

Biodiversity of a wreck from the Belgian Continental Shelf: monitoring using scientific diving. Preliminary results

by Cl. MASSIN, A. NORRO & J. MALLEFET

Abstract

Scientific diving from aboard the *r/v Belgica* has been employed to carry out a preliminary study of the macrofauna living on a wreck (the *Birkenfels*) located on the Belgian Continental Shelf (BCS). The study revealed an extremely rich sessile and slow moving fauna (at least 40 species), 3 jellyfish species and 8 fish species. The presence of at least 51 species represents a biodiversity of macrofauna on the wreck that is much higher than that found in nearly all known surrounding soft bottom communities belonging to the BCS. The covering of large parts of the wreck is represented by three species: *Sarsia eximia* (Hydrozoa) and *Jassa herdmanni* (Crustacea) associated with *Tubularia indivisa* (Hydrozoa). It should also be pointed out that 53 % of the species identified in this study are species not included as members of the Belgian marine fauna in a recent list dealing with offshore fauna. Moreover, some, such as *Sarsia eximia* or *Epithonium clathratulum*, previously thought to be rare, have been found in large numbers. Furthermore, *Diadumene cincta* and *Caprella tuberculata* are new species for the Belgian marine fauna.

Key-words: biodiversity, Belgian Continental Shelf, wreck, scientific diving.

Résumé

L'utilisation de la plongée scientifique à partir du *r/v Belgica* a permis une étude préliminaire de la macrofaune vivant sur une épave (le *Birkenfels*) située sur le plateau continental belge (PCB). Cette étude a révélé une faune sessile et une faune à mouvements lents très riches (au moins 40 espèces), plus 3 espèces de méduses et 8 espèces de poissons. La présence d'au moins 53 espèces représente, pour l'épave, une biodiversité de la macrofaune bien supérieure à celle de presque toutes les communautés benthiques de substrats meubles connues du PCB. L'essentiel de la couverture de l'épave est représenté par trois espèces: *Sarsia eximia* (Hydrozoa) et *Jassa herdmanni* (Crustacea) associée à *Tubularia indivisa* (Hydrozoa). Cinquante trois % des espèces identifiées dans cette étude ne sont pas mentionnées comme appartenant à la faune marine belge dans une liste récente traitant de la faune du large. De plus, certaines espèces comme *Sarsia eximia* ou *Epithonium clathratulum*, supposées rares, ont été trouvées en grand nombre. *Diadumene cincta* et *Caprella tuberculata* sont des espèces nouvelles pour la faune marine belge.

Mots-clés : biodiversité, Plateau Continental Belge, épave, plongée scientifique.

Introduction

Biodiversity of the Belgian marine benthos is well documented for the meiobenthos and the small macrobenthos (up to a few mm long) from soft bottoms (see CATTRIJSSE & VINCX, 2001 for extensive literature review). Large epibenthos and sessile fauna have been collected for more than a century (VAN BENEDEN, 1883; GILSON, 1900) but few papers have been published until now, e.g. COENJAERTS (1997), DEGRAER (1999) DEGRAER *et al.* (1999) and BEYST (2001). The collection of samples in these studies were all based on the same method (the VAN VEEN grab). Previous studies on epibenthos were carried out by the Departement voor Zeevisserij (formerly Rijksstation voor Zeevisserij) Oostende (DvZ). They focussed their attention mainly on commercially important species (*Crangon crangon*, Pleuronectidae, Soleidae, Gadidae, Clupeidae) and occasionally on by-catches (Hydrozoa, Anthozoa, Annelida, Bryozoa, Crustacea, Mollusca and Echinodermata)(see among others DE CLERCK, *et al.*, 1973; 1974a; 1974b; 1975; MAERTENS, 1987). These samples were either collected by means of different trawls or by VAN VEEN grab. Most of their results were published in «grey» literature.

Since GILSON (1900), collecting methods for the study of marine benthic biodiversity, have not varied much: VAN VEEN grabs, box corers, trawls and sledges. These methods may be sufficient to give an overview of the soft bottom benthic fauna on the Belgian Continental Shelf, but are totally inappropriate or result in underestimations for hard bottoms (rocks and wrecks) and particularly for sessile fauna. Furthermore, data concerning this sessile epifauna are very scarce (CATTRIJSSE & VINCX, 2001).

Scientific diving on wrecks with direct observations of benthic and particularly sessile fauna has been performed by Dutch scientists (WAARDENBURG, 1988; VAN MOORSEL *et al.*, 1989; 1991). They prospected 22 wrecks along the Dutch Coast. Biodiversity was estimated *in situ* and on video tapes. Surprisingly, only a few samples were collected for identification; as a consequence, this work reveals only a part of the biodiversity. Nevertheless, the results clearly indicate that wrecks are much richer than the surrounding sand and appear an oasis for marine life.

To fill the gap of our knowledge on the sessile macrofauna of the BCS, a preliminary campaign on board of *r/v Belgica* was performed in July 2001 to test the feasibility of a study of sessile macrofauna by means of scientific diving.

Material & Methods

The target wreck was the «*Birkenfels*» (ED50, N51° 39', 040-E002° 32', 350; 156 m length; 42 m depth HW). It was prospected twice by two teams of divers. Three samples were taken on horizontal surfaces at 22, 28 and 29 m depth. Only macro-organisms (visible with the naked eye) were taken into account.

Three complementary techniques were used:

1. **Photography:** surfaces delimited by a frame 50 X 50 cm were photographed (using digital video camera). Species diversity can be estimated from these photographs.

2. **Estimate of covering:** within the same 50 X 50 cm frame, divers estimated the rate of coverage (fig. 1B) with the main benthic sessile organisms using the techniques established by DAHL (1981).

3. **Sampling:** within each 50 X 50 cm frame, a surface of 25 X 25 cm was scraped off (fig. 1C) in order to collect all the sessile fauna and slow moving vagile fauna. On board, each sample was properly labelled, animals anaesthetized in 3% magnesium chloride and preserved in buffered formalin. Later the material was transferred to buffered alcohol, identified and for a few species the number of specimens/surface unit was counted.

Fishes living in open water were identified *in situ* by divers.

Topography of the wreck was carried out using the onboard *Belgica* Kongsberg Simrad EM1002S multibeam sonar (fig. 1A). Such a technique requires tidal reduction. Maps were produced with the help of the Fund for sand extraction (Belgian Ministry of Economics Affairs).

Results

The dominant species on vertical and horizontal surfaces were *Sarsia eximia* and *Jassa herdmanni* associated with *Tubularia indivisa* (fig. 1D-E). They represented more than 80% of the covering. Sea anemones (particularly *Diadumene cincta* and *Metridium senile*; figs 1F, 2E) represented more or less 10% of the covering. Locally they are more abundant, particularly on overhangs (fig. 2C).

On some spots *Ophiothrix fragilis* (fig. 2A) represented up to 30% of the covering. These ophiurians aggregate, forming several layers with population densities that varied from 288 to 1,440 specimens/m². All body sizes were observed from early juveniles (4 vertebral ossicles/arm) to adults. *Psammechinus miliaris* is represented by juveniles (maximum 10 mm across) only with densities varying from 32 to 256 specimens/m².

Living specimens of *Nassarius incrasatus* and *Epithonium clathratulum* were observed. Their population density reached up to 80 specimens/m² and 96 specimens/m², respectively.

Discussion & conclusions

With at least 51 species identified in only 3 samples, the biodiversity of the Birkenfels's macrofauna is considerably higher than that of nearly all the prospected soft bottom communities on the BCS. CATTRIJSSE & DEGRAER (2001) report an average of 8 to 30 macrobenthos species per prospected zone, the number of observations per zone varying between 13 and 209. Regarding the epibenthos species, CATTRIJSSE (2001) reports an average of 12 to 18 species per prospected zone, the number of observations per zone varying between 3 and 67. Intensive sampling of the wreck will certainly bring more species. *Sarsia eximia* and *Epithonium clathratulum* were considered rare species for the Belgian fauna. *S. eximia* was mentioned only once by LELOUP (1947) on mussel shells collected on the West-Hinder lightship in 1905 (this information is repeated in LELOUP, 1952). According to our observations it is a common species in offshore Belgian waters.

Before the present study, *E. clathratulum* was only known from a few stranded specimens (BACKELJAU, 1986; VANHAELEN, 1989) and by a single living specimen collected on a breakwater at Koksijde (JONCKHEERE, 2001).

Jassa herdmanni was very recently ascribed to the Belgian fauna (D'UDEKEM D'ACQZ, 1993). It has been found associated with *Tubularia* spp. on rocky substrate along the coast. This species is much more common than predicted but it has very often been confused with *Jassa falcata*. *Caprella tuberculata* is a rare species in the North Sea and should be considered as a new species for the Belgian marine fauna.

Diadumene cincta is very common on the wreck. However, it has not previously been mentioned as belonging to the marine Belgian fauna (LELOUP, 1947; 1952; DARO, 1969; MANUEL, 1981; HAYWARD & RYLAND, 1995). Checking the «grey» literature it is possible to find 3 references (HUYSEUNE, 1978; MEIRE, 1981; VANDERPERREN, 1991) listing *D. cincta* from the Belgian coast (Bredene, St Idesbald, Ostende). However, these observations were not checked by a specialist and confusion with some *Sagartia* species cannot be excluded (KERCKHOF pers. comm.). *D. cincta* must be considered a new species for the Belgian marine fauna. Its presence along the coast line is still to be confirmed.

Twenty seven species in table 1 (53% of the observed species), are not recorded in the species list of the CBS established by CATTRIJSSE & VINCX (2001) and based on offshore records from 1970 to 1998. Most of these 27 species belong to the sessile and slow moving fauna. It clearly illustrates our poor knowledge of this type of fauna and the importance of careful sampling for the hard bottom fauna of the CBS. In this respect scientific diving is an efficient, cost effective and reliable tool.

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References

- BACKELJAU, Th., 1986. Lijst van de recente mariene mollusken van België. *Studiedocumenten Koninklijk Belgisch Instituut voor Natuurwetenschappen*, 29: 1-106.
- BEYST, B., 2001. Epi- and hyperbenthic communities of Belgian sandy beaches. Ph.D. Thesis University Ghent, 351p.
- CATTRIJSE, A., 2001. Epifauna of the Belgian Continental Shelf. In Biodiversity of the benthos and the avifauna of the Belgian Coastal waters, pp 21-23, Federal Office for Scientific, Technical and Cultural Affairs, Brussels, 48 pp.
- CATTRIJSE, A. & VINCX, M., 2001. Biodiversity of the benthos and the avifauna of the Belgian Coastal waters. Federal Office for Scientific, Technical and Cultural Affairs, Brussels, 48 pp.
- CATTRIJSE, A. & DEGRAER, S., 2001. Macrofauna biodiversity patterns of the Belgian waters. In Biodiversity of the benthos and the avifauna of the Belgian Coastal waters, pp17-20, Federal Office for Scientific, Technical and Cultural Affairs, Brussels, 48 pp.
- COENJAERTS, J., 1997. Het macrobenthos van de Vlaamse Banken en omliggende zandbank ecosystemen. M. Sc. Thesis, University Ghent, 115 pp + 5 bijlagen.
- DAHL, A.L., 1981. Coral reef monitoring handbook. South Pacific Commission, Noumea, 21 pp.
- DARO, M.H., 1969. Etude écologique d'un brise-lames de la côte belge. 1. Description et zonation des organismes. *Annales de la Société Royal Zoologique de Belgique*, 99 (3-4) : 111-152.
- DE CLERCK, R., CLOET, N. & REDANT, F., 1973. Bestandopname langsheen de Belgische Kust (7). *Mededelingen van het Rijksstation voor Zeevisserij*, 81B/10: 5 p. + 2 tabs + 26 maps.
- DE CLERCK, R., CLOET, N. & REDANT, F., 1974a. Bestandopname langsheen de Belgische Kust (8). *Mededelingen van het Rijksstation voor Zeevisserij*, 87B/12: 5 p. + 2 tabs + 31 maps.
- DE CLERCK, R., CLOET, N. & REDANT, F., 1974b. Bestandopname langsheen de Belgische Kust (9). *Mededelingen van het Rijksstation voor Zeevisserij*, 98B/13: 5 p. + 2 tabs + 29 maps.
- DE CLERCK, R., CLOET, N. & REDANT, F., 1975. Bestandopname langsheen de Belgische Kust (10). *Mededelingen van het Rijksstation voor Zeevisserij*, 110B/15: 5 p. + 2 tabs + 29 maps.
- DEGRAER, S., 1999. Macrobenthos of shallow marine habitats (Belgian Coast) and its use in Coastal zone management. Ph.D. Thesis University Ghent, 156 p.
- DEGRAER, S., VINCX, M., MEIRE, P. & OFFRIGA, H., 1999. The macrozoobenthos of an important wintering area of the common scoter (*Melanitta nigra*). *Journal of the Marine Biological Association U.K.*, 79: 243-251.
- d'UDEKEM d'ACQZ, C., 1993. Présence et abondance de *Jassa herdmani* (WALKER, 1893) sur la côte belge (Crustacea, Amphipoda, Ischyrocenidae). *De Strandvlo*, 13(4) : 134-138.
- GILSON, G., 1900. Exploration de la mer sur les côtes de la Belgique. *Mémoire du Musée royal d'Histoire naturelle de Belgique*, 1: 1-81.
- HAYWARD, P.J. & RYLAND, J.S., 1995. Handbook of the Marine Fauna of North-West Europe. Oxford University Press, Oxford, 800 pp.
- HUYSEUNE, A., 1978. Waarnemingen en Vondsten. *Tuimelaar*, 5(1): 9-10.
- JONCKHEERE, I., 2001. Witte wenteltrap *Epitonium clathratulum* levend op een golfbreker te Koksijde. *De Strandvlo*, 21(2): 53-57.
- LELOUP, E., 1947. Les coelentérés de la faune belge. *Mémoire du Musée royal d'Histoire naturelle de Belgique*, 107: 1-71.
- LELOUP, E., 1952. Coelentérés. In Faune de Belgique, Patrimoine IRScNB, Bruxelles, 283 pp.
- MAERTENS, D. 1987. Analyse van de levensgemeenschappen op het Belgisch continentaal shelf: Studie van de epibenthische biocoenoses en van de demersale Pisces in het lozingsgebied voor afvalstoffen afkomstig van een anilineproductie. *Mededelingen van het Rijksstation voor Zeevisserij*, 219 : 1-28 + 5 figs.
- MEIRE, P., 1981. Uit het Natuurhistorisch Archief, Aflevering 3. *De Strandvlo*, 1(4): 115-118.
- MANUEL, R.L., 1981. British Anthozoa. In Synopses of the British fauna (New Series), D.M. KERMACK & R.S.K. BARNES (eds), 18: 1-241, Academic Press, London.
- VAN BENEDEN, E. 1883. Compte rendu sommaire des recherches entreprises à la Station biologique d'Ostende pendant les mois d'été 1883. *Bulletin de l'Académie Royale des Sciences, Lettres et Beaux-Arts de Belgique*, 3^e Série, 6: 458-483.
- VANDERPERREN, J.-P., 1991. Verslag Natuurhistorisch Archief 1990. *De Strandvlo*, 11(3): 65-75.
- VANHAELLEN, M.-Th., 1989. Enkele waarnemingen van het strand tussen Koksijde en Oostduinkerke tijdens en na de warme zomer van 1989. *De Strandvlo*, 9(4): 117-120.
- VAN MOORSEL, G.W.N.M., SIPS, H.J.J. & WAARDENBURG, H.W., 1989. De fauna op en rond wrakken in de Noordzee in 1988. Bureau WAARDENBURG, Culemborg, Nederland, 21 p + 2 figs + 6 tabs.
- VAN MOORSEL, G.W.N.M., WAARDENBURG, H.W. & VAN DER HORST, J., 1991. Het leven op en rond scheepswrakken en andere harde substraten in de Noordzee (1986T/M 1990). Een Synthese. Bureau WAARDENBURG, Culemborg, Nederland, 49 p + 3 addenda.
- WAARDENBURG, H.W., 1988. De fauna op een aantal scheepswrakken in de Noordzee in 1987. Bureau WAARDENBURG, Culemborg, Nederland, 27 p + 3 addenda.

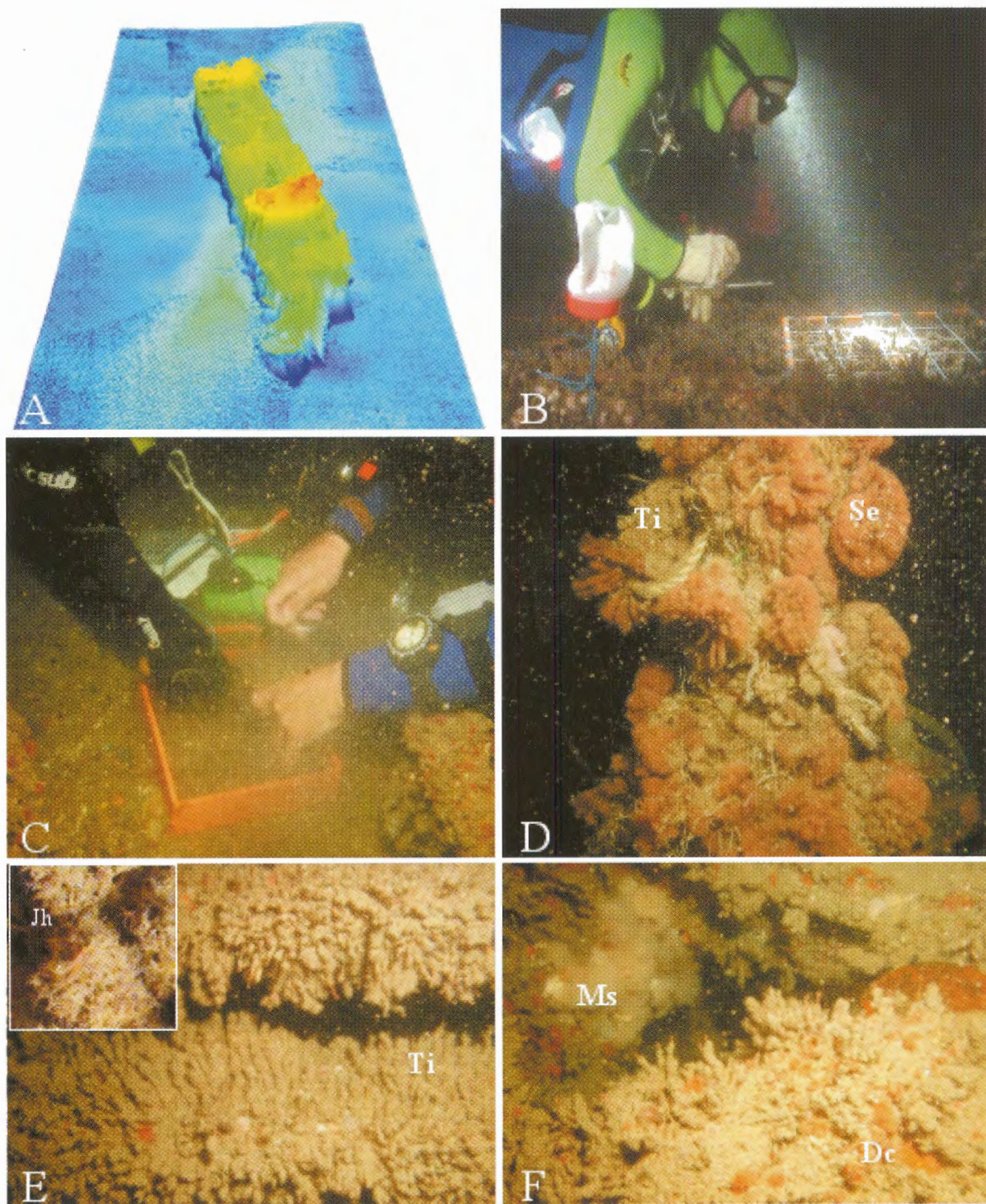


Fig. 1 A. Multibeam map of the *Birkenfels*. B. Diver estimating the covering within a 50 X 50 cm frame (photo MALLEFET). C. Divers scraping a 25 X 25 cm frame (photo NORRO). D. *Sarsia eximia* (Se) and *Tubularia indivisa* (Ti) (photo NORRO). E. *Tubularia indivisa* (Ti) clogged with furrows of *Jassa herdmanni* (Jh) (photo NORRO, magnified part, photo MALLEFET). F. *Diadumene cincta* (Dc) and *Metridium senile* (Ms) (photo NORRO)

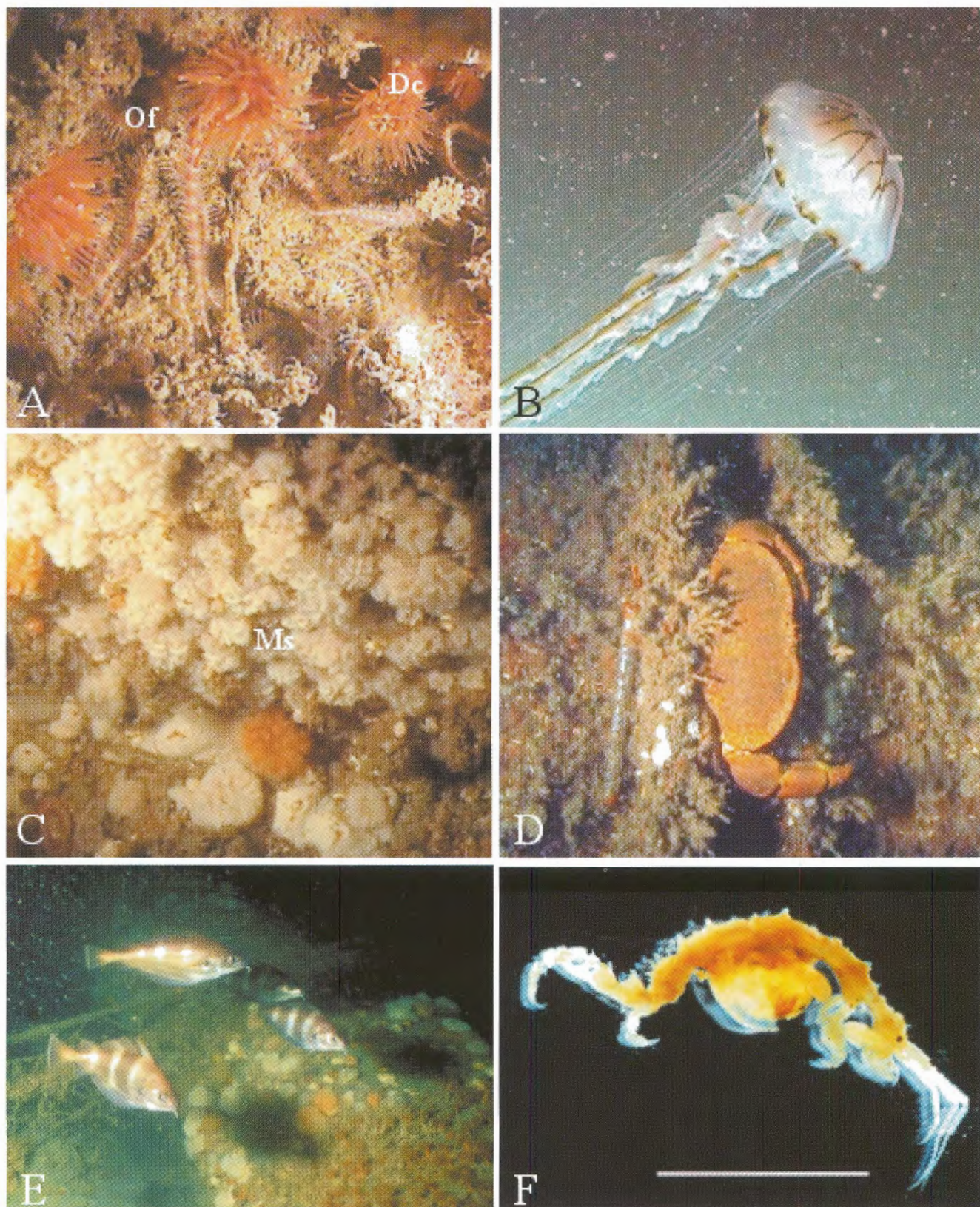


Fig. 2 **A.** *Ophiothrix fragilis* (Of) (photo MALLEFET). **B.** *Chrysaora hysoscella* (photo MALLEFET). **C.** Overhang with numerous *Metridium senile* (photo MALLEFET). **D.** *Cancer pagurus* (photo MALLEFET). **E.** *Trisopterus luscus*, the most abundant fish around the wreck (photo NORRO). **F.** *Caprella tuberculata* (photo MALLEFET)

PORIFERA		Gasteropoda	
Nihil		<i>Nassarius incrassatus</i> (Ström, 1768)	
CNIDARIA		<i>Nassarius reticulatus</i> (Linnaeus, 1758)	
Hydrozoa		<i>Epithonium clathratulum</i> (Kanmacher, 1798)	
<i>Tubularia indivisa</i> Linnaeus, 1758		<i>Flabellina verrucosa</i> (M. Sars, 1829)	
<i>Sarsia eximia</i> (Allman, 1859)		<i>Dendronotus frondosus</i> (Ascanius, 1774)	
<i>Hydractinia echinata</i> (Flemming, 1828)		<i>Flabellinidae</i> sp (photo)	
<i>Aequorea vitrina</i> Gosse, 1853 *			
Scyphozoa		CRUSTACEA	
<i>Chrysaora hysoscella</i> (Linnaeus, 1766) *		Decapoda	
<i>Cyanea lamarcki</i> Péron & Lesueur, 1809 *		<i>Cancer pagurus</i> Linnaeus, 1758	
Anthozoa		<i>Liocarcinus holstatus</i> (Fabricius, 1798)	
<i>Sagartia troglodytes</i> (Price, 1847)		<i>Hias araneus</i> (Linnaeus, 1758)	
<i>Sagartia</i> sp. (photo)		<i>Pisidia longicornis</i> (Linnaeus, 1767)	
<i>Diadumene cincta</i> Stephenson, 1925**		<i>Pagurus bernhardus</i> (Linnaeus, 1758)	
<i>Urticila felina</i> (Linnaeus, 1766)(photo)		Amphipoda	
<i>Metridium senile</i> (Linnaeus, 1758)(photo)		<i>Stenothoe valida</i> Dana, 1855	
<i>Anemonia</i> sp. (photo)		<i>Jassa herdmanni</i> (Walker, 1893)	
		<i>Phtisica marina</i> Slabber, 1769	
		<i>Caprella linearis</i> (Linnaeus, 1767)	
		<i>Caprella tuberculata</i> Guérin, 1836**	
CTENARIA			
Nihil		BRYOZOA	
NEMERTA		<i>Electra pilosa</i> (Linnaeus, 1767)	
Nemertinea spp.		ECHINODERMATA	
ANNELIDA		<i>Asterias rubens</i> Linnaeus, 1758	
Polychaeta		<i>Psammechinus miliaris</i> (Gmelin, 1778)	
<i>Lanice conchilega</i> (Pallas, 1766)		<i>Ophiothrix fragilis</i> (Abildgaard, 1789)	
<i>Lepidonotus squamatus</i> (Linnaeus, 1761)		<i>Ophiura albida</i> Forbes, 1839	
<i>Pomatoceros triqueter</i> (Linnaeus, 1767)		TUNICATA	
<i>Harmothoe impar</i> (Johnston, 1839)		Nihil	
Harmothoe spp.		PISCES	
<i>Anaitides maculata-mucosa</i> (Linnaeus, 1767)-		<i>Gadus morrhua</i> Linnaeus, 1758 *	
Oersted, 1843		<i>Trisopterus luscus</i> (Linnaeus, 1758) *	
<i>Procerastea halleziana</i> Mallaquin, 1893		<i>Trisopterus minutus</i> (Linnaeus, 1758) *	
MOLLUSCA		<i>Pollachius pollachius</i> (Linnaeus, 1758) *	
Bivalvia		<i>Pollachius virens</i> (Linnaeus, 1758) *	
<i>Mytilus edulis</i> Linnaeus, 1758		<i>Trachurus trachurus</i> (Linnaeus, 1758) *	
<i>Heteranomia squamula</i> (Linnaeus, 1758)		<i>Scomber scombrus</i> Linnaeus, 1758 *	
<i>Venerupis senegalensis</i> (Gmelin, 1791)		<i>Pomatoschistus</i> sp (photo) *	

Table 1: Preliminary list of the collected species. «photo» between brackets means that the species was not collected but only observed on video records. Species with * were observed *in situ* but not collected. Species with ** were new for the Belgian marine fauna. Species in bold are not mentioned in the faunal list of CATRISSE & VINCX (2001).

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