                    | 0.2                   | 872       | 85.3                            |                   | 0.3  | 0.6    |        | 13.8    |         |
| 278                    | 0.1                   | 1587      | 73.0                            | 22.3              | 4.1  | 0.5    |        |         |         |
| 212                    | 0.1–0.3               | 1817      | 98.0                            |                   |      |        |        |         |         |
| 345                    | 0.2                   | 1850      | 100.0                           |                   |      |        |        |         |         |
| 302                    | 0.2–0.5               | 1903      | 92.0                            |                   |      |        |        | 8.0     |         |
| 301                    | 0.3–4.0               | 1918      | 100.0                           |                   |      |        |        | 0.1     |         |
| 309                    | 0.3–0.5               | 1950      | 81.6                            | 12.0              | 4.0  | 2.4    |        |         |         |
| 322                    | 1.4–2.9               | 2010      | 91.3                            | 8.1               | 0.4  | 0.1    |        |         |         |
| 279                    | 0.1                   | 2044      | 99.3                            |                   |      |        |        | 0.8     |         |
| 490                    | 1.7                   | 2181      | 95.9                            | 4.0               | 2.3  | 1.4    |        |         |         |
| **SERPENT**            |                       |           |                                 |                   |      |        |        |         |         |
| Asterix                | 2.2                   | 1340      | 100                             |                   |      |        |        |         |         |
| Gro                    | 0.11                  | 1380      | 100                             |                   |      |        |        |         |         |
| Dalsnuten              | 0.5                   | 1452      | 100                             |                   |      |        |        |         |         |
| Edvarda                | 5.11                  | 1730      | 95                              |                   |      |        |        | 5       |         |

Note: MAREANO, marine area database for Norwegian waters; SERPENT, scientific and environmental ROV partnership using existing industrial technology.
Based on counting of observed amphipods within 200-m-long video transect sequences, the density varies between < 1 and up to 4 per 100 m$^2$ (Table 2). Results from beam trawl and epibenthic sled samples provide slightly higher density ‘estimates’ up to 12 individuals per 100 m$^2$ for larger areas (Tables 2 and 3). Local-scale observations from video and grab samples, however, showed that N. monstrosa often forms densely populated patches or colonies of 10–35 individuals/m$^2$. Clearly, density estimates based on long video sequences or hauls with beam trawl or epibenthic sled represent minimum estimates while video close-ups and grab samples from patches reveal local densities that are up to 10 times higher.

Video results from frame grabs showed that N. monstrosa is patchily distributed. Counting the burrows within areas where N. monstrosa has been observed revealed that the normal patch size varies in spatial extent between 10 and 30 m (Figure 4). Typically, a densely populated area consisted of a mixture of small and large burrows, presumably belonging to individuals of different sizes (Figure 5).

The density of N. monstrosa burrows at the five SERPENT sites is shown in Table 2. Inspection of burrows with close-up video footage and still photography showed N. monstrosa were present in the burrows at four of the five locations. At Asterix, the closest N. monstrosa burrow was 94 m from the well, compared to cerianthids which were found less than 40 m away. Other epibenthic megafauna common at the sites where N. monstrosa were present include cerianthids and the asteroid Pontaster tenuispinus (von Düben & Koren, 1846) (at all five sites), large numbers of ophiuroids at Asterix

**Table 3. Density of Neohela monstrosa on sampling stations per 100 m$^2$ from epibenthic sled and beam trawl and per m$^2$ from grab samples, together with information on depth and temperature.**

| Station no. | Neohela | Depth | Temp. |
|-------------|---------|-------|-------|
|             | (ind/100 m$^2$) | (m)   | (°C)  |
| Epibenthic sled |         |       |       |
| 3           | 0.47    | 432   | 5.0   |
| 404         | 0.98    | 623   | 4.8   |
| 259         | 0.12    | 1899  | 4.5   |
| Beam trawl |         |       |       |
| 111         | 0.22    | 367   | 6.5   |
| 189         | 1.22    | 881   | 6.5   |
| 311         | 12.31   | 1330  | −0.8  |
| 351         | 0.53    | 730   | −0.9  |
| 488         | 0.29    | 2241  | 6.5   |
| Van Veen grab |       |       |       |
| 14          | 16      | 221   | 5.7   |
| 100         | 8       | 323   | 7.0   |
| 100         | 8       | 323   | 7.0   |
| 111         | 4       | 366   | 6.5   |
| 111         | 4       | 365   | 6.5   |
| 301         | 5       | 1935  | 6.5   |
| 301         | 10      | 1937  | 6.5   |
| 322         | 5       | 1999  | 6.5   |
| 351         | 35      | 765   | 6.5   |
| 351         | 15      | 765   | 6.5   |
| 351         | 5       | 765   | 6.5   |
| 397         | 4       | 636   | 4.5   |
| 488         | 4       | 2167  | −0.9  |

**Abundance**

Based on counting of observed amphipods within 200-m-long video transect sequences, the density varies between < 1 and up to 4 per 100 m$^2$ (Table 2). Results from beam trawl and epibenthic sled samples provide slightly higher density ‘estimates’ up to 12 individuals per 100 m$^2$ for larger areas (Tables 2 and 3). Local-scale observations from video and grab samples, however, showed that N. monstrosa often forms densely populated patches or colonies of 10–35 individuals/m$^2$. Clearly, density estimates based on long video sequences or hauls with beam trawl or epibenthic sled represent minimum estimates while video close-ups and grab samples from patches reveal local densities that are up to 10 times higher.

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and Gro [collected specimens were identified as *Ophiocten gracilis* (G.O. Sars, 1871)] and the glacial eelpout (*Lycodes frigidus* Collett, 1879).

**Tunnel description and behavioural observations**

The burrows often have a funnel-shaped upper part, 3–10 cm wide, with a horizontal side burrow occurring a couple of centimetres below the surrounding seabed surface (Figures 6a–c). We observed *Neohela* pushing and rolling sediment balls, which seem to be kept together by amphipod ‘silk’, out of its burrow (Figures 7a–c). This was done primarily using the large shovel-like gnathopods. From the video observations, it is clear that the normal position for *Neohela* is in the opening of its burrow. The video observations at Asterix of a specimen in this position showed a constant waving and sweeping motion of the second antennae, sometimes alternating the left and right sides, other times simultaneously (Figure 8a and b), while the first antennae remain in...
a more upright position, and it often sweeps the antennae along the sediment surface, which may draw collected particles towards the mouth.

When disturbed by the presence of an ophiuroid arm, the specimen retreated rapidly a short distance inside the burrow. In a period of approximately 2 minutes 40 seconds, the specimen completed seven sweep motions with the second antennae (counted on the animal’s right side) between two disturbances (ophiuroid arm and sediment tumbling into burrow).

**Discussion**

**Distribution and abundance**

Identification of *Neohela* specimens to the species level from in situ video records is challenging because of the small morphological details necessary for identification. However, close-up footage of the organisms suggested the genus *Neohela*, and the
The sizes of the burrows and specimens observed are too large to represent *Neohela lamia* (Udekem d’Acoz pers. comm.). Furthermore, the sampled specimens were all identified as *N. monstrosa* in all cases. Thus, we are convinced that the specimens observed on video are *N. monstrosa*. An additional area of uncertainty is whether or not all the small burrows in an area are made by this amphipod, or whether they are still inhabited, which cannot be determined without sampling.
Our data highlight the importance of multiple approaches to sampling the deep sea. Epibenthic sleds and beam trawls alongside photographic and video methods are important to describe the benthic megafaunal invertebrate assemblage (Table 4). *N. monstrosa* digs deep burrows, and density estimates based on sled and beam trawl samples that accumulate organisms mainly from the sediment surface from long tows (400 m) will represent minimum values that underestimate densities. In contrast, at some locations the large numbers of *N. monstrosa* that were sampled by Van Veen grab (covering 0.2–0.25 m$^2$) suggest densely populated small patches; thus, information from video analysis that allows for patch identification and calculation of burrows proved the most reliable estimate of density.

In the densest patches, *Neohela* was present with 15–36 individuals per 100 m$^2$, and the sizes of burrows indicated inhabitants of varying size. The upper part of the burrows reaches several centimetres into the sediment and often has a side burrow (Figure 6c). According to Enequist (1949), the side burrow can easily be 10 cm or more in length; thus, when occurring in dense populations, as observed in the Norwegian Sea, *N. monstrosa* must be an important bioturbator that could increase surface layer, irrigation and oxygenation at depth.

**Behavioural observations**

Video documentation is an effective method to collect *in situ* behavioural information that is an important supplement to the thorough aquarium observations made by Enequist (1949). The digging behaviour of *N. monstrosa* was earlier observed in aquaria by Enequist (1949), who noted that it was simultaneously reworking the sediments with its mouthparts when pushing out sediment. He also noted that *N. monstrosa* could dig a ~2-cm-deep hole quickly, from which a horizontal burrow was built. One day’s digging activity resulted in a 10-cm-long burrow that often had two openings. However, our observations could not support the existence of the two openings to the burrow as observed by Enequist, which we believe may be an artefact from keeping this deep-sea species in an aquarium for observations.

The burrow-digging primarily using the large shovel-like gnathopods confirms the aquarium observations made by Enequist (1949). In addition, our observations show that the sediment is pushed out as mud balls that seem to be kept together by amphipod ‘silk’. Glands for production of amphipod ‘silk’ for the purposes of nest-building are common among species in the superfamily Corophioidea (Kronenberg et al. 2012) to which Unciolidae belongs. These glands that are positioned in the bases of pereiopods.

**Table 4.** Density estimates for *Neohela monstrosa* based on different sampling gears from the same MAREANO (marine area database for Norwegian waters) station.

| Stations | Grab (ind/m$^2$) | Beam trawl (ind/100 m$^2$) | Video (ind/100 m$^2$) |
|----------|------------------|----------------------------|-----------------------|
| 301      | 5–10             | 0.31–4.03                  |                       |
| 322      | 5                | 1.35–2.89                  |                       |
| 351      | 5–35             | 0.53                       |                       |
| 488      |                  | 0.29                       | 4                     |
3–4 and open through pores at the tips of the dactyls are considered to be a major evolutionary innovation of corophiideans (Myers and Lowry 2003).

*Neohela monstrosa* is typically seen with the head in the opening of the burrow and antennae widely spread. Enequist also noted this position at the burrow entrance and reported that the pleiopods are not used to ventilate the burrow. Our observations showed *N. monstrosa* often sweeps the antennae along the sediment surrounding its burrow, probably drawing collected particles towards its mouth, indicating that the amphipod feeds by collecting newly settled organic-rich particles from the sediment surface. This is in line with a suggestion by Enequist (1949) who believed that the digging of a burrow was not part of a feeding process, and noted that the pleiopods are not used to ventilate the burrow and that the amphipod is mainly positioned in the entrance.

The burrow appears to be important for protection for this large amphipod species, similar to what has been suggested for the burrowing decapod *Nephrops norvegicus* (Rice and Chapman 1971) that easily could fall prey to demersal fish species like the Glacial eelpout (*Lycodes frigidus*; Figure 9). *Neohela monstrosa* has been found in stomachs of Longfin hake (*Phycis cheserti*) off Atlantic USA (Sedberry and Musick 1978) and in Cod (*Gadus morhua*) stomachs from the Gulf of Saint Lawrence (Sainte-Marie and Brunel 1985). The burrow might also provide important protection for newly released juveniles. Amphipods are brooders and release the juveniles from a brood chamber looking like miniature adults. Many amphipods protect their offspring, either in their burrows or on their antennae. The newly released juveniles are very vulnerable and maternal care seems to be essential (Thiel 1998). The video records show that the burrows occur in different sizes that correspond to the size of the inhabitant (see Figure 7); presumably it is a demanding task to build and sustain a burrow, and newly released juveniles probably stay in the mother’s burrow, as has been observed for other domicolous amphipod species (Thiel 1998).

**Anthropogenic disturbance**

*Neohela monstrosa* is present in habitats subject to anthropogenic disturbance from oil and gas exploration. At drilling locations, our observations showed reduced abundance close to the well, in line with previous studies of benthic megafauna from the deep

![Figure 9](image.png) Glacial eelpout (*Lycodes frigidus*) is often observed in the same habitat as dense populations of *Neohela monstrosa* and may represent an important predator from which the latter has to hide in its burrow.
Norwegian Sea (Gates and Jones 2012). It is important that the efforts are made to improve the understanding of the behaviour and local-scale variability of deep-sea species in areas undergoing anthropogenic impacts, especially as industries move into deeper and less explored areas. The abundance of burrows encountered at these sites was undoubtedly reduced by drill cuttings. At Asterix, the closest *N. monstrosa* burrow was 94 m from the well, compared to cerianthids which were found less than 40 m away. Background studies would show greater abundance because cuttings deposition significantly reduces megafaunal abundance (Gates and Jones 2012).

**In conclusion**

- *Neohela monstrosa* occur in patches with a density that can reach 15–36 individuals per m$^2$ on mud or sandy mud bottoms at 200–2181 m depth off Northern Norway.
- The locally high density of *N. monstrosa* together with its habit of making deep and long burrows indicates that it is a major bioturbator.
- *Neohela monstrosa* normally is positioned in the opening of its burrow, which is used for protection against predators, where it feeds on newly settled detritus that it collects from the surface sediment through the use of its long antennae.

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No potential conflict of interest was reported by the authors.

**Supplemental material**

Supplemental material for this article can be accessed here: [http://dx.doi.org/10.1080/00222933.2015.1062152](http://dx.doi.org/10.1080/00222933.2015.1062152)

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