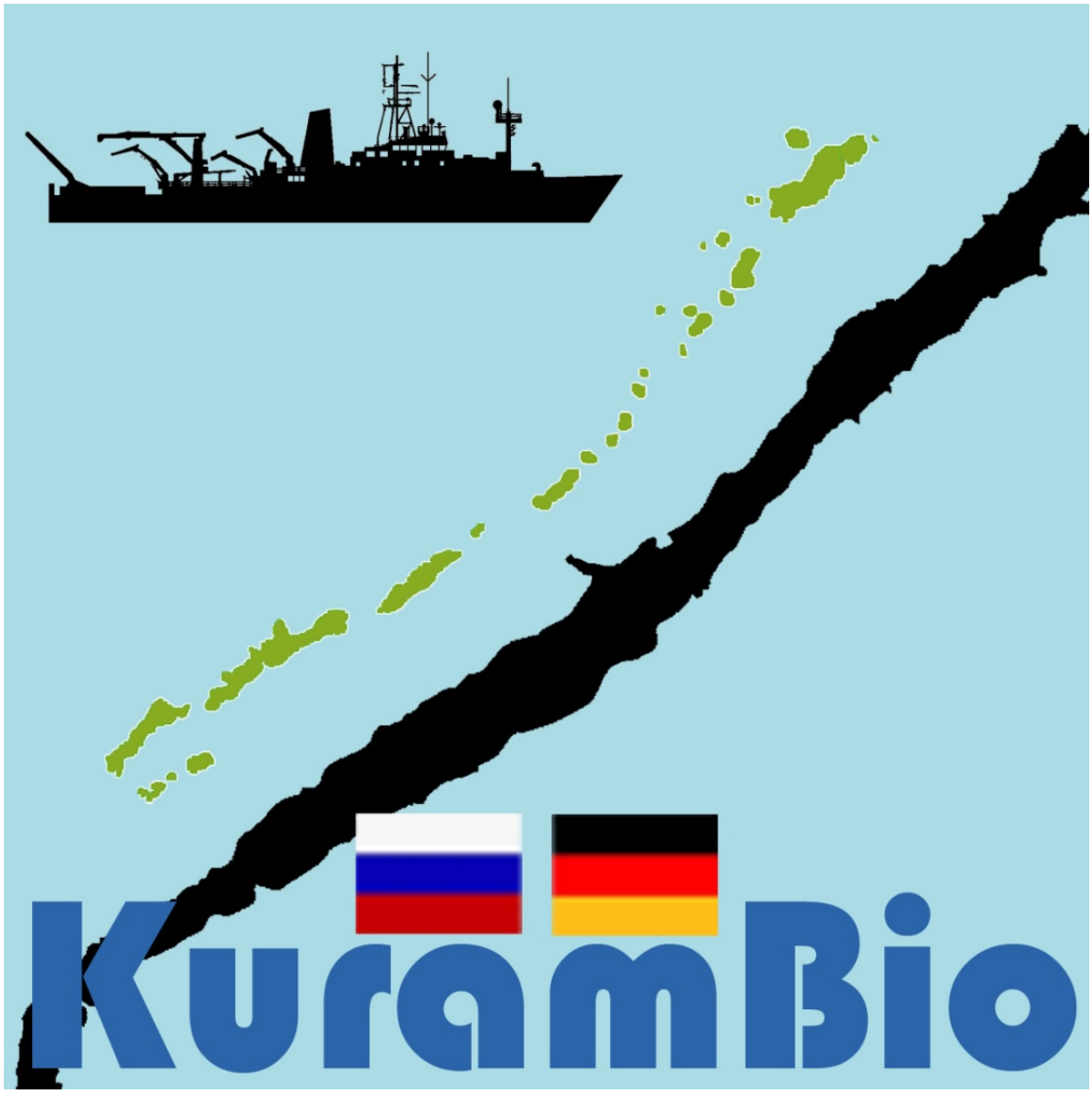
The German-Russian deep-sea expedition KuramBio (Kurile Kamchatka Biodiversity Study)

to the Kurile Kamchatka Trench and abyssal plain on board of the R/V *Sonne*, 223rd Expedition

July 21th – September 7th 2012

Angelika Brandt[1] & Marina Malyutina[2]

[1] Angelika Brandt, Biocenter Grindel and Zoological Museum, University of Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany. E-mail: Abrandt@uni-hamburg.de
[2] Marina V. Malyutina, A.V. Zhirmunsky's Institute of Marine Biology, FEB RAS, 17 Palchevskogo Str., 690059, Vladivostok, Russia. E-mail: m_malyutina@mail.ru



Introduction

The joint German/Russian expedition **KuramBio** (Kurile Kamchatka Biodiversity Study) onboard of the R/V *Sonne* (SO 223) to the Kurile Kamchatka Trench and adjacent abyssal plain started in Busan, South Korea on July 21th and terminated in Busan on September 7th, 2012.

The project **KuramBio** is implemented within the frameworks of the Special Russian Federal Program "World Ocean", the programs of the Presidium of the Far-Eastern Branch of the Russian Academy of Sciences (FEB RAS) "Biodiversity changes in some areas of the World Ocean with space and time", "Marine biota response to the changes of environment and climate","Technologies of Investigation and Monitoring of Biodiversity of the Deep-Sea Regions of the Far Eastern Seas" and international projects and programs: "Census of the Diversity of Abyssal Marine Life" (CeDAMar) and "Circulation Research in East Asian Marginal Seas "(CREAMS) within the North Pacific Marine Science Organization (PICES). A Memorandum of Understanding (MoU) was signed in Vladivostok in September 2007 by representatives of the A.V. Zhirmunsky Institute of Marine Biology (IMB), Zoological Institute and Museum (ZIM) of the University of Hamburg, and the Senckenberg am Meer, German Centre for Biodiversity Research (SAM), Wilhelmshaven. The MoU included exchange of material and scientists as well as the establishment of joint expeditions and projects. The **KuramBio** project is a follow-up project of the joint Russian/German project **SoJaBio** (Sea of Japan Biodiversity Study). The joint Russian/German expedition **SoJaBio** from board of the R/V *Akademik Lavrentyev* to the deep Sea of Japan started in Vladivostok on August 11th and terminated in Vladivostok on September 5th, 2010. First data of this expedition are published in a special volume in Deep-Sea Research II (Guest editors: M.V. Malyutina & A. Brandt).

The scientific team of the **KuramBio** expedition included 14 biologists from Germany, mainly from the ZIM, SAM DZMB, ZSNM Műnchen, as well as from Geneva, Switzerland and 11 Russian biologists from the IMB, FEB RAS the V.I. Il'ichev Pacific Oceanological Institute (PIO) FEB RAS, Vladivostok; P.P. Shirshov Institute of Oceanology (IO) RAS, A.N. Severtzov Institute of Ecology and Evolution, Moscow.

Aims of the RV *Sonne* expedition to the Kurile-Kamtchatka region are to investigate the biodiversity and community patterns of the meio-, macro- and megafauna. Using methods of community analyses and coefficients, the selected meio-, macro-, and megabenthic communities shall be characterised and compared with regard to their composition and diversity. New species shall be described and made available for future investigations. The new data on taxonomic species composition and zoogeographic distribution of the fauna of the geologically old open abyssal plain of the Kurile-Kamtchatka region will be compared with the faunistic data from the semi-enclosed and younger Sea of Japan, with the existing global deep-sea data from the Atlantic and Pacific Oceans which were obtained during the CeDAMar project using a standardised sampling protocol as well as the data from the adjacent shelf and bathyal zones.

We aim to test the following hypotheses: 1. Communities of the Kurile Kamtchatka stations (and transects) differ in terms of species composition and richness. 2. The non-isolated abyssal plain of Kurile-Kamtchatka area causes an increase of the abyssal biodiversity in comparison to the geographicaly "relatively" isolated Sea of Japan. 3. In the Kurile-Kamtchatka Trench and abyssal plain we will sample around 50% of new species in the

different taxa. 4. The standardised sampling techniques will increase the faunistic knowledge about that region. 5. Enhanced productivity leads to an increase in biodiversity (species richness).

The Kurile-Kamtschatka Trench (KKT) and the adjacent abyssal area has already been investigated in the last century during expeditions onboard the R/V *Vityaz* in 1949, 1953 and 1966 (Ushakov, 1952, Zenkevich at al., 1955, Zenkevich, 1963; Belyaev, 1983, 1989, Belyaev and Vilenkin, 1983). The fauna found in this area has been described in many publications, for example data on 660 species were published into two volumes of the transactions P.P. Shirshov Institute of Oceanology (1970, 1971). Isopoda was one of the dominant taxa in species richness (more than 100 species) in the deep-water macrobenthos (Birstein, 1963, 1970, 1971; Kussakin, 1971; Kussakin and Vasina, 1990). Nevertheless, Birstein (1971) noticed that that major fractions of the fauna were probably not sampled due to inappropriate sampling gear and methods used for sieving and washing; and thus the true deep-sea biodiversity was only partly studied.

Biological expeditions with standardized and comparable sampling design, however, were not performed in that area until now and since the *Vitjaz* expeditions the area was not revisited. We therefore think that new methods of sample treatment and more effective gears, which were already deployed successfully during previous expeditions (CeDAMar), will help to discover a higher biodiversity and collect more species than known at present.
Previous deep-sea expeditions in the framework of the international CeDAMar project revealed a high patchiness (e.g. Kaiser & Barnes, 2008; Kaiser et al., 2009; Brandt et al., 2007) leading to the anticipation that we will find a high number of different and new species in the KKT and adjacent abyssal plain (Fig. 1).

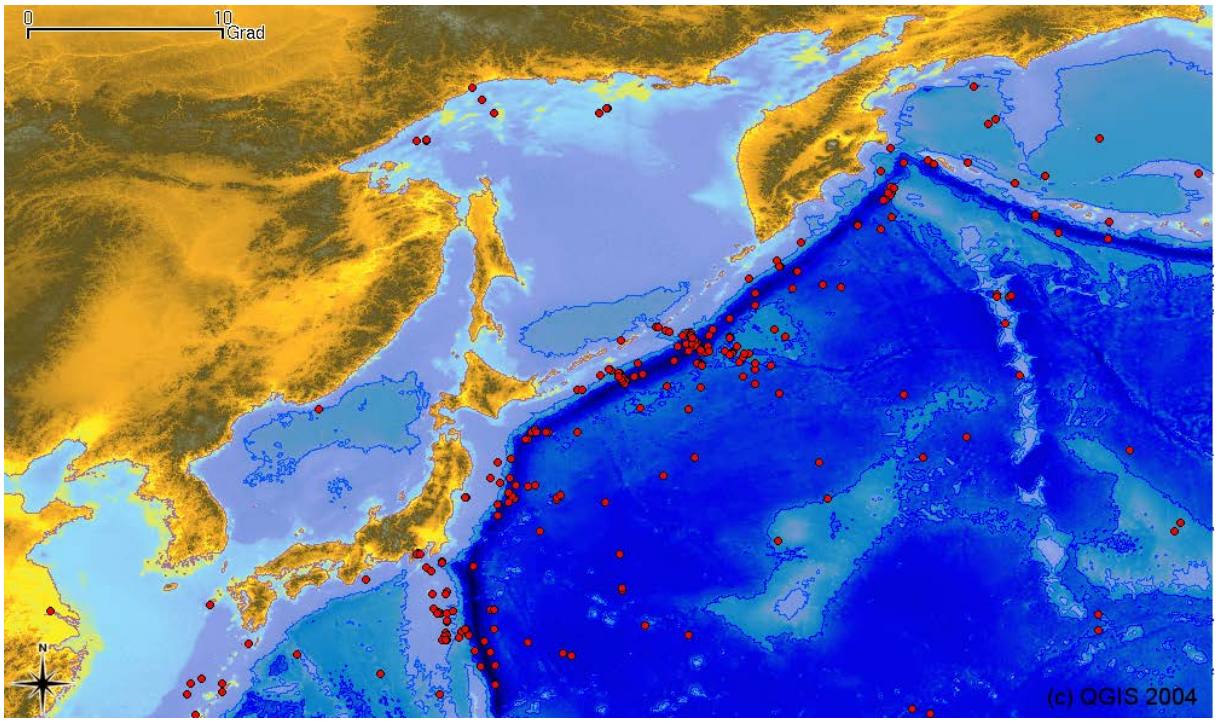


Figure 1. Abyssal stations sampled in the area of the Kurile Kamtchatka Trench and abyss (changed after Stuart et al., 2008).

The shallow boreal Pacific fauna is influenced in its origin by the north Pacific fauna (Kussakin, 1978, 1999; 2004), especially from the region of the Kurile Islands as well as the Sea of Okhotsk (Kussakin, 1979; Skarlato, 1974; Tyler, 2002). The species of this region can migrate into the Sea of Japan and the Kurile Kamchatka abyssal area following shallow water routes from the Pacific Ocean. Despite the limited faunistic data from this region, some faunistic similarities between these deep-sea areas were reported. For example, in the Sea of Japan isopod genera were sample which were also known from the deep sea of the Kurile Kamchatka area, (deep-sea genera of the Asellota like *Eurycope*, *Ilyarachna*, *Mirabilicoxa* or some Arcturoidea) (Gurjanova, 1936; Golovan & Malyutina, 2006, Golovan, 2007). Until now, about 100 species of Isopoda were known from the Kurile Kamtchatka deep sea, from the Sea of Japan, on the contrary, only one species, *Eurycope spinifrons* Gurjanova, 1933 (Elsner et al., 2012; Malyutina et al., 2012). The Russian-German expedition SoJaBio in summer of 2010 confirmed this low biodiversity for Isopoda, however, this species occurs in very high abundances, what is characteristic for an evolutionarily young or early successional stage of an ecosystem.

The northwestern Pacific (KuramBio work area) is situated in an eutropic area (Fig. 2). Until now mainly oligotrophic basins of the young Atlantic Ocean (with the exception of the Southeren Ocean) were investigated using our standard gear (CTD, MUC (multicorer); GKG (giant box corer); EBS (epibenthic sledge); and AGT (Agassiz Trawl) being deployed in a standardized way (z. B. Brandt et al., 2007a-c; Brandt & Hilbig, 2004; Glover et al., 2002; Gutzmann et al., 2004; Martinez & Schminke, 2005; Rose et al., 2005). From the eastern Pacific especially the manganese nodule areas were sampled in the framework of the French KAPLAN and NODINAUT projects, areas which are also classified as oligotrophic. Therefore we also aim at comparing the species composition and species richness on the background of food availability (oligotrophic versus eutrophic deep-sea basins).

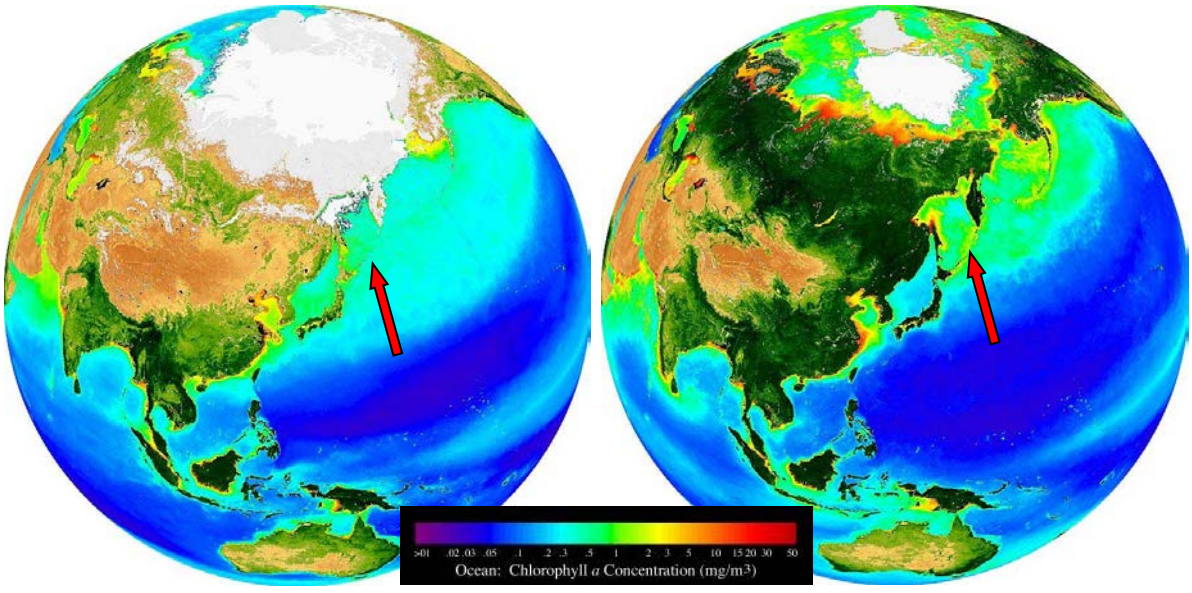


Figure 2. Productivity (Chl_a) in the Kurile-Kamtchatka area. A, boreal winter; B, boreal summer. (http://oceancolor.gsfc.nasa.gov/cgi/biosphere_globes.pl)

The scientists joining KuramBio have already partly been involved in SoJaBio and collaborated during the joint Russian/German expedition with RV *Akademik Lavrentjev* to the Sea of Japan in 2010. Samples and material from the historic expeditions with RV Vitjaz to

the Kurile Kamchatka area between 1954 and 1966 are available in the Zoological Museum in St. Petersburg, at the P. P. Shirshov-Institute of the Russian Academy of Sciences in Moskau or in the A. V. Zhirmunsky Institute for Marine Biology in Vladivostok. We resampled three stations in the Kurile Kamchatka Trench and at the abyssal plain which were previously sampled during the RV Vitjaz expeditions (e.g. Birstein, 1970a, b, 1971; Chlebovic, 1959; Kussakin, 1971, 1972a-c; Kussakin & Mezhov, 1979; Kussakin & Vasina, 1990). Moreover, we are interested in testing whether we will report a higher species richness in the Kurile Kamchatka area due to improved gear and a standardized deployment.

During the KuramBio expedition at each station usually after the location of the station (Fig. 3) via Parasound and Hydrosweep, the CTD was deployed, followed by the OFOS, two GKGs, three MUCs, 2 EBS and 2 AGTs. In the end two AGTs were deployed after the first EBS and at the end one last EBS was deployed. This had the advantage that the battery of the C-EBS could be charged (table xx). In total, 606.216 m of wire were deployed during 708 work hours of KuramBio, the CTD was deployed 11 times, the OFOS (Ocean Floor Observing system) 13 times, the MUC (multiple corer) 35 times, GKG (giant box corer) 23 times, the EBS (epibenthic sledge) 21 times and the AGT (Agassiz trawl) 19 times.

Table 1. Deployments of the gear used at the different stations. All deployments were successful! * EBS was caught in fishing net and supra net cod end filled only; (+/-) The OFOS turned off at the sea floor, it only recorded through the water column.

Station/gear	Parasound	CTD	OFOS	GKG (2x)	MUC (3x)	EBS (2x)	AGT (2x)
1	√	√	+/-	√	√	√	√
2	√	√	+/-	√	√	√	√
3	√	√	√	√	√	1	-
4	√	√	√	√	4	1*	-
5	√	√	√	√	√	√	√
6	√	√	√	√	√	√	√
7	√	√	√	√	√	√	√
8	√	√	√	√	√	√	√
9	√	√	√	√	√	√	√
10	√	√	√	√	√	√	√
11	√	√	√	√	√	√	√
12	√	-	-	1	1	1	1