"THE IBSO CATALOGUE OF LUMINOUS BACTERIA CULTURES"

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Abstract

The luminous bacterium culture catalogue gives an idea of the special collection of luminous marine bacteria held at the Institute of Biophysics, Siberian Branch of the Russian Academy of Sciences (IBSO). The catalogue contains the description maintained strains of marine luminous bacteria (free-living and associate, including symbiotic) belonging to 5 species (*Photobacterium phosphoreum, P. kishitanii, P.leiognathi, Vibrio harveyi and V. fischeri*). The luminous bacteria of the Collection were isolated in various regions of the Indian, the Atlantic and the Pacific Oceans, of the Black, Mediterranean and other seas, from tropical to polar latitudes and from the surface layers to the depth of several thousand meters. The description includes the strain history, synonyms and commonly encountered previous names, isolation substrates, and georaphical location. The catalogue also contains recipes for recommended media, preservation and storage conditions, methods of quick identification of strains, and potentially important biotechnological properties of the strains. Brief information on the peculiarities of morphology, physiology, biochemistry, and metabolism of luminous bacteria is supplemented with illustrations, such as advertisements of preparations for the bioluminescent analysis, based on freeze-dried luminous bacteria as well as the bienzyme luciferase- oxidoreductase system isolated from the cell. The cited litersture is compiled of the books and papers on the physiology, taxonomy, biochemistry, ultrastructure, and ecology of these microorganisms. The catalogue is intended for specialists in microbiology and biotechnology; it may also be a guidebook for selecting the strain, which will be best, suited for a particular purpose. The Collection in primarily used for educational purposes.

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Cataloques:

- The catalogue of luminous bacteria of the Institute of Biophysics was published in 1997 in "Nauka" Publishing House in English and in Russian.
- The electronic English version of "The IBSO Catalogue of Luminous Bacteria Cultures" is available at the IBP-site http://www.ibp.ru/ccibso and Collection-site bl.ibp.ru.

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INTRODUCTION

The most effective way to preserve microbiological resources is their maintaining in modern microbial collections that have the conditions for guaranteed maintaining and long-term deposit of the organisms isolated under the natural conditions. The culture collections are the centers for the study of biological objects' systematics, the development of the methods to identify cultures and to keep them for a long time. They are also banks of information on the history of the available strains, their properties, as well as a safe depository for cultures [di Gastri, Younes, 1990, Grassle et al., 1991, Hawksworth, Colwell, 1992, Ivshina, 1993, Green, Bousfield, 1993, Kirsop, Kalakoutskii, 1993].

At present, culture collections of microorganisms of different kind exist in many countries of the world. They constitute the world collection stock and are united in various international communities, such as the European Culture Collections' Organization (ECCO) and the World Federation of Culture Collections (WFCC). There are three main types of microbial collections: maintenance, special and individual ones. The objective of maintenance collections is to preserve the diversity of systematic groups of microorganisms described to date, which are generally represented in them by a small number of strains. Special and individual collections are characterized by the presence of a large number of strains of the few species of special interest [Fateeva, 1983]. Cultures maintained in collections serve as a resource for prompt application of scientific advances in developing new technologies and producing new preparations. Incorporation of Russian culture collections into the Microbial Strain Data Network (MSDN) will significantly extend the range of application of microorganisms in science and in practice and make the necessary information more readily accessible [Kalakoutskii et al, 1993, 1996].

BRIEF INFORMATION ABOUT LUMINOUS BACTERIA

The investigation of the World Ocean bioluminescence showed the luminous bacteria to be among the most numerous unicellular inhabitants of sea waters. Bioluminescence is one of the forms of a chemiluminescent reaction, the final product of which is visible light [Hastings, 1968, Gitelson et al., 1984]:

$$FMNH_2 + RCHO + O_2 \xrightarrow{\text{luciferase}} FMN + RCOOH + H_2O + \text{light}$$

The unique specific culture collection of luminous marine bacteria (IBSO CC) has been maintained and enlarged in the Institute of Biophysics of RAN SB (Krasnoyarsk) for many years. There are no collections like that anywhere within Russia or the former Soviet Union. There are luminous bacteria in the National Collection NCMB (England), in the American Type Cultures Collection ATCC (USA), in the All-Russian Collection of Microorganisms (VKM, Russia) and in some other collection.

The collection dates back to the 60's and included about 700 strains belonging to 5 species: *Photobacterium phosphoreum, P. kishitanii, P.leiognathi, Vibrio harveyi and V. fischeri.* They were isolated in various regions of the Indian, the Atlantic and the Pacific Oceans, of the Black, Mediterranean and other seas, from tropical to polar latitudes and from the surface layers to the depth of several thousand meters. The type strains of luminous bacteria there are in the Collection IBSO also. Luminous bacteria are the constant, and in some cases rather substantial component of the sea water microflora, constituting 0.1 to 10% of the total amount of saprophytic bacteria in open waters and 60-70% in the lagoons of coral atolls [Chumakova, Gitelson, 1975, Gitelson et al., 1984].

Collection strains of luminous bacteria, associated with marine fauna, are represented by symbiontes isolated from light organs, and commensals inhabiting the gastrointestinal tract [Gitelson, Vorobyova, 1986, 1988; Primakova, Kuznetsov, 1990; Vydryakova et al., 1995, Vydryakova, Kuznetsov, 1997].

Luminous bacteria are gram-negative bacilli, facultative anaerobes. Insignificant oxygen concentrations are enough for them to grow and emit light. Like many other marine microorganisms, luminous bacteria are halophilous. The medium in which they can grow and develop must contain sodium ions (2-3% NaCl) which can not be substituted for by potassium or magnesium ions. The optimum pH values for growth and luminescence of luminous bacteria are close to 7.0, very rarely exceeding 7.5. Most of Collection strains are mesophylls, the Collection also holds psychrophilic strains. Thermophilic luminous forms have not been recorded [Chumakova, Gitelson, 1975; Gitelson et al., 1984]. The Collection holds dim and dark variants of luminescent forms (spontaneous and specially produced) [Gitelson et al., 1984, Rodicheva et al., 1998, 2000, Gitelson et al., 2000].

The technique of in vitro molecular DNA/DNA hybridization and luminescent reaction kinetics were used to determine the similarity between the DNA nucleotide sequences of unidentified psychrophilic and mesophilic strains of luminous bacteria [Vorobyova et al., 1982, Primakova et al., 1983a, 1986]. There have been many studies on physiological and biochemical features of the growth and luminescence of luminous bacteria [Petushkov et al., 1982, 1984, 1985, Popova, 1982, Popova et al., 1982, Rodionova et al., 1988, Shenderov et al., 1989, Kalacheva et al., 1990, Kudryasheva et al., 1990, 1991, 1993, Rodicheva et al., 1991, 1993, 1997, Primakova, Sandalova, 1991, Petushkov, Raibekas, 1990a,b, Raibekas, 1991, Sandalova, Tyulkova, 1992, Kratasyuk et al., 1994, Sokolova et al., 2000, Sukovataya, Tyulkova,

2000, 2001]. The selection of optimal rations of some components of the medium for the growth and luminescence of luminous bacteria belonging to the genus *Photobacterium* has been done by the methods of experimental design. Examination of luminous bacteria have enabled us to reveal the nutrient medium components effecting growth, luminescence intensity and luciferase synthesis. These agents are nucleic components (nucleotides, nucleosides and amine basis), aminoacids and vitamins [Rodicheva et al., 1973, 1990, 1991, 1993, 1997]. The dependence of luciferase content and luminescence intensity of luminous bacteria on dilution rate at their cultivation in chemostat regime is studied [Gitelson et al., 1984]. The investigation of the peculiarities of luminescent system development in luminous bacteria in diauxic growth was carried out [Vysotski et al., 1982]. The kinetics of pyruvic acid production by luminescent bacteria was studied during its growth in composite and minimal media with glucose as a carbon source. The bacteria were shown to form the major quantity of pyruvate upon glucose catabolism [Andreyeva et al., 1981]. The composition of lipids was studied in the luminescent bacteria under the conditions of maximal luminescence. The synthesis of total lipids and poly-ß-hydroxybutyric acid was investigated in dynamics under the conditions of *P.leiognathi* batch cultivation. The fatty acid composition of luminous bacteria and dark mutants was studied in dynamics [Kalacheva et al., 1980, 1981a,b]. It was studied the cell morphology and ultrastructure of some strains of *P.leiognathi, P.phosphoreum, V.harveyi* [Medvedeva et al., 1975, 1979, 2006, 2009a, Primakova et al., 1981, Gitelson et al., 1984, Rodicheva et al., 1993]. A closer electron microscopy examination of the colony structure revealed densely packed cells of two morphotypes [Mogilnaya et al., 1989, 1991, Medvedeva et al., 2006, 2009a]. It was studied the nucleoid structure and location of the luminescent system in bacterial cells and isolated nucleoid [Protopopov et al., 1989, 1990, Mogilnaya et al., 1990]. It was studied the gene nucleotide sequence and luciferase structure [Salnikov et al., 1981, Illarionov et al, 1988, 1987, 1988, 1990, Sandalova, Lindqvist, 1995]. It was investigated the effect of some chemical substances on luciferase, metabolism and structure of luminous bacteria [Medvedeva et al., 1990, 2009 в, Popova et al., 1991, 1994, Stom et al., 1992, Tyulkova, Sandalova, 1996, Medvedeva, 1999, Kudryasheva et al., 2002, Rodicheva et al., 2004, Fedorova et al., 2007, Tyulkova et al., 2009].

RECOMMENDATIONS FOR QUICK IDENTIFICATION OF LUMINOUS BACTERIA

Among the luminous bacteria isolated from various natural sources, the most frequently found are the following: *Photobacterium phosphoreum, Photobacterium leiognathi, Vibrio fischeri and Vibrio harveyi.*

Due to their ability to emit visible light luminous bacteria colonies on solid medium can be easily differentiated from other bacterial colonies in darkness. Bacteria *V. fischeri* form yellow pigment and can be easily differentiated by the colony colour. *V.harveyi* produce into the medium brown pigment, their colonies have respective colouring in case of long cultivation or storage on solid medium.

The genus of luminous bacteria can be determined by examining the form of growth in semi-liquid agar (compact, usually consisting of microcolonies - for *Photobacterium*; dissipated, homogeneous - for *Vibrio*) [Medvedeva et al., 1993], and by estimating the luminescence reaction kinetics [Vorobyova et al., 1982, Sandalova, Tyulkova, 1992]. The specific dependence of the luminescence reaction kinetics on the length of the aldehyde used makes it possible to assign luminous bacteria to certain species [Vorobyova et al., 1982].

Taxonomically close species, *P.phosphoreum* and *P.leiognathi*, have different temperature characteristics of growth. *P.phosphoreum* strains grow at 4°C, however most of them terminate their growth at a temperature of 25°C and have optimal temperatures of growth between 18 and 20°C. *P.leiognathi* strains grow well at temperatures between 30 and 35°C, don't grow at 4°C and above 40°C.

RESEARCH AREAS AND PRACTICAL APPLICATION OF LUMINOUS BACTERIA

The research work in the collection done along the following lines:

- Guaranteed preservation of viability and initial properties of the Collection gene pool;
- Development of optimum methods of gene pool storage;
- Study of physiological, biochemical, and morphological properties of collection strains;
- Screening of strains producing luciferases, oxidoreductases and other target products, including, using of E.coli as heterologic owner of such products;
- Study of distribution of these microorganisms in waters of the World ocean and their taxonomy identification;
- Study of population heterogeneity and dissociation under various cultivation conditions;
- Research of structural organization and fatty acid composition of luminous bacteria.
- Research of luminescent system localization;
- Finding out of the mechanism of toxicant action on the cell and the population as a whole;
- Research of activity and stability of enzymes of the luminescence reaction;
- Culture collection information network, computer databases of microorganisms;
- Development of high-sensitive toxicity biotest for monitoring of a environment;
- Manufacturing of a complete set of reagents for the bioluminescent analysis on the basis of the isolated bienzyme system of luminous bacteria.

The IBSO Collection carried out the work for creating the database within the framework of the international program Microbial Strain Data Network (MSDN) and the State Research - and - Development Project "Aids to Investigations in Physico-Chemical Biology and Biotechnology", “Microbial diversity” (the part "Culture collection of microorganisms"). Now there is the database about features of natural and transgenic bacteria carring marker *lux*-gene (Medvedeva et al., 2001). Since 2003, the Collection of marine luminescent bacteria is an affiliated member of the WFCC (World Federation of Cultures Collections) and is presented in the World Data Center for Microorganisms database (WDCM) under the acronym CCIBSO 836. Data on the properties of natural luminescent bacteria from the IBSO Culture Collection are presented in a consolidated Catalogue microorganisms of Russian collections (http://www.vkm.ru) and on the website of the International Society for the Collections of Cultures (WFCC-MIRCEN World Data Center for Microorganisms - http://www.wdcm.org/) in the Global Catalog of Microorganisms (http: // gcm.wfcc.info/). The information web-portal "Bioluminescence and luminous organisms" (http://bl.ibp.ru), created on the basis of the Collection, provides users with multifaceted opportunities for acquaintance with luminous organisms, their features and practical use. Inclusion in the MSDN network the information on luminous bacteria, supported in the CCIBSO, ensures the efficiency of the Collection and the rapid exchange of information between interested participants. Participation of the Collection in the MSDN makes its activity more effective and information exchange more expeditions.

Luminous bacteria are a convenient object to be used in solving general biological problems, genetic and genetic-engineering researchs [Gitelson et al., 1984, Rodicheva et al., 2003]. The Collection of luminous bacteria can serve as a basis for researching the strain-superproducers of luciferases, NADH:FMN-oxidoreductase, decarboxylase, endonuclease of restriction, chitinase producers [Ruzgiene et al, 1990, 1991, 1992, Kolykhalov et al, 1991, Repin et al., 1993, 1995a,b, 1997a,b, Vydryakova et al., 1993, Rodicheva et al., 1998]. They can be used successfully to determine toxicity of microquantity of different substances [Kratasyuk, Gitelson, 1987, Popova et al., 1993, Kudryasheva et al., 1996, 2017].

Strains from the luminous bacteria collection are used as a basis for preparation of lyophilized bacteria for measurements of the integral biological toxicity of different substances: heavy metals, phenols, narcotics, toxins, pesticides, medicines etc. [Kuznetsov et al., 1990, 1996]. The method is based on quenching the bioluminescence of luminous bacteria by different toxicants.

The microbiosensor based on freeze-dried luminous bacteria has been used successfully to control the water quality in different water bodies, such as rivers, waste water of wood-pulp and paper production facilities and other industries [Kuznetsov et al., 1990, 1997-2000, Kratasyuk et al., 1991, 1997, 1998, 2001, Stom et al., 1986, 1992, Popova et al., 1993, Geel et al., 1993, Kudryasheva et al, 1996, Tyulkova et al., 2009, Medvedeva et al., 2009b]. The preparation produced on the basis of freeze-dried luminous bacteria in comparable with the "Microtox" preparation produced by the Beckman but less expensive.

Unconventional techniques for cultivating of luminous bacteria [Rodicheva et al., 1973, Zavoruev et al., 1982, Gitelson et al., 1984] and deriving highly purified bacterial luciferases from four species (*Photobacterium phosphoreum, Photobacterium leiognathi, Vibrio fischeri and Vibrio harveyi*) have been developed [Mezhevikin et al, 1983, Bondar et al., 1988, Tyulkova, 1990, Sukovataya, Tyulkova, 2001].

At present, biotechnology department produces sets of analytical luminescence reagents based on the coupled enzyme system: luciferase - NAD(P)H:FMN-oxidoreductase isolated from luminous bacteria [Tyulkova, Illarionov, 1994, Kuznetsov et al., 1997]. A kit of reagents for analytical bioluminescence (KRAB) can be used in medicine, ecological monitoring, and for quality inspection of newly synthesized substances.

The diagnostic kit (KRAB) can be used for determination of NAD-dependent dehydrogenases, proteases and antiproteases in blood plasma and serum, platinoids etc [Petushkov et al., 1983, 1984, 1985, 1987, Kratasyuk et al., 1985, Gitelson et al., 1985, Kratasyuk, 1995]. Institute of Biophysics offers an immobilized reagent for bioluminescent assay (IRBA) [Kratasyuk et al., 1994]. Using the kit of reagents for analytical bioluminescence (KRAB) and the hydrogenase of hydrogen bacteria, researchers of the Institute of Biophysics have developed methods for determining hydrogenase activity and the concentration of dissolved hydrogen [Petushkov V.N., Guseinov O.A., 1992].

Researchers of the Institute of Biophysics have developed the bioluminometers, a devices for measuring luminescence intensity. Such devices are now produced by the Institute together with the "Nauka" Special Design and Development Office (Krasnoyarsk).

Bacterial bioluminescence can be used as a basis for making visual aids and creating tasks for laboratory work at schools and universities. Bioluminescence methods may be employed in investigating fine details of gene structure and functioning, conjugated chains of enzymatic reactions, determining the quantity of substrates, cofactors, etc. [Andrade, 1995; Kratasyuk et al., 1995, 1997, Kratasuyk, Kudinova, 1999]. Besides its evident educational advantages, the cold luminescence of life is aesthetically and emotionally attractive.

Remarkable opportunities offered by the use of luminous bacteria in the various areas of biology, their ecological and technological applications permit us to state that they deserve close attention of biologists and other experts of the adjacent areas of knowledge.

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HOW TO USE THE CATALOGUE

The scientific names of bacteria enumerated in this Catalogue are given in accordance with the accepted nomenclature of these organisms. In this Catalogue are used the valid names of bacteria which have been published in the International Journal of Systematic Bacteriology (IJSB), Index of the Bacterial and Yeast Nomenclatural Changes, as well as the invalid names of some strains. If the correct species name is not known, the strain is referred to as "sp." instead of the species name. When preparing this Catalogue use was also made of the current hand books [Bergey's, 1984] and original papers [Chumakova et al., 1972, Reichelt, Baumann, 1973, Reichelt et al., 1976, Baumann et al., 1980, Vorobyova et al., 1982, Primakova et al., 1983a,b, 1986].

A brief explanation of the catalogue scheme.

The cultures listed in the Catalogue are arranged into groups. Each of them contains the strains of one species enumerated by their increasing numbers in CC IBSO. Type strains are indicated as Type. Below is example of the record of bacterial strain with short comments.

Photobacterium leiognathi(1) Boisvert,Chatelain et Bassot 1967(2)

54(3) Synonym: Photobacterium mandapamensis Hendrie, Hodkiss et Shewan 1970.(9)
Seawater, 200 m.(11)
Ex: The Pacific, 09º45'S, 164º09'E.(12)
(Medium 1, S-4, 25ºC, 3, S-6)(13),
(1, 4, 5, 14, 15)(14)

(1) The names of the genus, species, subspecies are valid according to the lists of approved names in some cases; the Catalogue also gives in inverted commas the names of bacteria invalid by the time of its publication. All valid names are given in medium italics, invalid ones, in italics;
(2) The author(s) who described and redescribed the (sub)species and the year of publication (according to the lists of approved names);
(3) Strain number in CC IBSO;
(4) The type strain for given species (subspecies);
(5) Collection (its abbreviation is given), person and/or organization from where the strain was obtained, under what number or designation;
(6) History of the strain in the chronological order, the movement of the strain is indicated by the arrow;
(7) In brackets, the designations of given strain in CC IBSO (dublicates) and in some other collections (taking into consideration the latest catalogues); the names of known investigators can be also given, the designation or name of the strain in their working collections;
(8) The name under which the strain was received in CC IBSO;
(9) Synonyms and old names (invalid) of a given strain;
(10) The given strain was the type strain for the species with the old name;
(11) The isolation substrate;
(12) The place where the strain was isolated, the names of Sea, Ocean, country and coordinates are given;
(13) Medium and temperature of cultivation which provide good restoration and development of the strain after its submission as well as the methods of storage and preservation enumerated in the lists of designations of these methods (see below);
(14) Bibliographic reference whose number corresponds to the serial number in the lists of references given in the Catalogue.

DESIGNATIONS FOR THE METHODS OF PRESERVATION AND STORAGE

S-1. Aerobic subculturing in liquid medium
S-4. Subculturing on agar slants
S-6. Subculturing in semiliquid medium under vaseline oil

F-2. Freeze-drying of cultures from liquid nutrient medium in sucrose-gelatine agar

NUTRIENT MEDIA.

1. Fish-peptone agar

Fish extract 0.5 l.
NaCl 30.0 g.
Peptone 10.0 g.
KH_2PO4 1.0 g.
$MgSO_4$ 0.5 g.
Agar-agar 18.0 g.
H_20 0.5 l.
pH 7.2-7.4

2. Semisolid fish-peptone agar

Fish extract 0.5 l.
Peptone 10.0 g.
NaCl 30.0 g.
KH_2PO_4 1.0 g.
$MgSO_4$ 0.5 g.
Agar-agar 2.0 g.
H_20 0.5 l.
pH 7.2-7.4

3. Semi-synthetic medium

Peptone 5.0 g.
NaCl 30.0 g.
KH_2PO_4 1.0 g.
$Na_2HPO_4.12H_2O$ 10.0 g
$MgSO_4$ 0.2 g.
$(NH_4)2HPO_4$ 0.5 g
glicerol 3.0 g
H_20 0.5 l.
pH 7.2-7.4

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LIST OF STRAINS

Photobacterium leiognathi Boisvert, Chatelain et Bassot 1967

19 Synonym: Photobacterium mandapamensis Hendrie, Hodkiss et Shewan 1970.
Ex: Seawater, 600 m. The Pacific, 04º14'S, 168º33'E
(Medium 1, S-4, 25ºC, 3, S-6) (9)

25 Synonym: Photobacterium mandapamensis Hendrie, Hodkiss et Shewan 1970.
Ex: Seawater, 300 m. The Pacific.
(Medium 1, S-4, 25ºC, 3, S-6)

54 Synonym: Photobacterium mandapamensis Hendrie, Hodkiss et Shewan 1970.
Ex: Seawater, 200 m. The Pacific, 09º45'S, 164º09'E
(Medium 1, S-4, 25ºC, 3, S-6) (1, 4, 5, 14, 15)

208 Ex: Seawater, 500 m. The Pacific, 15º26'N, 141º21'E
(Medium 1, S-4, 25ºC, 3, S-6) (27, 29)

213 Ex: Seawater, 250 m. The Pacific, 15º26'N, 141º21'E
(Medium 1, S-4, 25ºC, 3, S-6) (23, 26, 29ϭ 30)

214 Ex: Seawater, 35 m. The Pacific, 15º26'N, 141º 21'E
(Medium 1, S-4, 25ºC, 3, S-6)

220 Ex: Seawater, 450 m. The Pacific. 15º26'N, 141º 21'E
(Medium 1, S-4, 25ºC, 3, S-6)

222 Ex: Seawater, 500 m. The Pacific, 15º26'N, 141º 21'E
(Medium 1, S-4, 25ºC, 3, S-6)

223 Ex: Seawater, 500 m. The Pacific, 15º26'N, 141º 21'E
(Medium 1, S-4, 25ºC, 3, S-6)

229 Ex: Seawater, 500 m.The Pacific, 16º29'N, 141º51'E
(Medium 1, S-4, 25ºC, 3, S-6)

231 Ex: Seawater, 450 m. The Pacific, 16º29'N, 141º51'E
(Medium 1, S-4, 25ºC, 3, S-6)

302 Ex: Seawater, 800 m. The Pacific, 11º41'N, 143º24'E
(Medium 1, S-4, 25ºC, 3, S-6)

307 Ex: Seawater. The Pacific, 18º00'N, 144º20'E
(Medium 1, S-4, 25ºC, 3, S-6)

354 Ex: Seawater, 400 m. The Pacific, 16º56'N, 144º00'E
(Medium 1, S-4, 25ºC, 3, S-6)

355 Ex: Seawater, 300 m. The Pacific, 13º15'N, 144º04'E
(Medium 1, S-4, 25ºC, 3, S-6)

383 Ex: Seawater, 300 m. The Pacific, 13º48'N, 143º20'E
(Medium 1, S-4, 25ºC, 3, S-6)

509 Ex: Zooplancton (Calanus sp.).
The Indian Ocean, 00º28'N, 56º01'E
(Medium 1, S-4, 25ºC, 3, S-6)

520 Ex: Seawater, 520 m. The Indian Ocean, 01º07'N, 56º44'E
(Medium 1, S-4, 25ºC, 3, S-6)

521 Ex: Seawater, 520 m. The Indian Ocean, 01º07'N, 56º44'E
(Medium 1, S-4, 25ºC, 3, S-6)

530 Ex: Seawater, 100 m. The Indian Ocean, 01º07'N, 56º44'E
(Medium 1, S-4, 25ºC, 3, S-6)

543 Ex: Fish (Sumbolophorus rufinus), stomach.
The Indian Ocean, 01º11'N, 56º35'E
(Medium 1, S-4, 25ºC, 3, S-6)

545 Ex: Fish (Sumbolophorus rufinus), stomach.
The Indian Ocean, 01º11'N, 56º35'E
(Medium 1, S-4, 25ºC, 3, S-6)

554 Ex: Seawater, 400 m. The Indian Ocean, 01º07'N, 56º32'E
(Medium 1, S-4, 25ºC, 3, S-6)

556 Ex: Seawater, 300 m. The Indian Ocean, 01º07'N, 56º32'E
(Medium 1, S-4, 25ºC, 3, S-6)

559 Ex: Seawater, 500 m. The Indian Ocean, 01º07'N, 56º32'E
(Medium 1, S-4, 25ºC, 3, S-6)

563 Ex: Seawater, 200 m. The Indian Ocean, 01º07'N, 56º32'E
(Medium 1, S-4, 25ºC, 3, S-6)

657 Ex: Seawater, 250 m. The Indian Ocean, 10º58'N, 50º35'E
(Medium 1, S-4, 25ºC, 3, S-6) (26)

658 Ex: Seawater, 250 m. The Indian Ocean, 10º58'N, 50º35'E
(Medium 1, S-4, 25ºC, 3, S-6)

660 Ex: Seawater, 250 m. The Indian Ocean, 10º58'N, 50º35'E
(Medium 1, S-4, 25ºC, 3, S-6)

661 Ex: Seawater, 250 m. The Indian Ocean, 10º58'N, 50º35'E
(Medium 1, S-4, 25ºC, 3, S-6)

683 Ex: Fish (Diaphus lucidus), stomach.
The Indian Ocean, 11º25'N, 51º09'E
(Medium 1, S-4, 25ºC, 3, S-6)

691 Ex: Crab. The Indian Ocean, 11º25'N, 51º09'E
(Medium 1, S-4, 25ºC, 3, S-6)

742 Ex: Hydroid. The Indian Ocean, 12º35'N, 48º04'E
(Medium 1, S-4, 25ºC, 3, S-6)

750 Ex: Seawater, 300 m. The Indian Ocean., 01º01'N, 56º33'E
(Medium 1, S-4, 25ºC, 3, S-6)

1175 (VCM B-1626Д) Ex: Mollusc (Nerita albicilla), bowel.
The South China Sea. The Gulf of Thailand,
(Medium 1, S-4, 25oC, 3, S-6) (12)

1212 (VCM B-1718Д) Ex: Seawater, 0 m. The South China Sea.
The Gulf of Thailand, (Medium 1, S-4, 25oC, 3, S-6) (26)

1421 Ex:Plaice (Chascanopsetta sp.), stomach.
The Indian Ocean, 12º20'N, 53º10'E

(Medium 1, S-4, 25ºC, 3, S-6)

1487 Ex: Seawater, 50 m. The Indian Ocean, 12º33'N, 52º45'E
(Medium 1, S-4, 25ºC, 3, S-6)

1491 Ex: Seawater, 50 m. The Indian Ocean, 12º33'N, 52º45'E
(Medium 1, S-4, 25ºC, 3, S-6)

1500 Ex: Seawater, 250 m. The Indian Ocean, 12º33'N, 52º45'E
(Medium 1, S-4, 25ºC, 3, S-6)

1504 Ex: Seawater, 250 m. The Indian Ocean, 12º33'N, 52º45'E
(Medium 1, S-4, 25ºC, 3, S-6)

1506 Ex: Seawater, 300 m. The Indian Ocean, 12º33'N, 52º45'E
(Medium 1, S-4, 25ºC, 3, S-6)

1509 Ex: Seawater, 300 m. The Indian Ocean, 12º33'N, 52º45'E
(Medium 1, S-4, 25ºC, 3, S-6)

1606 Ex :Seawater, 100 m. The Indian Ocean, 10º16'N, 56º07'E
(Medium 1, S-4, 25ºC, 3, S-6)

1608 Ex: Seawater, 100 m. The Indian Ocean, 10º16'N, 56º07'E
(Medium 1, S-4, 25ºC, 3, S-6)

1609 Ex: Seawater, 100 m. The Indian Ocean, 10º16'N, 56º07'E
(Medium 1, S-4, 25ºC, 3, S-6)

1610 Ex: Seawater, 100 m. The Indian Ocean, 10º16'N, 56º07'E
(Medium 1, S-4, 25ºC, 3, S-6)

1615 Ex: Seawater, 350 m. The Indian Ocean, 10º16'N, 56º07'E
(Medium 1, S-4, 25ºC, 3, S-6)

1618 Ex: Fish (Mene maculata), bowel. The Indian Ocean.
(Medium 1, S-4, 25ºC, 3, S-6)

1676 Ex: Seawater, 100 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 25ºC, 3, S-6)

1680 Ex: Seawater, 200 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 25ºC, 3, S-6)

1681 Ex: Seawater, 200 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 25ºC, 3, S-6)

1682 Ex: Seawater, 200 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 25ºC, 3, S-6)

1686 Ex: Seawater, 200 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 25ºC, 3, S-6)

1689 Ex: Seawater, 350 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 25ºC, 3, S-6)

1702 Ex: Seawater, 250 m. The Indian Ocean, 15º23'S, 42º13'E
(Medium 1, S-4, 25ºC, 3, S-6)

1703 Ex: Seawater, 250 m. The Indian Ocean, 15º23'S, 42º13'E
(Medium 1, S-4, 25ºC, 3, S-6)

1704 Ex: Seawater, 250 m. The Indian Ocean, 15º23'S, 42º13'E

(Medium 1, S-4, 25ºC, 3, S-6)

1705 Ex: Seawater, 250 m. The Indian Ocean, 15º23'S, 42º13'E
(Medium 1, S-4, 25ºC, 3, S-6)

1707 Ex: Seawater, 250 m. The Indian Ocean, 15º23'S, 42º13'E
(Medium 1, S-4, 25ºC, 3, S-6)

1759 Ex: Cuttle (Sepia confusa), bowel.
The Indian Ocean, 25º03'S, 35º16'E,
(Medium 1, S-4, 25ºC, 3, S-6)

1796 Ex: Seawater, 150 m. The Indian Ocean, 23º21'S, 43º22'E
(Medium 1, S-4, 25ºC, 3, S-6)

1799 Ex: Seawater, 850 m. The Indian Ocean, 23º21'S, 43º22'E
(Medium 1, S-4, 25ºC, 3, S-6)

2120 Ex: Seawater, 250 m. The Indian Ocean, 12º44'S, 61º10'E
(Medium 1, S-4, 25ºC, 3, S-6)

2121 Ex: Seawater, 250 m. The Indian Ocean, 12º44'S, 61º10'E
(Medium 1, S-4, 25ºC, 3, S-6)

2135 Ex: Squid (Loligo siboga), the light organ.
The Indian Ocean, 10º17'S, 61º09'E
(Medium 1, S-4, 25ºC, 3, S-6)

2147 Ex: Squid (Loligo siboga), bowel.
The Indian Ocean, 10º17'S, 61º09'E
(Medium 1, S-4, 25ºC, 3, S-6)

Photobacterium phosphoreum (Cohn 1878) Beijerinck 1889

1 Type <-- Hendrie M., 1972, (ATCC 11040=NCMB 1282).
(Medium 1, S-4, 24-25ºC, 3, S-6) (9)

185 Ex: Seawater, 150 m. The Pacific, 24º52'N, 134º08'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

189 Ex: Seawater, 300 m. The Pacific, 11º20'N, 139º14'E
(Medium 1, S-4, 24-25ºC, 3, S-6) (11)

195 Ex: Seawater, 300 m. The Pacific, 11º20'N, 139º14'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

200 Ex: Seawater, 270 m. The Pacific, 12º15'N, 141º18'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

202 Ex: Seawater, 270 m. The Pacific, 12º15'N, 141º18'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

204 Ex: Seawater, 230 m. The Pacific, 12º15'N, 141º18'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

211 Ex: Seawater, 400 m. The Pacific, 15º26'N, 141º21'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

237 Ex: Seawater, 800 m. The Pacific, 18º00'N, 141º51'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

239 Ex: Seawater, 150 m. The Pacific, 18º00'N, 141º51'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

256 Ex: Seawater, 600 m. The Pacific, 17°56'N, 141°20'E
(Medium 1, S-4, 24-25°C, 3, S-6)

288 Ex: Seawater, 800 m. The Pacific, 15°22'N, 143°32'E
(Medium 1, S-4, 24-25°C, 3, S-6)

294 Ex: Seawater, 600 m. The Pacific, 15°22'N, 143°32'E
(Medium 1, S-4, 24-25°C, 3, S-6)

357 Ex: Seawater, 300 m. The Pacific, 13°15'N, 144°04'E
(Medium 1, S-4, 24-25°C, 3, S-6)

378 Ex: Seawater, 300 m. The Pacific, 13°15'N, 143°26'E
(Medium 1, S-4, 24-25°C, 3, S-6)

379 Ex: Seawater, 200 m. The Pacific, 13°15'N, 143°26'E
(Medium 1, S-4, 24-25°C, 3, S-6)

382 Ex: Seawater, 200 m. The Pacific, 13°15'N, 143°26'E
(Medium 1, S-4, 24-25°C, 3, S-6)

386 Ex: Seawater, 400 m. The Pacific, 15°23'N, 143°30'E
(Medium 1, S-4, 24-25°C, 3, S-6)

387 Ex: Seawater, 400 m. The Pacific, 15°23'N, 143°30'E
(Medium 1, S-4, 24-25°C, 3, S-6)

388 Ex: Seawater, 400 m. The Pacific, 15°23'N, 143°30'E
(Medium 1, S-4, 24-25°C, 3, S-6)

430 Ex: Seawater, 300 m. The Pacific, 18°31'N, 128°44'E
(Medium 1, S-4, 24-25°C, 3, S-6)

467 Ex: Seawater, 400 m. The Pacific, 18°31'N, 128°44'E
(Medium 1, S-4, 24-25°C, 3, S-6)

473 Ex: Seawater, 300 m. The Pacific, 18°31'N, 128°44'E
(Medium 1, S-4, 24-25°C, 3, S-6)

484 Ex: Seawater, 600 m. The Pacific, 18°31'N, 128°44'E
(Medium 1, S-4, 24-25°C, 3, S-6)

491 Ex: Seawater, 700 m. The Pacific, 18°31'N, 128°44'E
(Medium 1, S-4, 24-25°C, 3, S-6)

492 Ex: Seawater, 700 m. The Pacific, 18°31'N, 128°44'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1232 Ex: Seawater, 22 m. Kamchatka.
(Medium 1, S-4, 15°C, 3, S-6)

1233 Ex: Seawater, 7 m. Kamchatka.
(Medium 1, S-4, 15°C, 3, S-6)

1286 Ex: Mollusc (Cyprea sp.), bowel. Mauritius.
(Medium 1, S-4, 24-25°C, 3, S-6) (22)

1287 Ex: Seawater, 600 m. The Indian Ocean, 12°26'S, 53°39'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1323 Ex: Seawater, 85 m. The Arabian Sea, 19°12'N, 66°19'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1327 Ex: Seawater, 40 m. The Black Sea, 43°30'N, 33°00'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1328 Ex: Seawater, 10 m. The Black Sea., 43°30'N, 33°00'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1329 Ex: Seawater, 60 m. The Black Sea, 43°30'N, 33°00'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1331 Ex: Seawater, 45 m. The Black Sea, 44°00'N, 35°55'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1334 Ex: Seawater, 80 m. The Black Sea, 44°00'N, 35°55'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1401 Ex: Fish (Physiculus sp.), the light organ.
The Indian Ocean, 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1402 Ex: Fish (Physiculus sp.), the light organ.
The Indian Ocean., 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6) (25)

1403 Ex: Fish (Physiculus sp.), the light organ.
The Indian Ocean., 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1404 Ex: Dog-fish (Erydcnis sp.), stomach.
The Indian Ocean., 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1407 Ex: Dog-fish (Erydcnis sp.), stomach.
The Indian Ocean., 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6) (25)

1409 Ex: Fish (Muraenesox sp.), bowel.
The Indian Ocean., 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1428 Ex: Shrimp, stomach. The Indian Ocean., 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1432 Ex: Shrimp, stomach. The Indian Ocean., 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1436 Ex: Shrimp, stomach. The Indian Ocean, 12°20'N, 53°10'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1450 Ex: Fish (Polyipnus indicus), bowel.
The Indian Ocean, 12°15'N, 53°06'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1451 Ex: Fish (Polyipnus indicus), surface.
The Indian Ocean., 12°15'N, 53°06'E
(Medium 1, S-4, 24-25°C, 3, S-6)

1455 Ex: Fish (Polyipnus indicus), enteric tract.
The Indian Ocean., 12°15'N, 53°06'E
(MEdium 1, S-4, 24-25°C, 3, S-6)

1458 Ex: Fish (Polyipnus indicus), enteric tract.
The Indian Ocean., 12°15'N, 53°06'E

(Medium 1, S-4, 24-25ºC, 3, S-6)

1459 Ex: Fish (Polyipnus indicus), enteric tract.
The Indian Ocean., 12º15'N, 53º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1481 Ex: Shrimp. The Indian Ocean., 12º15'N, 53º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1483 Ex: Shrimp. The Indian Ocean., 12º15'N, 53º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1513 Ex: Fish (Gonostoma sp.), enteric tract.
The Indian Ocean, 12º22'N, 53º05'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1514 Ex: Fish (Gonostoma sp.), enteric tract.
The Indian Ocean, 12º22'N, 53º05'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1516 Ex: Fish (Chauliodus sp.), bowel.
The Indian Ocean, 12º22'N, 53º05'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1526 Ex: Silver conger (Muraenesox sp.), stomach.
The Indian Ocean, 12º22'N, 53º02'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1528 Ex: Silver conger (Muraenesox sp.), bowel.
The Indian Ocean, 12º22'N, 53º02'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1529 Ex: Silver conger (Muraenesox sp.), bowel.
The Indian Ocean, 12º22'N, 53º02'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1545 Ex: Fish (Polymetme corytheola), stomach.
The Indian Ocean, 12º19'N, 53º11'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1559 Ex: Sea-urchin (Aspidodiadema sp.),the digestive tract.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1561 Ex: Sea-urchin (Aspidodiadema sp.),the digestive tract.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1570 Ex: Crab (Fam. Majidae), roe.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1580 Ex: Fish (Polymixia fusca), surface.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1581 Ex: Fish (Polymixia fusca), surface.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1585 Ex: Fish (Polymixia fusca), bowel.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1586 Ex: Fish (Polymixia fusca), bowel.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1587 Ex: Fish (Polymixia fusca), stomach.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1589 Ex: Fish (Polymixia fusca), stomach.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1591 Ex: Fish (Polymixia fusca), stomach.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1593 Ex: Fish (Beryx splendens), surface.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1594 Ex: Fish (Beryx splendens), stomach.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1596 Ex: Fish (Beryx splendens), stomach.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1601 Ex: Fish (Beryx splendens), bowel.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1602 Ex: Fish (Beryx splendens), stomach.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1603 Ex: Fish (Beryx splendens), stomach.
The Indian Ocean, 10º19'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1611 Ex: Seawater, 100 m. The Indian Ocean, 10º16'N, 56º07'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1621 Ex: Fish (Mene maculata), stomach. The Indian Ocean.
(Medium 1, S-4, 24-25ºC, 3, S-6)

1667 Ex: Fish (Oplophorus gracilirostris), stomach.
The Indian Ocean, 12º51'S, 48º00'E
(Medium 1, S-4, 24-25ºC, 3, S-6) (25)

1668 Ex: Fish (Thysanopoda aequalis), stomach.
The Indian Ocean, 12º51'S, 48º00'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1679 Ex: Seawater, 200 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1684 Ex: Seawater, 250 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1685 Ex: Seawater, 250 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1691 Ex: Seawater, 350 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1692 Ex: Seawater, 350 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1693 Ex: Seawater, 350 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1694 Ex: Seawater, 450 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1695 Ex: Seawater, 450 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1697 Ex: Seawater, 500 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1698 Ex: Seawater, 500 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1699 Ex: Seawater, 500 m. The Indian Ocean, 12º26'S, 48º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1708 Ex: Seawater, 250 m. The Indian Ocean, 15º23'S, 42º13'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1710 Ex: Fish (Coelorynchus sp.), stomach.
The Indian Ocean, 20º45'S, 35º58'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1711 Ex: Fish (Coelorynchus sp.), stomach.
The Indian Ocean, 20º45'S, 35º58'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1713 Ex: Fish (Coelorynchus sp.), stomach.
The Indian Ocean, 20º45'S, 35º58'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1715 Ex: Fish (Coelorynchus sp.), stomach.
The Indian Ocean, 20º45'S, 35º58'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1724 Ex: Fish (Polyipnus indicus), bowel.
The Indian Ocean, 21º10'S, 35º42'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1728 Ex: Fish (Polyipnus indicus), bowel.
The Indian Ocean, 21º10'S, 35º42'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1730 Ex: Fish (Polyipnus indicus), stomach.
The Indian Ocean, 21º10'S, 35º42'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1735 Ex: Shrimp (Hymenopenaeus sp.), surface.
The Indian Ocean, 21º10'S, 35º42'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1740 Ex: Shrimp (Hymenopenaeus sp.), stomach.
The Indian Ocean, 21º10'S, 35º42'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1741 Ex: Euphasia recurva, surface.
The Indian Ocean, 24º40'S, 35º32'E
(Medium 1, S-4, 24-25ºC, 3, S-6) (26)

1752 Ex: Fish (Acropoma japonicum), bowel.
The Indian Ocean, 25º03'S, 35º16'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1753 Ex: Fish (Acropoma japonicum), bowel.
The Indian Ocean, 25º03'S, 35º16'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1757 Ex: Fish (Acropoma japonicum), stomach.
The Indian Ocean, 25º03'S, 35º16'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1762 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1763 Ex: Fish (Chlorophthalmus sp.), light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1764 Ex: Fish (Chlorophthalmus sp.), light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1765 Ex: Fish (Chlorophthalmus sp.), light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1766 Ex: Fish (Chlorophthalmus sp.), light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1768 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1772 Ex: Fish (Chlorophthalmus sp.), stomach.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1773 Ex: Fish (Chlorophthalmus sp.), stomach.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1776 Ex: Fish (Malacocephalus laevis), the light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1777 Ex: Fish (Malacocephalus laevis), the light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1778 Ex: Fish (Malacocephalus laevis), the light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1779 Ex: Fish (Malacocephalus laevis), the light organ.
The Indian Ocean, 25º08'S, 35º22'E

(Medium 1, S-4, 24-25ºC, 3, S-6)

1780 Ex: Fish (Malacocephalus laevis), the light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1781 Ex: Fish (Malacocephalus laevis), the light organ.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1784 Ex: Fish (Malacocephalus laevis), stomach.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1790 Ex: Fish (Malacocephalus laevis), stomach.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1792 Ex: Fish (Malacocephalus laevis), stomach.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1794 Ex: Fish (Malacocephalus laevis, stomach.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1795 Ex: Fish (Malacocephalus laevis, stomach.
The Indian Ocean, 25º08'S, 35º22'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1802 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1803 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1804 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1805 Ex: Fish (Chlorophthalmus sp., the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1806 Ex: Fish (Chlorophthalmus sp., the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1807 Ex: Fish (Chlorophthalmus sp., bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1808 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1809 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1810 Ex: Fish (Chlorophthalmus sp.), bowel.

The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1812 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1813 Ex: Fish (Chlorophthalmus sp., the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1814 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1815 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1822 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1823 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1825 Ex: Shark (Etmopterus sentosus), bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1828 Ex: Shark (Etmopterus sentosus), stomach.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1829 Ex: Shark (Etmopterus sentosus), bowel.
The Indian Ocean, 22º17'S, 43º03'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1833 Ex: Fish (Coelorhynchus denticulatus), bowel.
The Indian Ocean, 22º19'S, 43º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1834 Ex: Fish (Coelorhynchus denticulatus), bowel.
The Indian Ocean, 22º19'S, 43º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1835 Ex: Fish (Coelorhynchus denticulatus), bowel.
The Indian Ocean, 22º19'S, 43º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1836 Ex: Fish (Coelorhynchus denticulatus), bowel.
The Indian Ocean, 22º19'S, 43º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1837 Ex: Fish (Coelorhynchus denticulatus), stomach.
The Indian Ocean, 22º19'S, 43º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1844 Ex: Fish (Coelorhynchus denticulatus), the light organ.
The Indian Ocean, 22º19'S, 43º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1856 Ex: Fish (Opisthoproctus soleatus), the light organ.
The Indian Ocean, 22º15'S, 42º50'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1858 Ex: Fish (Opisthoproctus soleatus), the light organ.
The Indian Ocean, 22º15'S, 42º50'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1859 Ex: Fish (Opisthoproctus soleatus), the light organ.
The Indian Ocean, 22º15'S, 42º50'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1870 Ex: Squid (Loligo chinensis), bowel.
The Indian Ocean, 25º41'S, 44º37'E
(MEdium 1, S-4, 24-25ºC, 3, S-6)

1888 Ex: Fish (Coryphaenoides serrulatus), bowel.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1890 Ex: Fish (Coryphaenoides serrulatus), stomach.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1891 Ex: Fish (Coryphaenoides serrulatus), stomach.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1898 Ex: Fish (Hoplostethus atlanticus), bowel.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1899 Ex: Fish (Hoplostethus atlanticus), bowel.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1900 Ex: Fish (Hoplostethus atlanticus), bowel.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1901 Ex: Fish (Hoplostethus atlanticus), stomach.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1902 Ex: Fish (Hoplostethus atlanticus), stomach.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1904 Ex: Fish (Hoplostethus atlanticus), stomach.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1906 Ex: Fish (Hoplostethus atlanticus), stomach.
The Indian Ocean, 32º58'S, 44º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1907 Ex: Fish (Coelorhynchus fasciatus), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1909 Ex: Fish (Coelorhynchus fasciatus), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1910 Ex: Fish (Coelorhynchus fasciatus), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1911 Ex: Fish (Coelorhynchus fasciatus), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1912 Ex: Fish (Coelorhynchus fasciatus), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1913 Ex: Fish (Coelorhynchus fasciatus), bowel
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1914 Ex: Fish (Coelorhynchus fasciatus), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1921 Ex: Fish (Coelorhynchus fasciatus), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1922 Ex: Fish (Coelorhynchus fasciatus), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1923 Ex: Fish (Coelorhynchus fasciatus), stomach.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1926 Ex: Fish (Coelorhynchus fasciatus), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1931 Ex: Fish (Coelorhynchus fasciatus), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1933 Ex: Fish (Coelorhynchus fasciatus), stomach.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1934 Ex: Fish (Coelorhynchus fasciatus), stomach.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1936 Ex: Fish (Coelorhynchus fasciatus), stomach.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1937 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1938 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1940 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 33º04'S, 43º52'E

(Medium 1, S-4, 24-25ºC, 3, S-6)

1941 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1942 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1943 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1948 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1949 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1951 Ex: Fish (Chlorophthalmus sp.), the light organ.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1953 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1955 Ex: Fish (Chlorophthalmus sp.), bowel.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1957 Ex: Fish (Chlorophthalmus sp.), stomach.
The Indian Ocean, 33º04'S, 43º52'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1964 Ex: Seawater, 20 m. The Indian Ocean, 33º08'S, 43º54'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1965 Ex: Seawater, 20 m. The Indian Ocean, 33º08'S, 43º54'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1968 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1969 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1970 Ex: Fish (Rouleina squamilatera), bowel.
TIndiahe n Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1973 Ex: Fish (Rouleina squamilatera), bowel
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1974 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1975 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1979 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1980 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1981 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1982 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1983 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1984 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1985 Ex: Fish (Coelorhinchus sp.), bowel
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1986 Ex: Fish (Coelorhinchus sp.), stomach.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1987 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1990 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1994 Ex: Fish (Coelorhinchus sp.), bowel
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1996 Ex: Fish (Coelorhinchus sp.), bowel.
The Indian Ocean, 33º00'S, 44º28'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1997 Ex: Fish (Nezumia bubonis), the light organ.
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1998 Ex: Fish (Nezumia bubonis), the light organ
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

1999 Ex: Fish (Nezumia bubonis), the light organ.
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2000 Ex: Fish (Nezumia bubonis), the light organ.
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2007 Ex: Fish (Nezumia bubonis), bowel.
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2009 Ex: Fish (Nezumia bubonis), bowel.
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2010 Ex: Fish (Nezumia bubonis), bowel.
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2011 Ex: Fish (Nezumia bubonis), bowel.
The Indian Ocean, 33º05'S, 44º26'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2012 Ex: Fish (Malococephalus laevis), the light organ.
The Indian Ocean, 33º07'S, 44º04'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2014 Ex: Fish (Malococephalus laevis), the light organ.
The Indian Ocean, 33º07'S, 44º04'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2016 Ex: Fish (Malococephalus laevis), the light organ.
The Indian Ocean, 33º07'S, 44º04'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2017 Ex: Fish (Malococephalus laevis), bowel.
The Indian Ocean, 33º07'S, 44º04'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2018 Ex: Fish (Malococephalus laevis), bowel.
The Indian Ocean, 33º07'S, 44º04'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2036 Ex: Fish (Halargyreus johnsonii), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2037 Ex: Fish (Halargyreus johnsonii), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2047 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2051 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2052 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2053 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E

(Medium 1, S-4, 24-25ºC, 3, S-6)

2054 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2055 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2056 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2057 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6) (26, 27)

2058 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2059 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2063 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2064 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2065 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2066 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2072 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2073 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2074 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2075 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2076 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2077 Ex: Fish (Rouleina squamilatera), bowel.

The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2079 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2082 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2083 Ex: Fish (Rouleina squamilatera), bowel.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2086 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2087 Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33º25'S, 43º37'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2093 Ex: Seawater, 500 m. The Indian Ocean, 33º36'S, 43º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2094 Ex: Seawater, 500 m. The Indian Ocean, 33º36'S, 43º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2095 Ex: Seawater, 500 m. The Indian Ocean, 33º36'S, 43º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2096 Ex: Seawater, 750 m. The Indian Ocean, 33º36'S, 43º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2097 Ex: Seawater, 1000 m. The Indian Ocean, 33º36'S, 43º48'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2099 Ex: Fish (Epigonus sp.), bowel.
The Indian Ocean, 33º26'S, 44º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2103 Ex: Fish (Epigonus sp.), stomach.
The Indian Ocean, 33º26'S, 44º06'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2120 Ex: Seawater, 250 m. The Indian Ocean, 12º44'S, 61º10'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2121 Ex: Seawater, 250 m. The Indian Ocean, 12º44'S, 61º10'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2122 Ex: Seawater, 250 m. The Indian Ocean, 12º44'S, 61º10'E
(Medium 1, S-4, 24-25ºC, 3, S-6)

2229 Ex: Seawater, 87 m. The Black Sea.
(Medium 1, S-4, 24-25ºC, 3, S-6)

2230 Ex: Seawater, 87 m. The Black Sea.
(Medium 1, S-4, 24-25ºC, 3, S-6)

2231 Ex: Seawater, 87 m. The Black Sea.
(Medium 1, S-4, 24-25ºC, (3, S-6)

2252 Ex: Seawater, 740 m. The Mediterranean Sea, 33ºN, 30ºE
(Medium 1, S-4, 24-25ºC, 3, S-6)

Photobacterium kishitanii (Ast et al. 2007

254 Ex: Sea water, 800m, Pacific Ocean, 17o 59'N.,141o 20'E,
(Medium 1, S-4, 24-25ºC, 3, S-6)

1856 Ex: Fish (Opisthoproctus soleatus fam. Opisthoproctidae), light organ,
Indian Ocean, 22o15'S, 42o50'E, 1500 m,
(Medium 1, S-4, 24-25ºC, 3, S-6)

1883 Ex: Fish (Coryphaenoides serrulatus fam. Macrouridae), bowel,
Indian Ocean, 32o58'S, 44o48'E, 1100 m
(Medium 1, S-4, 24-25ºC, 3, S-6)

1889 Ex: Fish (Coryphaenoides serrulatus), bowel,
Indian Ocean, 32ºS8'S, 44º48'E, 1100 m,
(Medium 1, S-4, 24-25ºC, 3, S-6)

1920 Ex: Fish (Coelorhynchus fasciatus), bowel,
Indian Ocean, 33º04'S, 43º52'E, (Medium 1, S-4, 25ºC, 3, S-6)

2015 Ex: Fish (Malococephalus laevis fam. Macrouridae), light organ,
Indian Ocean, 33o07'S, 44o04'E, 760-785 m, (Medium 1, S-4, 25ºC, 3, S-6)

2089 Ex: Fish (Rouleina squaмilatera), stomach,
Indian Ocean, 33º25'S, 43º37'E, (Medium 1, S-4, 25ºC, 3, S-6)

2095 Ex: Sea water, 500 m, Indian Ocean, 33o36'S, 43o48'E,
(Medium 1, S-4, 25ºC, 3, S-6)

Alivibrio fischeri (Beijerinck, 1889) Urbanczyk et al., 2007

1231 Synonym: Vibrio fischeri (Beijerinck 1889)
Lehmann et Neumann 1896
Ex: Fish (bullhead), Seawater 60-80 m,
Indian Ocean, 52o54'N.,158o53'E,
(Medium 1, S-4, 25ºC, 3, S-6)

2088 Synonym: Vibrio fischeri (Beijerinck 1889)
Lehmann et Neumann 1896
Ex: Fish (Rouleina squamilatera), stomach.
The Indian Ocean, 33ºS5'S, 43º37'E
(Medium 1, S-4, 25ºC, 3, S-6)

Vibrio harveyi (Johnson et Shunk 1936) Baumann, Baumann, Bang et Woolkalis 1981

53 Synonym: Photobacterium belozerskii Chumakova et
al. 1972; Beneckea harveyi Reichelt et Baumann, 1973.
Ex: Seawater, 100 m. The Pacific, 09º45'S, 164º09'E
(Medium 1, S-4, 25ºC, 3, S-6) (2, 6)

72 Synonym: Lucibacterium harveyi Hendrie, Hodgkiss
et Shewan 1970; Beneckea harveyi Reichelt et
Baumann 1973. Ex: Seawater, 5 m. The Pacific, 09º45'S, 164º09'E

(Medium 1, S-4, 25ºC, 3, S-6)

82 Synonym: Lucibacterium harveyi Hendrie, Hodgkiss et Shewan 1970; Beneckea harveyi Reichelt et Baumann, 1973. Ex: Seawater, costal zone, 0 m. The Sea of Japan, 09º45'S, 164º09'E (Medium 1, S-4, 25ºC, 3, S-6)

103 Synonym: Lucibacterium harveyi Hendrie, Hodgkiss et Shewan 1970; Beneckea harveyi Reichelt et Baumann, 1973. Ex: Seawater, costal zone. 0m. The Sea of Japan, 09º45'S, 164º09'E (Medium 1, S-4, 25ºC, 3, S-6)

107 Synonym: Lucibacterium harveyi Hendrie, Hodgkiss et Shewan 1970; Beneckea harveyi Reichelt et Baumann, 1973. (VCM B-1714Д). Ex: Seawater, costal zone, 0 m. The Sea of Japan, 09º45'S, 164º09'E (Medium 1, S-4, 25ºC, 3, S-6)

161 Synonym: Beneckea harveyi Reichelt et Baumann 1973. Ex: Seawater, 9 m. The Pacific, 09º45'S, 164º09'E (Medium 1, S-4, 25ºC, 3, S-6)

162 Synonym: Beneckea harveyi Reichelt et Baumann 1973. Ex: Seawater, 9 m. The Pacific, 25º47'N, 133º03'E (Meduim 1, S-4, 25ºC, 3, S-6)

175 Synonym: Beneckea harveyi Reichelt et Baumann 1973. Ex: Seawater, 7 m. The Pacific, 24º52'N, 134º08E (Medium 1, S-4, 25ºC, 3, S-6)

320 Synonym: Beneckea harveyi Reichelt et Baumann 1973. Ex: Seawater, 0 m. South China Sea, 01º00'S, 106º37'E. (Medium 1, S-4, 25ºC, 3, S-6)

328 Synonym: Beneckea harveyi Reichelt et Baumann 1973. Ex: Seawater, 15 m. South China Sea, 11º39'N, 143º58'E (Medium 1, S-4, 25ºC, 3, S-6)

329 Synonym: Beneckea harveyi Reichelt et Baumann 1973. Ex: Seawater, 15 m. South China Sea, 11º39'N, 143º58'E (Medium 1, S-4, 25ºC, 3, S-6)

464 Synonym: Beneckea harveyi Reichelt et Baumann 1973. Ex: Seawater, 45 m. South China Sea, 01º58'N, 105º26'E (Medium 1, S-4, 25ºC, 3, S-6) (30)

974 Ex: Sea cucumber (Holothurioidea), stomach. The Indian Ocean. Carkados-Carakhos Islands, (Medium 1, S-4, 25ºC, 3, S-6)

985 Ex: Sea cucumber (Holothurioidea), bowel. The Indian Ocean. Carkados-Carakhos Islands, (Medium 1, S-4, 25ºC, 3, S-6)

986 Ex: Sea cucumber (Holothurioidea), bowel. The Indian Ocean. Carkados-Carakhos Islands, (Medium 1, S-4, 25ºC, 3, S-6)

987 Ex: Sea cucumber (Holothurioidea), bowel. The Indian Ocean. Carkados-Carakhos Islands, (Medium 1, S-4, 25ºC, 3, S-6)

1027 Ex: Hydroid, bowel. The Indian Ocean. Carkados-Carakhos Islands, (Medium 1, S-4, 25ºC, 3, S-6)

1028 Ex: Hydroid, bowel. The Indian Ocean. Carkados-Carakhos Islands, (Medium 1, S-4, 25ºC, 3, S-6)

1111 Sea cucumber (Holothurioidea), bowel.
Ex: The South China Sea, The Gulf of Thailand,
(Medium 1, S-4, 25ºC, 3, S-6)

1122 Ex: Starfish (Asteroidea), the digestive tract.
The South China Sea, The Gulf of Thailand,
(Medium 1, S-4, 25ºC, 3, S-6)

1123 Ex: Starfish (Asteroidea), the digestive tract.
The South China Sea, The Gulf of Thailand,
(Medium 1, S-4, 25ºC, 3, S-6)

1152 Ex: Mollusc (Electroma ovalis), bowel. The South China Sea.
The Gulf of Thailand, (Medium 1, S-4, 25ºC, 3, S-6)

1153 Ex: Coral (Acropora intermedia), surface. The South China Sea.
The Gulf of Thailand, (Medium 1, S-4, 25ºC, 3, S-6)

1154 Ex: Coral (Acropora intermedia), surface. The South China Sea.
The Gulf of Thailand, (Medium 1, S-4, 25ºC, 3, S-6)

1174 Ex: Mollusc (Nerita albicilla), bowel. The South China Sea.
The Gulf of Thailand, (Medium 1, S-4, 25ºC, 3, S-6)

1325 Ex: Seawater, 200 m. The Arabian Sea, 19º12'N, 66º19'E
(Medium 1, S-4, 25ºC, 3, S-6)

1472 Ex: Shrimp (Sergestes (Sergia) challengeri).
The Indian Ocean, 12º20'N, 53º10'E
(Medium 1, S-4, 25ºC, 3, S-6)

1518 Ex: Fish (Chauliodus sp.), bowel.
The Indian Ocean, 12º22'N, 53º05'E
(Medium 1, S-4, 25ºC, 3, S-6)

1522 Ex: Fish (Stomias sp.), bowel.
The Indian Ocean, 12º22'N, 53º05'E
(Medium 1, S-4, 25ºC, 3, S-6)

1533 Ex: Conger eel (Muraenesox sp.), fecal material.
The Indian Ocean, 12º22'N, 53º02'E
(Medium 1, S-4, 25ºC, 3, S-6)

1961 Ex: Seawater, 20 m. The Indian Ocean., 33º08'S, 43º54'E
(Medium 1, S-4, 25ºC, 3, S-6)

1963 Ex: Seawater, 20 m. The Indian Ocean, 33º08'S, 43º54'E
(Medium 1, S-4, 25ºC, 3, S-6)

2025 Ex: Seawater, 0 m. The Indian Ocean., 33º04'S, 44º05'E
(Medium 1, S-4, 25ºC, 3, S-6)

2266 Ex: Seawater. The Mediterranean Sea
(Medium 1, S-4, 25ºC, 3, S-6)

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