



**Stellungnahme zum  
Leibniz-Institut für Ostseeforschung Warnemünde  
an der Universität Rostock (IOW)**

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## Vorbemerkung

Der Senat der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz – Leibniz-Gemeinschaft – evaluiert in Abständen von höchstens sieben Jahren die Forschungseinrichtungen und die Einrichtungen mit Servicefunktion für die Forschung, die auf der Grundlage der Ausführungsvereinbarung Forschungseinrichtungen<sup>1</sup> von Bund und Ländern gemeinsam gefördert werden. Diese Einrichtungen haben sich in der Leibniz-Gemeinschaft zusammengeschlossen. Die wissenschaftspolitischen Stellungnahmen des Senats werden vom Senatsausschuss Evaluierung vorbereitet, der für die Begutachtung der Einrichtungen Bewertungsgruppen mit unabhängigen Sachverständigen einsetzt. Die Stellungnahme des Senats sowie eine Stellungnahme der zuständigen Fachressorts des Sitzlandes und des Bundes bilden in der Regel die Grundlage, auf der der Ausschuss Forschungsförderung der Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK) überprüft, ob die Einrichtung die Fördervoraussetzungen weiterhin erfüllt.

Auf der Grundlage der vom Institut für Ostseeforschung Warnemünde (IOW) eingereichten Unterlagen wurde eine Darstellung des Instituts erstellt, die mit dem IOW sowie mit den zuständigen Ressorts des Sitzlandes und des Bundes abgestimmt wurde (Anlage A). Die vom Senatsausschuss Evaluierung eingesetzte Bewertungsgruppe hat das IOW am 7./8. November 2005 besucht und daraufhin einen Bewertungsbericht erstellt (Anlage B). Auf der Grundlage dieses Bewertungsberichts und der vom IOW eingereichten Stellungnahme zum Bewertungsbericht (Anlage C) erarbeitete der Senatsausschuss einen Entwurf für die Senatsstellungnahme. Der Senat der Leibniz-Gemeinschaft hat die Stellungnahme am 23. November 2006 erörtert und verabschiedet. Er dankt den Mitgliedern der Bewertungsgruppe für ihre Arbeit.

## 1. Beurteilung und Empfehlungen

Der Senat schließt sich der Beurteilung und den Empfehlungen der Bewertungsgruppe an. Das IOW ist das einzige deutsche Meeresforschungsinstitut, das sich auf die Untersuchung meereswissenschaftlicher Probleme konzentriert, die im Zusammenhang mit der Ostsee stehen. Das IOW erforscht die Verknüpfungen und Interaktionen zwischen Küstenmeer, Landzone und Atmosphäre im baltischen Raum. Das Institut erbringt gute, in Teilen sehr gute Forschungsleistungen in der physikalischen und biologischen Ozeanographie, in der Meereschemie sowie in der Marinen Geologie. Die Resultate werden allerdings international nicht hinreichend sichtbar. Das Forschungsprogramm ist überzeugend und international wettbewerbsfähig.

Eine Stärke des IOW liegt in seinem interdisziplinären Forschungsansatz zur Funktionsweise mariner Ökosysteme am Beispiel der Ostsee. Die interdisziplinäre Zusammenarbeit in den drei Forschungsschwerpunkten „Transport- und Transformationsprozesse im Meer“, „Marine Lebensgemeinschaften und Stoffkreisläufe“ und „Marine Ökosysteme im Wandel“ sowie den drei Querschnittsbereichen „Messtechnik“, Modellierung“ und „Wissenstransfer: Küstenmeere und Gesellschaft“ wird als erfolgreich bewertet. Die Interdisziplinarität spiegelt sich allerdings noch nicht hinreichend in gemeinsamen Publikationen in referierten Zeitschriften wider.

Als Alleinstellungsmerkmal verfügt das IOW über ein einzigartiges Beobachtungssystem und bedeutsame Datenbestände, die für die Erforschung der Veränderlichkeit mariner Ökosysteme eine entscheidende Grundlage bilden. Auf diese Weise leistet das IOW erhebliche Beiträge zu

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<sup>1</sup> Ausführungsvereinbarung zur Rahmenvereinbarung Forschungsförderung über die gemeinsame Förderung von Einrichtungen der wissenschaftlichen Forschung (AV-FE)

nationalen und internationalen marinen Beobachtungsprogrammen und ergänzt damit auch die meereskundliche Forschung an den Universitäten.

In methodischer Hinsicht spielen am IOW Modellierungsaktivitäten eine große Rolle. Das Institut hat auf der Basis eines weltweit genutzten Modellsystems (*3-D Princeton Model*) ein eigenes interdisziplinäres Modellsystem aufgebaut, das für die Forschungsarbeiten am Institut genutzt und weiterentwickelt wird. Auf diesem Wege hat das IOW eine überzeugende Modellierungskompetenz erworben, die aber noch nicht in allen Bereichen zufrieden stellend genutzt wird. Daneben wird die Entwicklung von technischen Überwachungseinrichtungen, Messstationen und anderer meereswissenschaftlicher Gerätetechnik mit großem Erfolg betrieben.

Das Institut pflegt intensive Beziehungen zu den Universitäten Rostock und Greifswald. Die Institutsmitarbeiter tragen mit einer Reihe von Lehrveranstaltungen substantiell zu den Bachelor- und Masterstudiengängen beider Universitäten bei. Darüber hinaus werden gemeinsame Forschungsprojekte durchgeführt sowie Gerätetechnik und experimentelle Infrastruktur gemeinsam genutzt.

Zugleich kooperiert das IOW mit einer Vielzahl von Partnerinstitutionen im meereswissenschaftlichen Bereich. Insbesondere nimmt es eine bedeutende Brückenfunktion zu Meeresforschungsinstituten in den Transformationsländern im Baltikum wahr und leistet wichtige Beiträge im Zusammenhang mit internationalen Initiativen. Das IOW ist – zum Teil federführend – in eine Reihe von europäischen und internationalen Forschungsnetzwerken eingebunden. Gemeinsam mit Partnerinstitutionen ist es dem IOW gelungen, umfangreiche Drittmittelprojekte einzuwerben.

Die kritischen Hinweise und Empfehlungen des Wissenschaftsrates hat das IOW mehrheitlich berücksichtigt. So wurden die Forschungsschwerpunkte entsprechend den Empfehlungen erfolgreich weiterentwickelt und die Kooperationsbeziehungen mit den benachbarten Universitäten ausgebaut.

Die Anzahl an Publikationen in begutachteten Zeitschriften hat sich ebenfalls erhöht, entspricht aber noch nicht internationalen Standards. Bislang publiziert das IOW noch zu viele der zum Teil hervorragenden Forschungsergebnisse nur in der hauseigenen „grauen Literatur“, so dass sie international nicht angemessen wahrgenommen werden. Das IOW ist insgesamt in der Präsentation seiner Forschungsleistungen sehr zurückhaltend, so dass es in der internationalen meereswissenschaftlichen Fachgemeinschaft teilweise nicht entsprechend seiner Leistungsfähigkeit sichtbar wird. Das IOW muss mehr Eigeninitiative und Innovationsgeist sowie strategische Orientierung entwickeln, wenn es das sich selbst gesteckte Ziel erreichen will, auf seinem Spezialgebiet eine weltweit führende Position einzunehmen. Die Institutsleitung sollte die Publikationszahlen jährlich überprüfen und dem Wissenschaftlichen Beirat über Fortschritte berichten. Dieser sollte bei seinen internen Evaluierungen den Publikationsleistungen besondere Aufmerksamkeit widmen.

Das IOW sollte den Wissenstransfer ausbauen und seine Forschungsergebnisse potentiellen Anwendern aus der meeresindustriellen Industrie sowie Entscheidungsträgern aus Politik und Gesellschaft regelmäßig präsentieren.

Hinsichtlich der wissenschaftlichen Nachwuchsförderung sollte die Anzahl der Doktoranden und Postdoktoranden erhöht werden. Zugleich sollte die Betreuung von Doktoranden intensiviert werden. Insbesondere sollten die Doktoranden ermuntert werden, ihre Forschungsergebnisse bereits während ihrer Promotionszeit in internationalen begutachteten Zeitschriften zu

veröffentlichen. Das IOW sollte erwägen, ein strukturiertes Doktorandenprogramm gemeinsam mit den kooperierenden Universitäten zu entwickeln.

Bislang hat das IOW noch kein überzeugendes Qualitätsmanagement eingeführt. Der Wissenschaftliche Beirat muss stärker in die regelmäßige Berichterstattung über die Institutsleistungen eingebunden werden. Er sollte das Institut kritischer begleiten und seine Ergebnisse detailliert dokumentieren. Die Institutsleitung sollte dem Beirat jährlich Bericht über die Leistungsentwicklung der Forschungseinheiten erstatten. Ein geeignetes Anreizsystem sollte entwickelt werden, das zugleich die Flexibilität und Mobilität der Mitarbeiter des Instituts stärkt.

Im Rahmen einer Verwaltungsvereinbarung mit dem Bundesamt für Seeschifffahrt und Hydrographie (BSH) führt das IOW das Ostsee-Monitoring durch, das in enger Verbindung zur Grundlagenforschung des Instituts steht, da diese Erhebungen die Datengrundlage für viele Forschungsarbeiten bereitstellen. Das IOW verfügt gegenwärtig über 32 Stellen, die vom BSH finanziert werden. Das BSH hat angekündigt, ab dem Jahr 2008 die finanzielle Unterstützung für 11 Stellen einzustellen. Der Senat schließt sich dem Votum der Fachgutachter an, dass die Fortsetzung der Datenerhebungen für die marine Ökosystemforschung unbedingt notwendig ist und sie die Basis für die international bedeutsame Rolle des IOW in der Ostseeforschung bilden. Der Senat empfiehlt den Zuwendungsgebern, die institutionellen Zuwendungen um den zur Finanzierung von sechs Institutsstellen nötigen Betrag aufzustocken, da diese Stellen zur Sicherung der Datenbasis für die Forschung erforderlich sind. Gleichwohl sollte das IOW eine Entwicklungsstrategie für die zukünftige Forschung entwerfen, die die Veränderung der finanziellen Rahmenbedingungen berücksichtigt.

Das IOW ist für die Durchführung seiner Forschungstätigkeit auf Forschungsschiffe angewiesen. Für die Aufrechterhaltung der Forschungs- und Monitoring-Aktivitäten hat das IOW langfristig einen Bedarf an Schiffszeiten von jährlich etwa 220 Tagen. Das institutseigene Forschungsschiff „PROFESSOR ALBRECHT PENCK“ muss aus Altersgründen demnächst stillgelegt werden. Der Senat ist der Ansicht, dass das Institut auch weiterhin jederzeit Zugriff auf ein flexibel nutzbares Forschungsschiff haben muss.

Dem Sitzland Mecklenburg-Vorpommern wird empfohlen, das IOW rechtlich zu verselbstständigen. Entsprechende Gestaltungsoptionen sollten das IOW und das Ministerium für Bildung, Wissenschaft und Kultur des Landes gemeinsam eruiieren.

Das IOW hat eine national und international bedeutsame Aufgabe in der meereswissenschaftlichen Ostseeforschung. Nach Auffassung des Senats erfüllt das IOW die Anforderungen, die an Einrichtungen von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischen Interesse zu stellen sind. Eine Eingliederung des IOW in eine Universität wird nicht empfohlen. Der Arbeitsauftrag des Instituts, der die Durchführung und Koordination komplexer Forschungsprojekte sowie die Bereitstellung der Infrastruktur für Meerese Expeditionen umfasst, kann nur in entsprechend vernetzten und betriebsförmig organisierten Strukturen erfüllt werden.

Das Institut soll dem Senat in drei Jahren berichten, welche Fortschritte es bei der Erhöhung der Anzahl von Veröffentlichungen in internationalen referierten Zeitschriften und bei der Einführung eines Qualitätsmanagements erreicht hat.

## **2. Zur Stellungnahme des IOW**

Das IOW hat zum Bewertungsbericht Stellung genommen (Anlage C). Es begrüßt die ausgewogene Einschätzung der Bewertungsgruppe und sieht sich in seiner Forschungsausrichtung

und Leistungsfähigkeit bestätigt. Die Handlungsempfehlungen der Gutachtergruppe wird das Institut aufgreifen und Pläne zu deren Umsetzung im Rahmen des Wissenschaftlichen Beirats besprechen.

Der Senat begrüßt die positive Aufnahme der Empfehlungen durch das IOW und den konstruktiven Umgang mit den Empfehlungen.

### **3. Förderempfehlung**

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das IOW als Forschungseinrichtung auf der Grundlage der Ausführungsvereinbarung Forschungseinrichtungen weiter zu fördern.



## Annex A: Presentation

### Leibniz Institute for Baltic Sea Research Warnemünde at the University of Rostock (IOW)<sup>1</sup>

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<sup>1</sup> This presentation, compiled by the Evaluation Office, has been approved by the Institute and the relevant Federal and State departments.

## List of Abbreviations

AWI	Alfred-Wegener Institute for Polar and Marine Research
BASYS	Baltic Sea System Study
BEOFINO	<i>Ökologische Begleitforschung zur Windenergienutzung im Offshore-Bereich auf Forschungsplattformen in der Nord- und Ostsee</i>
BMBF	Federal Ministry of Education and Research ( <i>Bundesministerium für Bildung und Forschung</i> )
BLK	Bund-Länder Commission for Educational Planning and Research Promotion ( <i>Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung</i> )
BMP	Baltic Monitoring Programme
BSRP	Baltic Sea Regional Programme
BSH	Federal Maritime and Hydrographic Agency ( <i>Bundesamt für Seeschifffahrt und Hydrographie</i> )
CTD	Conductivity-Temperature-Depth
DFG	German Science Foundation ( <i>Deutsche Forschungsgemeinschaft</i> )
DEKLIM	German Climate Research Programme (Deutsches Klimaforschungsprogramm)
DWK	German Scientific Commission for Marine Research ( <i>Deutsche Wissenschaftliche Kommission für Meeresforschung</i> )
DYNAS	Dynamics of natural and anthropogenic sedimentation
EDP	Electronic Data Processing
ESF	European Science Foundation
EU	European Union
EUR-Oceans	European Network of Excellence for Ocean Ecosystems Analysis
ERANET	European Research Area Network
FIMR	Finnish Institute of Marine Research
GDR	German Democratic Republic
GEOHAB	Global Ecology and Oceanography of Harmful Algal Blooms
GKSS	GKSS Research Centre, Geesthacht
GLOBEC	Global Ocean Ecosystem Dynamics
GOOS-COOP	Global Ocean Observing System - Coastal Ocean Observation Panel
HELCOM	Helsinki Commission: Baltic Marine Environmental Protection Commission
HLRN	<i>Norddeutscher Verbund für Hoch- und Höchstleistungsrechnen</i>
IBSEN	Integrated Baltic Sea Environmental Study
ICBM	<i>Institut für Chemie und Biologie des Meeres, Universität Oldenburg</i>
ICES	International Council for the Exploration of the Sea
ICSU	International Council for Science
IGBP	International Geosphere-Biosphere Programme



IKZM-Oder	<i>Integriertes Küstenzonenmanagement in der Odermündungsregion</i>
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
IOC	Intergovernmental Oceanographic Commission
IOW	Leibniz Institute for Baltic Sea Research Warnemünde ( <i>Leibniz-Institut für Ostseeforschung Warnemünde</i> )
KDM	German Marine Research Consortium ( <i>Konsortium Deutsche Meeresforschung</i> )
MARBEF	Marine Biodiversity and Ecosystem Functioning
MARNET	Marine Environmental Monitoring Network in the North Sea and Baltic Sea
POMOR	Master programme for applied polar and marine sciences (Russian acronym)
QuantAS	Quantifizierung der Wassermassentransformation in der Arkonasee, Impact of off-shore wind farms
SCOR	Scientific Committee on Oceanic Research
SME	Small and medium-sized enterprises
SMHI	Swedish Meteorological and Hydrological Institute
SIBIK	<i>Satellitengestütztes Interpretations- und Bewertungsinstrument für das Küstenmonitoring des Landes Mecklenburg-Vorpommern</i>
SINCOS	DFG funded research group "Sinking Coasts - Geosphere, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea"
UNEP-ICARM	United Nations Environment Programme: Expert Group on Integrated Coastal Area and River Basin Management
WGL	Leibniz Association ( <i>Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz</i> )
WR	German Science Council ( <i>Wissenschaftsrat</i> )
ZMAW	Centre of Marine and Atmospheric Sciences, Hamburg University

## 1. Development and Funding

The Baltic Sea Research Institute Warnemünde (IOW for “Institut für Ostseeforschung Warnemünde”) was founded in 1992 in accordance with a recommendation by the German Science Council (Wissenschaftsrat). It succeeded the Institute for Marine Research Warnemünde which was a member of the Academy of Science of the German Democratic Republic.

Since 1992, the IOW has been receiving institutional funding from the German Federal Government and the community of German Länder (States) at a ratio of 50:50. The Ministry for Education, Science and Culture of the State of Mecklenburg-Western Pomerania is responsible for funding the Institute. The Federal Ministry of Education and Research oversees the work of the Institute as funding representative of the Federal Government.

In 1992, the German Science Council also recommended that the IOW should contribute to the Baltic Monitoring Programme<sup>2</sup> (BMP) in close connection to its research programme. Accordingly, the IOW holds a contract on “Oceanographic Tasks in the Baltic Sea” with the BSH<sup>3</sup> – an agreement which is exclusively federally funded.

The previous evaluation of IOW by the German Science Council took place in 1997. In 1999, based on the evaluation report, a statement by the German Science Council (dated 10 July 1998) and a joint statement by both Ministries, the committee of the Bund-Länder Commission for Educational Planning and Research Promotion subsequently decided to continue funding the IOW.

## 2. Mission, Tasks, Main Work Areas and Scientific Environment

According to the IOW, the **overall objectives** of the Institute are to promote science, research and teaching in the field of marine research, to conduct interdisciplinary marine research with particular attention to the ecosystem of the Baltic Sea and to link research and monitoring programmes. Against this background, the Institute describes its **mission** as to improve knowledge of the coupling and interactions between the coastal ocean, land and atmosphere, while furthering the prognostic capacity with regard to changes in the ecosystem in relation to natural external forcing and anthropogenic activities. The main area of study is the Baltic Sea which also works as a model coastal ocean to gain more generic insights. For comparative studies IOW researchers consider other marine ecosystems outside the Baltic Sea as well.

In 1992, the research foci and main research objectives at the IOW were formulated in a long-term research programme. In 2002, this programme was updated to follow a system approach and system relevant interdisciplinary research strategy with **three research foci**:

### *1. Transport and Transformation Processes in the Sea*

As these processes regulate not only the matter and energy cycles in the sea, but also the exchange between surface water and atmosphere as well as between bottom water and sediments, to know, quantify and parameterise them is a prerequisite for the understanding and the modelling of currents, layers and matter cycles. The investigations focus (1) on the quantification of those processes which create and maintain environmental gradients, (2) on the external

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<sup>2</sup> The BMP is an essential part of the Helsinki Convention (HELCOM), an internationally ratified convention for the Protection of the Marine Environment of the Baltic Sea.

<sup>3</sup> BSH - Federal Maritime and Hydrographic Agency

forcing and the dynamical properties of the system and their time scales, (3) on the recognition of the biogeochemical and ecological reactions driven by physical processes and the variability of the gradients.

### *2. Marine Communities and Matter Cycles*

This research focus comprises investigations of the organisms' and communities' reactions on anthropogenically or climatically caused changes in the matter and energy cycles. This includes also research on the general understanding of the role each group of organisms plays in the Baltic Sea ecosystem. The research concentrates (1) on quantifying the impact of species and communities on the fluxes of matter and (2) on describing the stabilising and regulating influence of adaptation on biological structures and fluxes of matter in marine ecosystems.

### *3. Changing Marine Ecosystems – External Forcing and Internal Change*

The Baltic Sea is subject to changes on different time scales determined by geological processes, climate driven changes on the hydrography or by anthropogenic influences. To differentiate between long-term changes and short-term fluctuations and between natural and anthropogenic developments is the major goal of this research focus. The main aspects are (1) explaining and modelling causal links between external forcing (climate) and chemical, biological and sedimentary reactions, (2) improving the classification of empirically approved changes in the ecosystem due to human influence and the estimation of its contribution to general variability, and (3) predicting changes within the next decades on the basis of improved process knowledge, the geological history and long-term observations as well as on climate and development scenarios for the entire Baltic Sea Region.

These foci are supported by two **cross-cutting activities**, the Modelling and the Instrumentation Group. A third cross-cutting activity, "Coastal Seas and Society", uses results and expertise from the three main research foci and meets the demand for scientifically based information for coastal zone management. This activity encompasses both the conveyance of research results to users and problem oriented projects based on a sound scientific approach where specific information is required.

This research programme is run by a **specific system approach** which, according to the Institute, comprises the three components:

1. Registration of the physical and chemical structures of the water column, the seafloor and the sediments as well as the composition of the pelagic and benthic communities in the light of the respective time scales of changes from seasons to millennia.
2. Analysis of processes determined by the abiotic and biotic properties of a coastal ocean as well as the analysis of the external forcing factors.
3. Depiction of causal coherences on the respective spatial and temporal scales through models.

Besides its research programme the Institute works on a contract on "Oceanographic Tasks in the Baltic Sea". This **BSH contract** comprises monitoring the German Exclusive Economic Zone (federal obligation), collection and interpretation of long-term oceanographic data sets in the open Baltic Sea within the framework of the BMP, monitoring the coastal waters off Germany, the operation and maintenance of three autonomous time series stations in the Western Baltic Sea as part of the BSH's MARNET-system and geological/sedimentological surveys needed for marine development plans. The Science Council in 1992 explicitly recommended

continuing the work in the open Baltic Sea. These tasks have strong inherent service functions. Fulfilling the contract is of mutual benefit to the BSH and the IOW.

The IOW is structured into **four scientific departments**: "Physical Oceanography and Instrumentation", "Biological Oceanography", "Marine Chemistry", and "Marine Geology". In addition, there are the units for administration and an EDP group (also called IT Group).

The scientific departments jointly work on the research programme. The department **Physical Oceanography and Instrumentation** provides specific expertise in Theoretical and Experimental Oceanography in the fields of regional oceanography of marginal seas, oceanic wave processes, thermodynamics of oceans, numerical circulation models, coupled physical-chemical-biological modelling, turbulence modelling, mesoscale circulation, remote sensing and oceanographic measurement techniques. The department is contributing to all research foci but has especially strong involvements in research focus 1 "Transport and transformation processes", as well as in the cross-cutting activities "Modelling" and "Measuring techniques and systems".

The department **Biological Oceanography** provides specific expertise in Phytoplanktology, Zooplanktology, Microbiology and Benthology in the fields of biogeochemical cycles, trophic interaction, microbial and molecular ecology, physiology of pelagic organisms, physiology of benthic organisms, organic pollutants in organisms, management of coastal zones and ecological modelling. The department is contributing to all research foci but has an especially strong involvement in research focus 2 "Marine communities and matter cycles".

The department **Marine Chemistry** provides specific expertise in Chemical Oceanography and Organic Marine Chemistry in the fields of nutrient cycles, natural organic components in sea water, heavy metals (cycles, redox processes), organic contaminants (environmental behaviour, ecotoxicology), carbon budget, gas exchange between sea and atmosphere and new monitoring technologies for chemical variables. It is contributing to all research foci but has especially strong involvements in research focus 1 "Transport and transformation processes".

The department **Marine Geology** provides specific expertise in Sedimentology, Sediment Physics, Geochemistry, Mineralogy, Mathematical Geology in the fields of sedimentation processes and their modelling, development of the Baltic Sea, paleoclimatology, micro analysis and sediment mapping. It is contributing to all research foci but has especially strong involvements in research focus 3 "Changing marine ecosystems".

According to the system approach the IOW sets the following major **medium-term objectives** for the future: firstly, to model the Baltic deep water life cycle and its influence on the biogeochemical processes; secondly, to characterise key bio-chemical processes and to identify key microbial organisms in element cycles and fluxes through the redox gradients at the permanent halocline and, thirdly, to identify and quantify crucial processes and variables during transition periods in the pelagic seasonal cycle. Further objectives are to improve the matter balance of key elements for different scenarios of anthropogenic loads and climate forcing in the pelagic and benthic realm, to identify and understand environmental changes on time scales of millenia to decades and, lastly, to install time series stations in the basins of the Central Baltic Sea.

The IOW sees these medium-term objectives as having inherent potential for **long-term development**. Major aspects of the long-term strategy include investigating in detail the internal regulation mechanisms with equate temporal and spatial resolution to improve the predictive capacity of the models used by the IOW. New generations of model system with substantial improvements of the process description and the inclusion of higher trophic levels should be developed.

The IOW wants to extend the working area to the Northern Baltic Sea. In addition, the models and strategies should be exported to other sea areas as well. The IOW plans to apply for a Collaborative Research Centre focusing on internal regulation mechanisms in a changing Baltic Sea, together with the Universities of Rostock and Greifswald.

Due to its interdisciplinary system approach and the closely linked realisation of the HELCOM monitoring programme, the IOW is – in its own estimate – established in the **scientific environment** as an internationally leading institute in Baltic Sea research. The IOW is, as it claims, the only research institution dedicated to the entire Baltic Sea ecosystem. **Comparable institutions** in the Baltic Sea region are the Finnish Institute of Marine Research in Helsinki or the Institute of Oceanology in Sopot, Poland. Concerning coastal sea research in general, a comparable scientific approach is followed by the Adria Institute (Italy) or the Horn Point Laboratory (USA), for example. German institutions involved in coastal sea research are GKSS, AWI, the Leibniz Institute of Marine Science in Kiel, the Institute for Chemistry and Biology of the Marine Environment at the University of Oldenburg (ICBM) or the Centre of Marine and Atmospheric Sciences at the University of Hamburg (ZMAW). The IOW is linked to a differing extent with all major German institutions and is a member of the Konsortium Deutsche Meeresforschung.

The IOW coordinates projects like the IGBP (International Geosphere-Biosphere Programme) project GLOBEC and three large integrated projects by the BMBF programmes IKZM, DEKLIM and "Geotechnologien". In the case of GLOBEC, the Institute acts as a national coordinator and represents Germany on international committees. These activities are part of the national science policy.

According to the IOW, the reasons for establishing the tasks in a **non-university institute** are related to their comprehensive nature (system approach) which, on the one hand, needs a multitude of specific disciplinary expertise and, on the other hand, a close and permanent interdisciplinary interaction directed by a joint decadal research programme.

Because of its research and infrastructure, the IOW argues that it is the ideal partner for the BSH for carrying out HELCOM monitoring.

### 3. Structural Features und Organisation

The IOW is a legally dependent institution of the Federal State of Mecklenburg-Western Pomerania, supervised by a Board of Governors. An overview of the organisational structure is given in App. 1. The IOW is divided into four research departments and three infrastructure units. It has four legal bodies: The **Director** is appointed for a five years term; re-election is possible. He represents the Institute internally and externally and is responsible for all scientific and administrative matters. The **Board of Governors** is in charge of all central decisions concerning the direction of the scientific mission, financial affairs and the appointment of the Management. It consists of representatives of State and Federal Governments, the University of Rostock, the chair of the Institute's Scientific Board as well as of a representative from the DFG and BSH. The **Scientific Advisory Council** is an internal advisory board; its members are the heads of the four departments and three scientists elected by the scientific staff for a period of three years. The Scientific Advisory Council is involved in creating the scientific programme. The **Scientific Advisory Board** has a maximum of ten members. The members are appointed by the Board of Governors according to suggestions from the Institute's directorate, the DFG and the Scientific Advisory Board itself. The term of office is four years which may be extended by one further term. The tasks of this committee are to give scientific advice to the Board of Governors

and the director, promote cooperation with national and international research institutes, comment on the director's annual reports, audit the work of the IOW and report their results to the Board of Governors.

The IOW's research work for the next decade is detailed in the **research programme**. The first research programme was set up in 1992 and a major modification followed in 2002. The research programme is adjusted by a working group consisting of the director, the heads of the departments, their deputies, the three elected members of the Scientific Advisory Council and the scientific coordinator. The draft is then presented to the scientific plenary assembly for discussion and, after possible changes and after consultation with the Scientific Board, presented to the Board of Governors, which is responsible for the decision of the programme. The research programme is supported by implementation plans describing current and planned projects for the next three to four years. These are broken down into yearly plans on department level for the utilisation of all resources. Implementation plans are formulated on the basis of two seminars per research focus and year. This ongoing process is summarised and presented to the director, Scientific Board and Board of Governors, which decides on the implementation plans.

To assure research quality the IOW uses internal **quality management** and external audits. Internal instruments are department workshops and seminars where IOW scientists present their work at least once a year. Seminars are held twice a month to present and discuss the research and results of the department members. The interdisciplinary workshops deal with actual research foci. The Scientific Board evaluates individual research foci on its annual meetings. Furthermore, the IOW regards scientific publications and lectures given at international conferences as further external audit instruments.

Like all Leibniz Institutes, the IOW has introduced a **cost performance accounting system** in compliance with the BLK decision. The IOW assigns costs according to the structure of the research programme (research foci, cross-cutting activities), supplemented by the additional cost units "Education" (e. g. supervision of Ph. D. students), "BSH-related work" and minor points. For performance documentation the IOW has established a system whereby the IOW scientists indicate their performance according to given categories.

The IOW is an **equal opportunity employer**. Applications from female scientists are given preference if the applicants have the same qualifications. The IOW started a special scholarship programme for female scientists following maternity leave or during child care enabling them to finish their doctoral thesis, publish their results or write a project proposal by giving a grant for three to six months and covering the costs of conference presentations.

#### 4. Resources and Personnel

In 2004, the Institute's **annual budget** amounted to a total of € 14.6 million (see Appendix 2). The institutional support including the financial support by the administrative agreement BSH monitoring in 2004 totaled € 11 million (75 % of the budget). The contract with the BSH generated € 2.5 million funding in 2004 (17 % of the Institute's total budget). The proportion of third-party funding in relation to total financial resources reached 20 % in 2004. In 2004, the IOW received funds from different **third-party sources**: by far the largest share of research support comes from the Federal Government (€ 1.88 million), followed by the DFG (€ 540 thousand) and the European Union (€ 450 thousand) – these funds amounting overall to ca. € 3 million

(see Appendix 3). During the report period, on average, the IOW received € 2.5 million in research support annually.

In line with the recommendation of the Science Council (1992), the IOW contributes to the BMP and a contract for "Oceanographic Tasks in the Baltic Sea" with the Federal Maritime and Hydrographic Agency (BSH). In 1997, the BSH and the IOW signed a new contract according to which, from 1998 onwards, the IOW was entrusted with the biological components of the BMP without additional funds. Since then, the contract has been subject to financial cuts resulting in the loss of four of the original 36 staff positions. The IOW expects further cutbacks up to 2010 and expects to lose a further 13.5 positions and the BSH funding for the long-term time series data collections in the open Baltic Sea in 2008. The IOW considers this activity central to the Institute's system approach and reckons that the BSH funding cannot be compensated by non-institutional sources alone. Therefore, the IOW seeks compensation in the form of six staff positions from additional financial resources under the terms of the Leibniz Association funding mechanism.

In 2004, € 7.2 million were provided for personnel and € 4.7 million for materials, supplies, and equipment. Investments, not including building investments, accounted for € 1.0 million.

Infrastructural resources include 107 offices (1,700 m<sup>2</sup> in total) and 44 laboratories (1,000 m<sup>2</sup>). As a result of the previous evaluation, additional space (12 offices and 5 laboratories including one laboratory complex with high standard clean room facilities) will become available by a building extension (construction starts in October 2005).

In the IOW's judgement the Institute is well equipped with measurement devices, analytical and computing facilities and a solid stock of standard instruments for seagoing activities. According to the IOW, the MARNET stations represent the cutting-edge of fixed autonomous station technology. Improvements are required over the next few years in relation to moored, floating and profiling equipment. For the IOW the modernisation of the research vessels is a major demand. The commissioning of r/v Maria S. Merian will, together with shiptime from the pool of medium-sized ships, compensate the loss of r/v A. v. Humboldt only. The IOW maintains that deterioration of the hull and technical equipment of the PROFESSOR A. PENCK, with 54 years the oldest ship in the German research fleet, makes the replacement of this ship indispensable and urgent.

On the reporting date 31.12.2004, the Institute had 168 **employees**, that is 146 employees in full time equivalents (see Appendices 4 to 6). Among the 168 employees were 67 positions for academic and higher management staff and 13 for doctoral candidates (6.5 full time equivalents). Doctoral candidates are generally paid according to the rules prevailing in Germany's public sector (BAT IIa/2) and employed on a temporary basis. 70% of the doctoral candidates were funded from external sources.

Out of 67 academic and higher management staff 30 % were paid by third-party funds and 16.5 % by the BSH funding. 42 % were on temporary contracts. The 11 positions financed by the BSH contract are on unlimited contracts. In 2004, ca. 30 % of the academic staff were aged 39 or younger, 24 % were 40 - 49, and 46 % were 50 or older. Approximately 37 % had worked at the establishment for less than five years and 19 % had worked there for more than 20 years.

Vacant positions for academic and higher management staff are always advertised in a national newspaper (Die Zeit), an international science journal (Nature) as well as on the Institute's homepage. Web-based job agencies are also used. IOW staffing includes nine professorships. Filling these positions must conform to the rules of appointment of the respective university.

However, recruitment commissions are always constituted with broad IOW representation and are chaired by the Institute's director.

Doctoral candidates are generally employed in part-time positions. The recruitment of qualified scientists is run in competition with the other oceanographic institutes. However, the salary difference between West und East Germany is still the main obstacle to success, although things are improving due to pay rate adjustments and the excellent working conditions the IOW offers.

Apart from the loss of 13.5 positions by 2010, the IOW expects ten higher staff positions ( $\geq$ BAT-IIa) to become vacant due to retirement by 2012 (among these three department heads and five senior scientists).

During the last seven years, five academic members of the Institute's staff were offered professorships, all of which were accepted.

## 5. Promotion of Junior Academics and Cooperation

At the Universities of Rostock and Greifswald the IOW is involved in the development of curricula for bachelor and masters courses. IOW scientists teach at both universities Rostock (Physical and Biological Oceanography, Marine Chemistry) and Greifswald (Marine Geology). During the reporting period, on average, 40 **courses** (lectures, seminars or practical exercises) were taught by IOW staff at universities annually, some of them lasting from two to 15 days. The IOW states that it is one of the educational centres for marine biology in Germany.

Between 2001 and 2004, 30 **Diploma theses**, 21 **Ph.D. theses**, and three **Habilitation theses** were carried out at the IOW. On average, the time period needed to complete a Ph.D. thesis was about three years. Since 2004, thesis committees have to be established for each new PhD student to comment on the progress of the research at defined intervals. The IOW offers seminars for diploma and PhD students to present their results and gives lectures on publishing, writing proposals and 'Regulations to assure good scientific practice'.

Since 2002, the IOW has organised summer schools on coastal sea research together with the GKSS and the AWI on the basis of a special agreement. Each of the three organizing institutions hosts the courses in rotation. In 2002 and 2005, the summer school took place in Warnemünde. The IOW plans to further develop its summer school system with special emphasis on student education on board ship. Furthermore, the IOW offers internships for students and pupils (ca. 12 p. a.) as well as offers three positions for apprentices.

Regarding **cooperation**, the Institute has connections to the Universities of Rostock and Greifswald. There are cooperation agreements referring mainly to joint appointments, the joint use of premises and equipment and the integration of the IOW's professors in academic self-government. The joint appointments refer to the nine professorship positions on the IOW staff.

Moreover, the IOW assesses the SINCOS, GLOBEC and DYNAS projects as the three most prominent and comprehensive national partnerships. **SINCOS** is a research unit funded by the DFG entitled "Sinking Coasts – Geosphere, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea". The IOW coordinates geoscientists, biologists, climate researchers and archaeologists from North Germany investigating the relations between geo-systems, ecosystems, climate and socio-economic systems. **GLOBEC** (Global Ocean Ecosystem Dynamics) is an International Geosphere-Biosphere Programme (IGBP) core project. A German GLOBEC was established in 2002, entitled "Trophic Interactions between Zooplankton and Fish under the Influence of Physical Processes". This BMBF-funded project is coordinated by the IOW involv-



ing seven German institutions. The BMBF-funded project **DYNAS** – Dynamics of natural and anthropogenic sedimentation – was aimed at the modelling of sediment dynamics under IOW coordination and involved potential users. The funding phase ended in May 2005. On the basis of the expertise gained, the IOW and European partners will, therefore, apply for an International Research Training Group on Particle Dynamics (DFG funded).

The IOW has traditional good contacts to **Central and Eastern European countries**. The Institute helped to introduce the Baltic Sea as a target area for European funding for marine science which resulted in the research project BASYS involving more than 60 partners from 13 countries. Subsequently, IOW scientists were appointed members of the scientific advisory boards in four Centres of Excellence in former EU candidate states. IOW scientists participate in advisory committees for intergovernmental organisations like ICES or HELCOM. The IOW regards playing a leading role in the publication of the regular assessment of the environmental state of the Baltic Sea.

The Institute is a member of the recently founded **German Marine Research Consortium** (KDM) which includes ten German research institutes and universities with substantial activities in marine sciences. The Consortium represents a total of about 2,200 marine scientists in Germany. IOW scientists also participate in **international educational programmes** like the DAAD-funded international Master Course at St. Petersburg State University (POMOR), the Joint Educational Training Center 'Hanoi – Greifswald' or the DAAD-funded short-term lectures in different countries.

The IOW works on a number of **bilateral projects** inside and outside the EU (e. g. Namibia, Indonesia, or South Africa). The IOW says that EU funding is very important for the IOW's international cooperation. It claims that four **EU projects** have, or have had a special impact on international networking: BASYS – Baltic Sea System Study (1996 - 1999) was a European regional sea project coordinated by the IOW and gathering together 60 partner institutes from 13 European countries. MARBEF – Marine Biodiversity and Ecosystem Functioning –, is a network of excellence (NoE) funded by the European Union, consisting of 56 European marine institutes from 17 European countries. It is coordinated by the Netherlands Institute of Ecology. EUR-Oceans – European Network of Excellence for Ocean Ecosystems Analysis –, is another NoE under French coordination (European Institute for Marine Studies and Laboratoire d'Océanographie de Villefranche) which comprises more than 60 research institutes and universities from 25 countries. PAPA is a programme for a Baltic network to assess and upgrade an operational observation and forecasting system in the region. The PAPA consortium embraces all the institutions engaged in operational services or observation programmes in the Baltic Sea and is coordinated by the Danish Meteorological Institute.

The IOW considers its involvement in the **Baltic Sea Regional Programme** (BSRP) as special. The International Council for the Exploration of the Sea (ICES) is responsible for a component which comprises activities to develop ecosystem-based assessments and management of the Baltic Sea. One of the BSRP's ICES study groups is chaired by the IOW and the IOW signed a memorandum of understanding which covers joint sponsorship of workshops, exchange of expertise, visiting scientists, and co-operative research.

The IOW offers **guest visits** totalling 18 person-months per year financed by the institutional budget. In the past three years, 56 scientists spent time at the IOW: Five came from Germany, 51 came from abroad. Out of these 51 guests about 41% of them came from central and eastern European countries (11 persons), the EU and other western European countries (12 per-

sons), and 20% from Africa (11 persons) respectively. Nine people came from Asia, five from the USA, Canada and Australia. 31 scientists visited the IOW for less than one month, ten stayed for a period of one to three months and 15 for more than three months. Among the visiting guests were one Heisenberg postdoctoral fellow, one Marie-Curie doctoral fellow, one doctoral fellow funded by the German federal environmental foundation (DBU), one Fulbright fellow, three DAAD fellows and two doctoral fellows from Syria who were financed by their university. During the last three years, 32 visits to other institutes (frequently Namibia, Angola and South Africa) were undertaken by IOW scientists, 26 thereof for less than one month.

## 6. Results – Research, Development and Services

The IOW supplies **working material** for external users, too: It provides assessment reports, environmental data and sea floor maps to the Federal Maritime and Hydrographic Agency in accordance with the BSH contract. The data, comprising information about the measured parameters and their value from each cruise the Institute runs for the BSH, is stored in the MUDAB<sup>4</sup> database where it is available for interested users on demand. On its own homepage the IOW provides data products (graphs and figures) integrating the data from three autonomous measurement platforms. The assessment reports on the state of the Baltic Sea marine environment are published annually in "Marine Science Reports". Moreover, the IOW provides photographs of typical Baltic Sea phytoplankton species for the public. A continuously enlarged collection of 25 planktic algal species serves as the basis for numerous projects. Interested scientists can receive material on demand.

With 45,000 volumes and a broad thematic range covering all disciplines of marine science, the IOW library is the largest oceanographic library in Mecklenburg-Western Pomerania.

The IOW puts emphasis on peer-reviewed **publications** in internationally leading journals. Senior scientists and postdocs deliver a working and publication plan which is evaluated by the heads of the department. The IOW's publication record is internally assessed every year. Students have to attend seminars on how to write a paper. The thesis committees check which types of publication are suitable and manageable. The IOW's main strategy of increasing publications aims at motivating individual scientists. However, with the growing sophistication of the cost-performance tools the IOW intends to increase the performance based allocation of institutional support at the level of research foci. In 2004, a total of 115 papers (57 in peer-reviewed journals and 19 in others) were published by the Institute (2003: 129, 2002: 114), compared to 45 in 1996 (1995: 45, 1994: 40). More than 50% were published by the department of Biological Oceanography in 2004; in 2003, the department of Physical Oceanography and Instrumentation had the largest publication share (40 %, see Appendix 7).

The IOW provides **consulting expertise** for public authorities, and reports on the IOW's activities serve as policy-forming documents in state and federal ministries. The director of the IOW is a member of the scientific advisory council to the Environment Minister of the state of Mecklenburg-Western Pomerania. Four IOW scientists are members of the German Scientific Commission for Marine Research (DWK) which formulates the German contribution to ICES activities. ICES itself represents a prime source for advice on marine ecosystems to governments and international regulatory bodies. 13 IOW scientists are members of corresponding committees, working and study groups. Four scientists are members of HELCOM committees and working

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<sup>4</sup> Marine and environmental data base at the BSH

groups. The HELCOM and ICES working groups are strongly intertwined. Members of the IOW serve on several international scientific committees and steering groups. The IOW considers the following to be the most important: SCOR, GEOHAB, GLOBEC, GOOS-COOP, UNEP-CARM and ESF-Marine Board.

The most important instruments for the **dissemination of results** are publications in peer-reviewed journals and oral and poster presentations at scientific conferences. The IOW uses four main instruments to disseminate scientific results to the *general public*: press releases, lectures and events for laymen and pupils, publishing in the internet or in brochures, and open days in the Institute and on board the research vessels. One example are the so called "Warnemünde Evenings" which have taken place weekly during the three summer months since 1997.

The IOW encourages its employees to present their results at prestigious conferences as well as holds **conferences** itself. The Institute calls attention to the following conferences: It initiated, organised and hosted the first *Baltic Sea Science Conference* in 1998 as the only conference joining physical oceanographers, marine chemists, marine biologists and marine geologists under the one umbrella of Baltic Sea Research. In 2007, the IOW will again host this conference together with the University of Rostock. The IOW initiated the *Warnemünde Turbulence Days* in September 2003. This biannual workshop focuses on basic research on marine turbulence. In December 1999, the IOW initiated and supported a *Dahlem Conference* on 'Science and Integrated Coastal Zone Management'. The conference served as a working platform for the exchange of ideas on how to improve the integration of generic research in planning and implementing corresponding projects. Besides these regular events other conferences with more specific perspectives took also place: During the reporting period, the IOW hosted i. a. the Annual Conference of the Association for Stable Isotopes (ASI), the 11<sup>th</sup> International Congress on Numerical Sea Modelling (JONSMOD) and the Annual Conference of the German Association of Geography's Working Group 'Geography of coasts and seas'. Apart from these conferences on a major scale the Institute organised 22 workshops in the years 2002 to 2004 which were mainly dedicated to international or national projects. The Institute hosted nine other workshops or sessions.

According to the IOW, scientists from the IOW were invited approximately 140 times to hold **lectures**, either at colloquia, workshops or conferences in the years 2002 to 2004. In 12 cases they were invited for keynote lectures.

Various IOW scientists received the following **awards** and honorary titles. A head of department was granted the Krumbein-Medal by the International Association of Mathematical Geology and was appointed a foreign member of the Russian Academy of Natural Sciences and the Lithuanian Academy of Sciences. Another scientist was granted the Alexander von Humboldt Award for his scientific work by the Belgian Fonds National de la Recherche Scientifique (FNRS). The German language branch of the Society of Environmental Toxicology and Chemistry dedicated its award for young scientists to a junior scientist for her dissertation.

## **7. Implementation of German Science Council's Recommendations**

### Research programme and output

a) *The number of publications must be increased.*

In 2004, the IOW published 115 papers compared to 45 in 1996 (see Appendix 7).

*b) In future, the IOW should strive for patent applications, if necessary in cooperation with small and medium sized enterprises. Cooperation with private companies should be improved.*

A new cross sectional task 'coastal seas and society' was added to the newly designed research programme in 2002 in order to scrutinize the Institute's research results for possible products for non-scientific users. Examples are the development of information and assessment tools based on satellite images (SIBIK), studies on the impact of offshore wind energy plants (BEOFINO) or wind parks (QUANTAS), projects which are run in close cooperation with related authorities on federal or state level. In a few cases, cooperation with environmental consultancies turned out to be an advantage to the project consortium.

The instrumentation group at the IOW is successfully working with small and medium-sized firms on the modification of existing sampling and measurement techniques (e.g., special water bottles, fluorescence probes and wave compensating winches). The IOW encourages these firms to look for commercial exploitation, but does not have the capacity to apply for patents on its own.

#### *c) Research Foci*

- *"Water exchange between North and Baltic Sea, supply of oxygen in deep waters": The IOW should also take the inclusion of biological themes into consideration.*

- *"Exchange of energy and matter between coastal waters and the open sea": The IOW should check whether macrozoobenthos and bioturbation can also be studied within this focus.*

- *"Processes in the water column and at boundary layers": The single projects listed under this umbrella are to a large extent not connected. The thematic focus on processes in the water column and at the boundary layers is not convincing. With respect to the envisaged Baltic Sea models, the processes on the sea floor have to be included into the investigations. In case the IOW does not have the capacity or the know-how for such work, cooperation with external working groups should be sought in order to include this field. Moreover, investigations on process velocity and a review of the redox processes in the Baltic Sea are missing.*

- *"Long-term changes in the Baltic Sea": The actuo-geochemical research on sediments should be enhanced and investigations of early diagenetic processes should be included.*

- *"Monitoring and related strategies": Modelling, although desirable, has only been done in isolated cases. The enhancement of modelling should be considered with this focus.*

The IOW adjusted the long-term research programme in 2002 according to these recommendations.

#### Departments and Project Groups

*d) Department of Marine Geology: Investigations of sediments and process studies should be intensified.*

IOW scientists have intensified this research. The work of Kay Emeis and its continuation, also the profile for the successor of Emeis, take account of this recommendation. Intensive sediment investigations have been carried out by Wolfram Lemke (sedimentology), Rudolf Endler (geophysics) and Thomas Leipe (geochemistry). The cross sectional project DYNAS also intensively studied sediment behaviour.

*e) Department of Marine Chemistry: Due to positions that are still unoccupied, important inspiration is lacking. This urgently has to be improved.*

The C3-position was filled in 1998 (McLachlan) as a catalyst for very successful research in the field of organic pollutants. In 2001, the newly-filled C4-position (Schulz-Bull) promoted the IOW's biogeochemistry research. McLachlan left the Institute in October 2003 and organic pollutant work has been somewhat reduced since then. Schulz-Bull took over the monitoring and intensified cooperation with the department of biological oceanography with regard to biomarker work. McLachlan's former position will now concentrate on more general biogeochemical research to foster cooperation between the department of marine chemistry and the department of marine geology.

*f) Department of Biological Oceanography: Benthos research should be intensified.*

Benthos research at the IOW encompasses research on the effect of organic pollutants. For five years, Stefan Forster worked on benthic processes before he took over a position at the University of Rostock. Michael Zettler works on benthic species, their habitat and diversity. There is close cooperation with Gerd Graf's benthos group at the University of Rostock as well as with respective groups at the University of Klaipeda, Lithuania.

*g) Department of Physical Oceanography and Instrumentation: The department of Physical Oceanography can be further integrated and coupled with the other departments. The processes studied by the department should increasingly be transferred to computer simulations.*

This has been done; examples are GLOBEC or DYNAS.

*h) Project group "System modelling": The modelling strategy should be thought over and a more analytical and diagnostic approach is recommended. To create the envisaged Baltic Sea ecosystem model, high quality data is needed as well as convincing theoretical studies. Processes on the sea floor should also be included in the modelling. Furthermore, some physical aspects, for example hydrodynamics, should be taken into consideration.*

The work on a 3D ecosystem model of the Baltic Sea has progressed considerably. Advances have been made particularly with regard to both the physical circulation and biogeochemical model components. The first generation of the biogeochemical models successfully depicted the lower food web including the development of anoxia in the layers below the halocline. Theoretical work was focussed on the description of zooplankton and a consistent theory was developed to describe the life cycle of copepods and subsequently also the behavioural aspects of their vertical migration.

*i) Project Group „Messtechnik“/Instrumentation Group: It is regrettable that this group has not yet applied for any patents. An intensified scientific exchange with groups from other institutes, for example from other Baltic Sea countries, would be of mutual benefit.*

The work of the group is focused on the integration of different products from collaborating partners (SME and scientific institutions) into a system geared to the needs of the IOW. The IOW does not consider it practical to patent them. Since the last evaluation, the instrumentation group has considerably strengthened its national and international cooperation (in the USA and Europe) with firms and institutes and has improved its direct and fast technology transfer. In the Baltic Sea, the group works together with FIMR (Finland) on ships of opportunity measuring systems, with SMHI (Sweden), Marine Institute Tallinn (Estonia), DHI Water & Environment (Denmark) and Danish Meteorological Institute on monitoring data transfer and processing, and with three Polish institutions on monitoring strategies and underway sampling devices.

### Organisation, personnel and equipment

*j) Wherever it is possible, open positions should be filled only for limited periods.*

No scientist, except in the C-positions, has been given a permanent contract since 1997.

*k) The number of third-party funded positions should be increased.*

The number of third-party funded scientists has more than doubled from 12 in 1997 to 29 in 2004. Ten technicians were third-party funded in 1997. The IOW had a minimum of five positions in 1998 and a maximum of 11 third-party funded positions for technicians in 2002. In 2004, nine technicians were third-party funded.

*l) The duration of financial support for doctoral fellows should not be extended beyond the completion of their doctorates. The coaching of doctoral fellows should be intensified.*

The funding period for doctoral students is three years. There is a possibility to apply for a three month extension in special cases. The IOW's Scientific Board confirmed that by comparison with other marine institutions this is at the lower end of the length of time allowed to a doctoral student.

*m) The duration of financial support for post doctoral fellows should not exceed two years.*

After the last evaluation, the IOW restricted the employment of postdocs to two years. This turned out to be a disadvantage in competing for the best-qualified candidates. Today, the IOW employs young scientists with a time limit of two years with the prospect of a third year extension. Scientists who have already gained several years of experience in research after their dissertation are offered a three year contract with the prospect of a two year extension. This practice has proven effective in attracting postdocs and is common practice.

*n) In the future the necessity for three internal committees (Scientific Advisory Council, Steering Committee, Professorium) should be examined.*

The Professorium no longer exists. The Scientific Advisory Council is the only statutory internal advisory group. The so-called Steering Committee, comprising, besides the director, the heads of the departments, the scientific coordinator and the head of the administration unit, is an informal group assisting the director in research management.

*o) The IOW should attempt to hold a plenary assembly once a year to discuss the research programme.*

The IOW holds a plenary assembly at least once a year during which the director reports on the success of the research, development plans and administrative issues.

*p) During the period 1994 to 1996, increasing sums were acquired from the German Science Foundation, which nevertheless could still rise. It is expected that the IOW will be actively involved in competition for this kind of soft money after the German Science Foundation opens their funding procedure for research topics along the main lines of the research programmes of institutes in the Leibniz Association.*

The IOW regularly and successfully submits proposals to the DFG. From 2002 (€ 286,000) to 2004 (€ 540,000 ) the DFG funds nearly doubled.

*q) Sufficient ship time for fulfilling the task of monitoring routines is indispensable for the IOW.*

The replacement of the 54 year-old research vessel PROFESSOR A. PENCK was difficult to achieve parallel to the construction of r/v MARIA S. MERIAN and the extension of the IOW building. Although the Scientific Board repeatedly stressed the urgent need for a replacement at al-

most every session, the funding was not available. Most recently, the Ministry of Science and Education of Mecklenburg-Western Pomerania has launched a new attempt applying for additional EU funds.

#### Cooperation and promotion of young scientists

*r) As with the University of Rostock, the Institute should sign a cooperation contract with the University of Greifswald.*

The contract was signed in 1998.

*s) An integrated master course should be offered to biology, geology, chemistry and physics graduates.*

The IOW has developed an interdisciplinary masters course for Marine Environmental Observations and Assessment. Although the implementation as a regular offer at the University of Rostock failed because of the lack of lecturing personnel, all elements of this curriculum were integrated in the newly designed bachelor and masters curricula of marine biology and environmental chemistry at the University of Rostock and marine geosciences at the University of Greifswald. Additionally, modules of this curriculum were taught in summer schools.

*t) The research partnership with Russian institutions should be continued and if necessary intensified.*

The IOW has continued and intensified cooperation with Russian partners (e. g. POMOR).

*u) Cooperation with private enterprises should be built up and soft money should increasingly be acquired within this field. The foundation of small and medium enterprises by former IOW employees and graduates should be encouraged.*

The IOW regards the spin-off recommendation critically as the main working field of the Institute is basic research in oceanography which could mainly lead to the foundation of environmental consultancies. The Institute considers that under the present economic conditions, there is only a very restricted market in Mecklenburg-Western Pomerania for such activities, which is currently oversaturated. Nevertheless, employees are regularly informed about special programmes for young business founders offered by The University of Rostock.

*v) The number of diploma students could be enlarged. They should be encouraged to study for the doctoral degree.*

Between 2001 and 2004, the number of diploma students was increased to about 30.

*w) Postdocs from abroad (including eastern European scientists) should be integrated into the research for the benefit of new approaches and the improvement of international cooperation.*

Due to the limited number of postdoc positions, this has only been realised in a few cases. However, the IOW has increasingly financed short-term visits by young scientists from abroad within the framework of the guest programme.

*x) The number of guest scientists could be increased.*

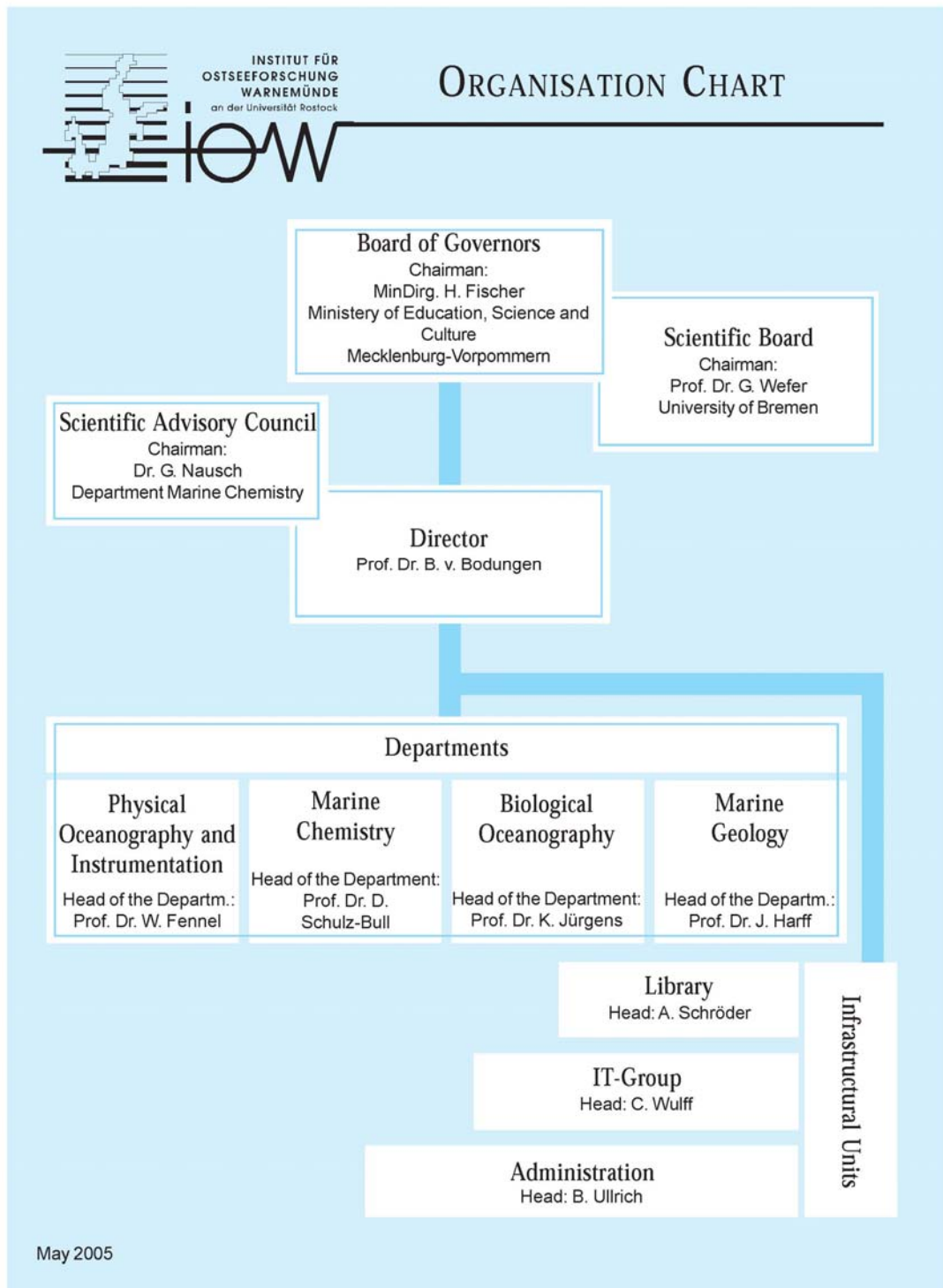
The number of guest scientists increased from 50 in the period 1994 -1997 (duration: one week to several months) to 56 in the period 2001-2004 (duration: one month to more than three months). The different duration of the visits has to be taken into account.

*y) IOW scientists and postdocs should aim for more research visits abroad.*

This has not been significantly increased. However, in the framework of cooperative projects numerous short-term visits by IOW scientists to partner institutes take place.



**Appendix 1**



## Appendix 2

### Financial resources and allocation of resources

(Figures in € 1,000)

	2004 <sup>1</sup>	2003	2002
<b>I. Financial resources (income)<sup>2</sup></b>	<b>14,633</b>	<b>13,448</b>	<b>13,857</b>
1.1 Institutional funding	10,960	10,747	10,237
- Federal States <sup>2</sup>	4,217	4,006	3,748
- Federal Government <sup>2</sup>	4,217	4,006	3,748
- Administrative Agreement BSH monitoring	2,525	2,735	2,741
<i>Institutional funding as a proportion of total financial resources (in %)</i>	74.9	79.7	73.9
<i>Institutional funding as a proportion of total financial resources – both numbers exclusively BSH (in %)</i>	69.6	74.5	67.4
1.2 Research support	2,959	2,137	2,348
<i>As a proportion of total financial resources (in %)</i>	20.2	15.8	16.9
<i>As a proportion of total financial resources exclusively BSH funding (in %)</i>	24.4	19.9	21.1
1.3 Services, contracts, licences, publications : administrative agreement BSH (monitoring)	0	0	0
<i>As a proportion of total financial resources (in %)</i>	0	0	0
<i>As a proportion of total financial resources exclusively BSH funding (in %)</i>	0	0	0
1.4 Other third-party resources	570	57	660
<i>As a proportion of total financial resources (in %)</i>	3.9	0,4	4.8
<i>As a proportion of total financial resources exclusively BSH funding (in %)</i>	4.7	0.5	5.9
1.5 Withdrawal from reserves and the like	144	507	612
<b>II. Expenditures</b>	<b>14,475</b>	<b>13,667</b>	<b>13,938</b>
2.1 Personnel	7,230	7,489	7,276
2.2 Materials, supplies, equipment	4,662	4,853	4,707
2.3 Investments (not incl. building investments)	997	1,124	1,285
2.4 Building investments <sup>3</sup>	1,084	57	163
2.5 Special positions	0	0	0
2.6 Allocations to reserves (where applicable) <sup>4</sup>	502	144	507
2.7 For information only: DFG charges	196	194	202

<sup>1</sup> Previous complete calendar year; preliminary data where applicable

<sup>2</sup> Funding according to BLK decision

<sup>3</sup> Building investments, multi-annual measures for building maintenance, land acquisition incl. demolition

<sup>4</sup> Annual surplus

### Appendix 3

#### Third-party resources classified by organisational unit<sup>1</sup>

(Figures in € 1,000)

	2004 <sup>2</sup>	2003	2002
<b>I. Total</b>	<b>2,959</b>	<b>2,137</b>	<b>2,348</b>
- DFG (German Research Foundation)	540	469	286
- Federal Government	1,883	1,147	1,623
- Federal States	0	0	0
- EU project funding	447	521	365
- Foundations, other research support	89	0	74
- R&D assignments, co-operation with industry, services, licences <sup>3</sup>	0	0	0
<b>II. By organisational unit</b>			
<b>Marine Chemistry</b>	<b>121</b>	<b>219</b>	<b>335</b>
- DFG (German Research Foundation)	43	71	127
- Federal Government	0	25	109
- Federal States	0	0	0
- EU project funding	75	123	62
- Foundations, other research support	3	0	37
- R&D assignments, co-operation with industry, services, licences <sup>3</sup>	0	0	0
<b>Biological Oceanography</b>	<b>1,244</b>	<b>1,001</b>	<b>960</b>
- DFG (German Research Foundation)	317	161	0
- Federal Government	546	451	741
- Federal States	0	0	0
- EU project funding	305	389	201
- Foundations, other research support	76	0	18
- R&D assignments, co-operation with industry, services, licences <sup>3</sup>	0	0	0
<b>Physical Oceanography and Instrumentation</b>	<b>1,161</b>	<b>484</b>	<b>655</b>
- DFG (German Research Foundation)	0	0	34
- Federal Government	1,085	475	516
- Federal States	0	0	0
- EU project funding	67	9	102
- Foundations, other research support	9	0	3
- R&D assignments, co-operation with industry, services, licences <sup>3</sup>	0	0	0
<b>Marine Geology</b>	<b>433</b>	<b>433</b>	<b>398</b>
- DFG (German Research Foundation)	180	237	125
- Federal Government	252	196	257
- Federal States	0	0	0

	<b>2004<sup>2</sup></b>	<b>2003</b>	<b>2002</b>
- EU project funding	0	0	0
- Foundations, other research support	1	0	16
- R&D assignments, co-operation with industry, services, licences <sup>3</sup>	0	0	0

<sup>1</sup> Actual expenditure in each year classified by financial resource; not incl. money in transit.

<sup>2</sup> Preceding complete calendar year

<sup>3</sup> Without BSH funding

## Appendix 4

### Staffing acc. to sources of funding and pay scale<sup>1</sup>

- Personnel (financed by institutional and third-party resources) in terms of full-time equivalents  
[reporting date 31.12.2004] -

	Total number <sup>2</sup>	Number financed by		
		Institutional resources <sup>2</sup>	BSH contract <sup>2</sup>	Third-party resources <sup>2</sup>
<b>Total</b>	<b>146.2</b>	<b>84.3</b>	<b>32.0</b>	<b>30.0</b>
<b>1. Academic and higher management staff</b>	<b>63.3</b>	<b>34.3</b>	<b>11.0</b>	<b>18.1</b>
C4	4.0	4.0	0.0	0.0
C3	2.0	2.0	0.0	0.0
BAT I / A 16	0.0	0.0	0.0	0.0
BAT Ia / A 15	4.0	4.0	0.0	0.0
BAT Ib / A 14	15.8	9.5	4.0	2.3
BAT IIa / A 13	37.5	14.8	7.0	15.8
<b>2. Doctoral candidates<sup>3</sup></b>	<b>6.5</b>	<b>2.0</b>	<b>0.0</b>	<b>4.5</b>
<b>3. Other staff</b>	<b>76.4</b>	<b>48.1</b>	<b>21.0</b>	<b>7.3</b>
BAT III, IV / A 12, A 11, A 10	21.5	10.0	6.0	5.5
BAT V / A 9, A 8	18.5	9.5	9.0	0.0
BAT VI / A 7	14.4	10.6	2.0	1.8
BAT VII, VIII / A 6, A 5	13.0	9.0	4.0	0.0
Wage brackets, other staff	6.0	6.0	0.0	0.0
Trainees	3.0	3.0	0.0	0.0

<sup>1</sup> Employment positions acc. to BAT or other collective pay agreements for staff financed by institutional or third-party resources (incl. trainees and guest scientists, but excl. diploma students, student assistants and contracts for work and services)

<sup>2</sup> In full time equivalent; correct to only one decimal place

<sup>3</sup> Doctoral candidates at IOW generally receive BAT-O IIa/2-contracts

**Appendix 5****Staffing acc. to organisational unit**

- Personnel (financed by institutional and third-party resources) in terms of full-time equivalents  
[reporting date 31.12.2004] -

	<b>Total</b>	<b>Academic and higher management staff<sup>1</sup></b>	<b>Doctoral candidates<sup>2</sup></b>	<b>Other staff, trainees</b>
<b>Entire establishment</b>	<b>146.2</b>	<b>63.3</b>	<b>6.5</b>	<b>76.4</b>
<b>Direction/Library</b>	5.5	2.0	0.0	3.5
<b>Administration</b>	13.8	1.0	0.0	12.8
<b>IT-Group</b>	6.0	4.0	0.0	2.0
<b>Physical Oceanography and Instrumentation</b>	38.0	20.0	0.0	18.0
<b>Biological Oceanography</b>	37.1	20.3	3.5	13.3
<b>Marine Chemistry</b>	19.5	5.0	1.5	13.0
<b>Marine Geology</b>	26.4	11.0	1.5	13.9

<sup>1</sup> BAT IIa and above (not incl. doctoral candidates)

<sup>2</sup> If financed by institutional or third-party resources

## Appendix 6

### Personnel

- Individuals (financed by institutional (incl. BSH) and third-party resources) acc. to pay scale [reporting date 31.12.2004] -

	Total number	Financed by third-party resources		Financed by BSH		Temporary contracts		Women		Women on temporary contracts	
		Number	%	Number	%	Number	%	Number	%	Number	%
<b>I. Total</b>	<b>168</b>	<b>36</b>	<b>21.4</b>	<b>32</b>	<b>19</b>	<b>57</b>	<b>34</b>	<b>73</b>	<b>43.5</b>	<b>20</b>	<b>27.4</b>
<b>1. Academic and higher management staff</b>	<b>67</b>	<b>20</b>	<b>29.9</b>	<b>11</b>	<b>16.5</b>	<b>28</b>	<b>42</b>	<b>11</b>	<b>16</b>	<b>4</b>	<b>36</b>
- C 4	4	0	0	0	0	0	0	0	0	0	0
- C 3	2	0	0	0	0	0	0	0	0	0	0
- I / A 16	0	0	0	0	0	0	0	0	0	0	0
- Ia / A 15	4	0	0	0	0	0	0	1	25	0	0
- Ib / A 14	17	3	18	4	23.5	6	35	1	6	0	0
- IIa / A 13	40	17	42.5	7	17.5	22	55	9	22.5	4	44
<b>2. Doctoral candidates<sup>1</sup></b>	<b>13</b>	<b>9</b>	<b>69</b>	<b>0</b>	<b>0</b>	<b>13</b>	<b>100</b>	<b>7</b>	<b>54</b>	<b>7</b>	<b>100</b>
<b>3. Other staff</b>	<b>88</b>	<b>7</b>	<b>8</b>	<b>21</b>	<b>24</b>	<b>16</b>	<b>18</b>	<b>55</b>	<b>62.5</b>	<b>9</b>	<b>16</b>
- III	25										
- IV	23										
- V	18										
- VI	13										
- Wage groups, other staff	6										
- Trainees	3										

<sup>1</sup> Doctoral candidates at IOW generally receive BAT-O IIa/2-contracts

## Appendix 7

### Publications

- Total number and classification by organisational unit<sup>1</sup>-

	2004	2003	2002
<b>I. Total number of publications</b>	<b>115</b>	<b>129</b>	<b>114</b>
- Monographs (authorship)	5	2	8
- Monographs (editorship) <sup>2</sup>	7	3	0
- Contributions to collective works	27	53	45
- Papers in peer-reviewed journals	57	51	50
- Papers in other journals	19	20	11
- Working Papers / Discussion Papers	0	0	0
- Electronic publications <sup>3</sup>	0	0	0
<b>II. By organisational unit</b>			
<b>Biological Oceanography</b>	<b>59</b>	<b>36</b>	<b>43</b>
- Monographs (authorship)	3	1	3
- Monographs (editorship) <sup>2</sup>	5	0	0
- Contributions to collective works	17	10	23
- Papers in peer-reviewed journals	25	14	13
- Papers in other journals	9	11	4
- Working Papers / Discussion Papers	0	0	0
- Electronic publications <sup>3</sup>	0	0	0
<b>Marine Chemistry</b>	<b>12</b>	<b>17</b>	<b>16</b>
- Monographs (authorship)	0	0	0
- Monographs (editorship) <sup>2</sup>	0	0	0
- Contributions to collective works	0	8	5
- Papers in peer-reviewed journals	9	6	9
- Papers in other journals	3	3	2
- Working Papers / Discussion Papers	0	0	0
- Electronic publications <sup>3</sup>	0	0	0
<b>Marine Geology</b>	<b>16</b>	<b>25</b>	<b>26</b>
- Monographs (authorship)	0	1	0
- Monographs (editorship) <sup>2</sup>	1	1	0
- Contributions to collective works	7	11	6
- Papers in peer-reviewed journals	6	12	17
- Papers in other journals	2	0	3
- Working Papers / Discussion Papers	0	0	0
- Electronic publications <sup>3</sup>	0	0	0



	2004	2003	2002
<b>Physical Oceanography and Instrumentation</b>	<b>28</b>	<b>51</b>	<b>29</b>
- Monographs (authorship)	2	0	5
- Monographs (editorship) <sup>2</sup>	1	2	0
- Contributions to collective works	3	24	11
- Papers in peer-reviewed journals	17	19	11
- Papers in other journals	5	6	2
- Working Papers / Discussion Papers	0	0	0
- Electronic publications <sup>3</sup>	0	0	0

<sup>1</sup> Each publication is counted only once and is assigned to one organisational unit.

<sup>2</sup> Contributions to a monograph, edited by employees of the establishment, are listed in "Contributions to collective works".

<sup>3</sup> Only electronic publications which have not been published in printed form, e.g. CDs, electronic manuals

## Appendix 8

### Documents submitted by IOW

- 1.1 Organisation chart
- 1.2 List of IOW departments
- 1.3 Statutes (only in German)
- 1.4 BSH-contract "Oceanographic Tasks in the Baltic Sea" (in German only)
- 1.5 Research programme
- 1.6 Implementation plan (2004 – 2006)
- 1.7 Biannual report (2003/2004) (in German only)
- 2.1 Last report of the Scientific Board
- 2.2 Minutes of the sessions of the Scientific Board (synthesis paper in English only)
- 2.3 List of the members of the Scientific Board (in German only)
- 3.1 Revenues and expenditures
- 3.2 Third party resources
- 3.3 Project list
- 3.4 Current budget (in German only)
- 4.1 Employment positions acc. to sources of support and pay/remuneration grade
- 4.2 Employment positions acc. to organisational units
- 4.3 Personnel: third party funding, temporary contracts, women
- 4.4 Academic and higher management staff: age and duration of employment
- 4.5 List of employees who have been offered a chair or professorship
- 5.1 Guest visits to the Institute
- 5.2 Visits by the Institute's staff
- 5.3 List of lectures and courses
- 5.4 Promotion of female scientists: "Come back to research" programme (in German only)
- 5.5 Promotion of PhD students (only in German)
- 5.6 Regulations to assure good scientific practice (in German only)
- 5.7 Cooperation contract with the universities of Rostock and Greifswald (in German only)
- 5.8 List of KDM members
- 6.1 Quantitative overview of publications
- 6.2 Publication list
- 6.3 List of the 10 most significant publications
- 6.4 Impact factors
- 6.5 Brochures and lectures for laymen (in German only)
- 7.1 Poster abstracts

## Annex B: Evaluation Report

### Leibniz Institute for Baltic Sea Research Warnemünde at the University of Rostock (IOW)

#### Contents

##### Abbreviations

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Appendix: Participants in the Evaluation Committee, Representatives of Cooperating Institutions

## List of Abbreviations

BASYS	Baltic Sea System Study
BSH	Federal Maritime and Hydrographic Agency <i>Bundesamt für Seeschifffahrt und Hydrographie</i> )
DFG	German Research Foundation ( <i>Deutsche Forschungsgemeinschaft</i> )
ERANET	European Research Area Network
GLOBEC	Global Ocean Ecosystem Dynamics
GETM	General Estuarine Transport Model
GFDL	Geophysical Fluid Dynamics Laboratory
GEOS	Global Earth Observation System
GOOS	Global Ocean Observing System
GOTM	General Ocean Turbulence Model
HELCOM	Helsinki Commission: Baltic Marine Environment Protection Commission
ICES	International Council for the Exploration of the Sea
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
MOM-31	Modular Ocean Model PAP
PAP	Research Vessel „PROFESSOR ALBRECHT PENCK“
SAB	Scientific Advisory Board
SINCOS	DFG funded research group “Sinking Coasts - Geosphere, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea”
W2 position	associate professorship according to the rules governing the remuneration of the civil servants at universities
WR	German Science Council ( <i>Wissenschaftsrat</i> )

## 1. Summarised Evaluation and Relevance of the Institute

The IOW was evaluated as a research institute at the usual evaluation interval. The task of the expert panel was to assess the Institute's performance over the past seven years as well as the Institute's success in implementing the recommendations made by the German Science Council (WR) after the last evaluation in 1998.

To a large extent, the IOW has complied with the recommendations satisfactorily and has developed considerably. The Institute has managed to make good progress and to take an internationally leading role amongst research institutes dealing with environmental aspects of the Baltic Sea. The IOW is the only German institute that specifically addresses research problems related to the Baltic Sea. Germany has an important Baltic Sea coastline and is therefore expected to carry out research on the sea. Warnemünde is the ideal place for such a research institute. It is located directly on the Baltic Sea and is very close to two universities (Rostock and Greifswald) which facilitates integration in academia and helps provide access to university facilities and students.

The research activities are considered to be good and in parts very good. The Institute's research programme is convincing and competitive on an international scale. All of the Institute's activities have a clear focus on the Baltic Sea system, with comparative studies on relevant systems in non-Baltic areas. The Institute's main **strength** lies in its interdisciplinary lower trophic level ecosystem research, which is of high quality and should be encouraged. Working with three research foci supports the integration of the lower trophic level ecosystem approach. The IOW is regarded as unique for its observational activities. It thereby complements the marine sciences at universities very well. The monitoring and process-oriented observation programmes, which provide time series data reaching back several decades, are important and successful. These data are crucial for identifying and predicting the evolution of marine ecosystems as well as identifying the key processes forcing change.

The IOW has managed to build up a modelling system which is very effective in describing complex systems of an interdisciplinary nature. In general, the modelling activities are good with great potential in terms of their application to different marine research problems.

The Institute has longstanding experience of operating time-series stations equipped with state of the art sensor systems. The work on developing monitoring devices receives praise: The Institute has developed oceanographic equipment which is setting new standards for this type of hardware. The IOW should cooperate with private companies in order to transfer technological knowledge and equipment and potentially to benefit commercially from this advanced position.

The Institute is successful in obtaining third-party research funding. It is widely accepted as a lead-partner in international Baltic Sea research, both for its scientific excellence and for its proven capabilities in the coordination of joint programmes and large international interdisciplinary projects (for example *Baltic Sea System Study (BASYS)* within the *EU Framework Programme Marine Science & Technology*).

The IOW has close connections to Rostock University and Greifswald University. This cooperation works very well and includes, for example, joint appointments of professors, joint research activities as well as joint cruises and equipment.

There are also some **shortcomings**: IOW output measured by peer reviewed publications is not yet good enough and below international standards. The trend is positive, but action ought

to be taken to raise the number of publications in the international literature. Primary research findings from interdisciplinary efforts still await publication in peer reviewed journals.

With regard to attracting and educating doctoral students and post-docs, there is some room for improvement: The number of doctoral students should be increased and their mentoring improved. The IOW, in principle, is a very attractive place for starting a career, but it should advertise itself much better, particularly abroad.

Currently, the IOW has to deal with two resource problems affecting the basis of the Institute's research: Firstly, the IOW's ageing **research vessel**, the "PROFESSOR ALBRECHT PENCK" (*PAP*), has to be decommissioned. The IOW needs at least 220 days ship time per year on a relatively small vessel that should be flexible for multiple use. If the IOW does not have access to such a vessel, the research programme of the Institute will suffer. Therefore, the majority of experts support the replacement of the *PAP* by a new, small research vessel.

Secondly, the IOW's near-future research programme is also severely affected by the announced cutback in funding from the **Federal Maritime and Hydrographic Agency (BSH)**. Monitoring – long-term investigations in the open Baltic Sea – as part of the BSH contract is unique and should be continued. Therefore, the IOW should require additional institutional support in order to be able to compensate at least for the loss of the six positions which deal with the collection and interpretation of long-term oceanographic data sets in the open Baltic Sea. At the same time, the IOW is requested to put forward a strategy which concentrates on measures for coping with the loss of resources.

## 2. Mission, Tasks, Main Work Areas

It is essential to carry out an intensive research programme on the Baltic Sea since the Baltic is a very interesting marine system, which offers unique opportunities to study:

Firstly, there is only limited exchange of the Baltic Sea with the North Sea and thus with the oceanic systems. It covers salinity gradients from almost freshwater to brackish; depending on location, both thermal and salinity stratification can exist. This results in a range of stable pycnoclines. Because of these permanent stratifications, the Baltic Sea has deep anoxic basins that could be used as model systems for past anoxic events. Secondly, the Baltic Sea receives a large amount of nutrients that are responsible for the frequent and dense occurrence of algae blooms. However, cyanobacterial blooms occurred in the Baltic Sea before the onset of anthropogenic influences and hence are at least in part a natural phenomenon that is not yet completely understood. Thirdly, the cyanobacterial blooms result in significant inputs of combined nitrogen into the Baltic Sea through their capacity for nitrogen fixation. Since these blooms may be toxic, they are of great environmental and health concern. Also, these blooms may contribute to the development of anoxic conditions. The IOW is **unique** among the German oceanographic institutions in the sense that its main research focus lies on oxygen-deficient environments in general and the changing oxygenation state of deeps in the Baltic Sea by inflow events in particular. It is also unparalleled in its monitoring and has strong modelling capabilities. The Institute collects, maintains and analyses long term databases of physical, chemical and biological parameters in the Baltic Sea and develops coupled hydrodynamic ecosystem models. The microbial loop research performed at the interfaces between the prominent Baltic Sea haloclines and oxyclines is rated very high. In general, research at the IOW is state of the art in marine sciences.

The IOW's **mission statement** is quite broad. In effect, research cannot address all issues covered by the mission. Nevertheless, the IOW should consider intensifying research on levels above the microbial loop and on top down controls on the functioning of marine ecosystems, which have been shown as critical for understanding the interaction between climate, biogeochemistry and marine ecosystems. The Institute's activities follow a more traditional biogeochemical approach to marine research, one that the international community is moving away from towards integration across the fields of climate, biogeochemistry and marine ecosystems (e.g. the project *Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)*). Unlike other institutions in Germany, by strengthening upper trophic level research the IOW would have the potential to integrate across these disciplines, thereby putting it on the leading edge of coupled ecosystem biogeochemistry and food web research. Therefore, strengthening of upper trophic level research should be considered.

As yet, the IOW has not fully realised its **scientific potential** and has not taken advantage of the range of opportunities available to it. The IOW has the potential to become a world leader in interdisciplinary coastal sea research. The research programme is convincing and internationally competitive but could still benefit from an implementation plan for translating the monitoring-related research into effective, broadly appreciated science. The IOW has a rich, diverse long-term monitoring data set available in the areas of physical, chemical and biological coupling, biogeochemistry (including land-water interactions, nutrient, oxygen and xenobiotics cycling, water column-sediment interactions), ecology and environmental change (including water quality and habitat dynamics). However, these data have neither been fully exploited nor adequately elaborated as publications and other forms of communication such as presentations or interactive websites. For example, these data could be exploited by their incorporation in the development of predictive models by the modelling group.

**Interdisciplinarity**, as recommended by the German Science Council, has been approached between the individual departments of the Institute by overarching research foci. This kind of interdisciplinary teamwork, however, has not been properly reflected in joint authorship of publications. The research programme includes physical oceanography, marine biology, marine chemistry and marine geology. Cross-cutting activities such as modelling, measuring systems and marine technologies, and the transfer of knowledge have been designed to enhance integration in the Institute. The expertise of the departments is, as shown during the Institute's visit, genuinely and sensibly interlinked within the following research foci:

#### *Research Focus 1 "Transport and Transformation Processes in the Sea"*

This research focus is productive. It demonstrates successful interdisciplinary teamwork by covering different modelling activities which are joint efforts by biologists, geologists and physicists. The projects presented are good. The project group "Dynamics of oxygen depletion" dealing with high quality physical oceanographic modelling is unique in being able to make long-term runs of the Baltic Sea. The datasets and models used allow the IOW to determine and investigate freshwater inflows rapidly and efficiently. This is very fundamental to understanding suboxic or anoxic systems which can be found at many marine sites, e. g. at the coastal region of Namibia. The modelling activities in sediment dynamics are on the leading edge of marine science. However, the members of Research Focus 1 are hesitating about going into forecasting of future developments within the Baltic marine ecosystem at least in the 10-year term which would be manageable for them using the data sets and models available at the

Institute. The experts recommend examining whether forecasting activities are useful and can be conducted.

### *Research Focus 2 “Marine Communities and Matter Cycles”*

This research focus works very well. The groups collaborate with other IOW groups exploiting their data or providing results to the modelling group.

The project group working on nitrogen fixation presented high quality research. The Baltic Sea offers a unique opportunity to study carbon and nitrogen cycling around the halocline. The research on the nitrogen fixation of bacteria is a very interesting issue in the shallow sea, in particular given the growing problems to be seen in the Adriatic or Caribbean. The group should enhance its ability to more completely assess the nitrogen cycle and budget by coupling nitrogen fixation to other nitrogen transformations, especially nitrification and denitrification, and correlate its findings with developments in other marine systems. The Molecular Biology Group performs state of the art observational microbial loop research focused on distributions and rates associated at interfaces between the prominent Baltic Sea haloclines and oxyclines. This group is very active and contributes to defining the key players at the species level in the bacterial community. In order to increase prognostic capabilities in this area, the group will need to identify key processes and determine their rates for inclusion in modelling activities. Hence an experimental approach needs to be fostered by this group whereby parameterisation of rates and limits should be performed in the laboratory and incorporated in the development of predictive models by the modelling group.

Research on processes at the pelagic redoxcline is very important because the role of the chemo-autotrophs as well as algae in the water column is very important for carbon fixation in the central part of the Baltic Sea. This type of research could be a distinctive feature of the IOW, even a reason for post-docs to choose the IOW, for example.

The *GLOBEC* groups (*Trophic Interactions between Zooplankton and Fish under the Influence of Physical Processes*) conduct highly rated research. Research is primarily performed in conjunction with external partners and appears to be heavily dependent upon external funding. Activities presented follow a correlative approach utilizing time series to identify changes in the Baltic ecosystem at the level of phytoplankton. These activities are of particular importance for identifying changes in ecosystems such as regime and trophic shifts. However, it should be noted that the “correlative approach” is not predictive due to the non-linear and complex interactions within and between species, which combine with abiotic forcing to modify the structure and function of ecosystems. Based on the direction pursued by the international community, which recognises the need to encompass the dynamics of ecosystems from end to end, a strengthening of this group and adoption of a mechanistic, process-oriented approach including field and laboratory activities seems advisable.

The Molecular Biology Group and the *GLOBEC* groups should communicate more and try to integrate their findings. In general, the research focus is concentrated on a microbial loop approach to marine ecosystems as is evidenced by the equipment and general activities of the Department of Biological Oceanography. A more diverse approach to marine ecosystems following the lead of *IMBER* is needed if the IOW wants to live up to its claim of being dedicated to the entire Baltic marine ecosystem. Nevertheless, setting up a molecular lab is a useful addition to the traditional methods. The application of molecular ecology is important and successful and developing very well.



### *Research Focus 3 “Changing Marine Ecosystems and Internal Change”*

Research Focus 3 has a convincing conceptual framework. The groups look at issues of change in the Baltic Sea ecosystem on various time scales determined by geological processes, climate driven changes of the hydrography or anthropogenic influences. They have achieved good research results. They are active and enthusiastic, working on a truly interdisciplinary basis.

The work of the geological group on the Baltic region coupled with the North Atlantic is of high quality. This also holds true for the biogeochemical interdisciplinary work on the data from the Baltic Sea repeat station network. The analysis of inter-annual to decadal changes in the standard hydrographical parameters in the deep basins should be improved by closer interaction with the modelling group. This will help to clarify the dynamics behind the ocean and atmosphere interaction processes involved.

The group, which studies the interesting linkage between the Atlantic climate and changes of the hydrographic conditions in the Baltic Sea, works with its own models. It cannot team up with the modelling group because of the specific times scales. Another group deals successfully with the time series of 30 and 40 years and its interpretation. Research in this focus on water columns and sediments, or chemical and biological aspects, is rather uncoupled. By linking these aspects and strengthening hypothesis-oriented research the publication record in this research focus could be improved. The scientists perform excellent research but should produce more interesting publications.

### *Cross Cutting Activity “Modelling”*

The IOW has managed to build up a modelling system which is very effective in describing complex systems of an interdisciplinary nature.

Two groups form the basis of the Cross Cutting Activity “Modelling”: the Hydrodynamic Modelling Group and the Ecosystem Modelling Group.

The Hydrodynamic Modelling Group is remarkably active, in particular with respect to turbulence modelling based on the General Ocean Turbulence Model (GOTM) and the General Estuarine Transport Model (GETM) family of models. The group is well regarded internationally with an excellent publication record. The group is relatively new but shows a great deal of potential.

The Ecosystem Modelling Group is one of two groups worldwide developing structured population models for marine copepods as food for larval and juvenile fish and, as such, is breaking new ground in this area. Furthermore, the group utilizes more classical *Nutrient, Phytoplankton, Zooplankton, Detritus (NPZD) Ecosystem Models* to assess the impact of eutrophication on Baltic Sea lower trophic level dynamics. The ecosystem models are of intermediate complexity. They should be extended and in particular be exploited more in the testing and identification of hypotheses. Although very active in the developing and application of these models, the number of publications by the group is low. A large number of *grey literature* is generated by this group, signalling a focus on report generation rather than publication in internationally reviewed journals. This publication focus should be modified where possible using reports as first drafts of manuscripts for publication. Although the Ecosystem Modelling Group at the IOW is very good at integrating physical, biological, chemical and geological processes, more discussion with marine ecologists, chemists and fisheries scientists on the development of pertinent hypotheses is necessary, particularly as the group had difficulty

presenting their future vision apart from the further development and validation of the models. For a breakthrough in ecosystem modelling, experts in bio-geo-chemical system modelling should be brought in.

The well known circulation model *Modular Ocean Model (MOM-31 or 3-D Princeton Model)* developed at the Geophysical Fluid Dynamics Laboratory (GFDL, Princeton, USA) was adopted by the IOW for the Baltic Sea. This circulation model reproduces fluctuating flows, upwelling and downwelling, driven by the winds and fresh water inflows with sufficient resolution – laterally, vertically and temporally. Hence, the results can be combined with biological-chemical-geological ecosystem models. The circulation model is augmented with a wave model, an ice model, a phytoplankton model, a sediment resuspension model, and potentially a stage resolving copepod model. It has been combined with the remote sensing results to produce maps of the currents and sea surface parameters. It aids the interpretation of monitoring results by showing how the different features of the physical, chemical, and biological parameters are controlled by the circulation and interaction with each other. Significant results on the scenarios for reducing nutrient fluxes into the Baltic, for example, have been produced: By modelling the dynamics of diatoms, dinoflagellates and cyanobacteria under different nutrient regimes it has been shown that a reduction of nitrate input into the Baltic will result in an increased cyanobacteria bloom because of their ability to fix atmospheric nitrogen while still gathering the phosphorus from the water column. These modelling activities will play a major role in an expected future rise in the publication of papers in international journals, and it has already elicited praise for the IOW at international meetings.

The interdisciplinary collaboration within the Cross Cutting Activity “Modelling” could be enhanced. This group mostly consists of physical oceanographers, physicists and mathematicians, but should involve biologists, ecologists or biochemists to improve the modelling work.

Altogether, modelling activities are an important and strong area of the IOW’s work. Nonetheless, a conceptual debate about the goals of modelling is required. So far, the mathematical technicalities are overemphasised, while the aspects of the purpose of the models and of the added value in knowledge are not sufficiently discussed. The goal of data analysis and assimilation needs more attention; also decadal reconstructions and scenarios should be on the Institute’s agenda.

Most of the modelling activities at the IOW seem to be focussed on model development rather than the application of the model as a tool to test hypotheses and identify research gaps necessary to further the predictive capacities required to assess the impacts of global change on marine ecosystems. This should be reconsidered.

#### *Cross Cutting Activity “Instrumentation”*

The Instrumentation Group is very successful. It has developed different types of instrumentation, such as deep sea pumps. These pumps offer a unique opportunity to work at up to 400 m water depth. Other instruments developed are platforms for the long term monitoring at the Darss Sill and Arkona Sea. The *Spar* (Darss Sill) and *Buoy* (Arkona Sea) are cleverly designed and could set the standard for the Baltic-wide monitoring system that is envisaged under the *Global Ocean Observing System (GOOS)*. In general, the analytical devices being developed are urgently needed to get online data on processes. Some consideration has been given to spin-offs or patent applications that might ensue from these

developments. But given the limited demand for oceanographic instrumentation, it is unlikely the group would want to spend time getting patents, but rather should work with other institutions and local companies to get their technological developments disseminated around the Baltic and other coastal seas. There are oceanographic suppliers and current meter manufacturers (e.g., Nortek or Aanderaa) who might be interested in selling measurement platforms along with their instruments.

#### *Cross Cutting Activity "Coastal Seas and Society"*

This group develops concepts for activities of public interest related to the marine system, like wind parks, for example. It provides important information which helps public agencies to make decisions on a sound scientific basis. The research strategy is successful. The group is dynamic and forward looking, having strong potential for contributing to further sharpening the IOW's profile despite the minimal personnel input provided by the IOW. Current institutional support is regarded as insufficient. To provide a solid institutional basis for this activity the IOW could establish another joint appointment with a university, a *W2 position*, for example. Furthermore, it would make sense to create professional links to social and cultural sciences to broaden the expertise necessary for performing the tasks; at present, this group only comprises physicists. Besides this, there is some concern that the group might be operating like an engineering firm, thus competing unfairly. Therefore, this group should only deal with projects that cannot be done elsewhere on the free market.

The *Extra Baltic Activities* are very important and supplement the Baltic activities with results on different marine systems. These activities are carried out on a very high scientific level.

### **3. Structural Features and Organisation**

Currently, the IOW is a **legally dependent institution** of the State of Mecklenburg-Western Pomerania. Therefore, the Institute and the Ministry of Education, Science and Culture of Mecklenburg-Western Pomerania are requested to examine possibilities for changing this status and creating a legally independent institute.

The **administration** works very well. The cost accounting is fully operative. A draft programme budget has been presented. However, the programme budget does not yet relate expenditure to achievement at departmental or research group level and therefore should be revised. In general, the experts left with the impression that the spirit of the new funding mechanisms, which involves funding according to output as well as accountability for achievements, has not been sufficiently developed either at the Institute or in its bodies. This should be reconsidered.

The **Scientific Advisory Board (SAB)** is composed of ten internationally renowned scholars according to the rules of the Leibniz Association for Advisory Boards. The SAB was involved in the development of the research programme and particularly encouraged interdisciplinary work and cooperation with the IOW's academic partners. Internal evaluations have been carried out. However, the members should participate in the meetings more regularly. Results of the internal evaluations should be documented more clearly and in detail; critical observations should be clearly exposed.

As yet, the management has not introduced a convincing **quality management scheme**, comprising performance indicators for research and service output as well as suitable incentives. This should be done as soon as possible.

The general **working atmosphere** at the Institute is good and the management of human capital appears to be good as well. People enjoy working at the Institute. The communication across departments and research foci could be improved by discussing the Institute's overarching goals more intensively.

The IOW should actively work on improving the **mobility** of its researchers and doctoral students and on improving the Institute's **flexibility** in order to cope with the rapidly changing political and economical environment. Much of the Institute's research has strong regional and national components, but the ever more European structure of research has to be recognised and used to assure the IOW a top position in the research community.

#### 4. Resources, Expenditures and Personnel

In 2004, 25% of the IOW's budget was financed by **third-party sources**. By far the largest share came from the Federal Government. 18% of the revenue from third party activities came from the DFG and 15% from the EU. In general, the IOW is active and successful in its acquisition of research funds. The IOW could consider to put more effort in developing larger projects like Collaborative Research Centres, instead of acquiring a large number of small and rather diverse third-party projects. These small projects do not contribute to keeping a sharp profile in its research.

With the exception of research vessel capacity for local and regional work, the IOW is blessed with **excellent instrumentation**, computational and infrastructure support. In addition, there is a highly diverse support staff (technicians, secretaries, and administrative assistants) able to assist researchers.

The **replacement of the old research vessel** "PROFESSOR ALBRECHT PENCK" is urgently needed. The Institute, therefore, has put forward convincing arguments for a long-term requirement of 220 days of ship-time for local and regional work with a small vessel. The experts support these arguments. The majority of them stress that an institute like the IOW needs a small research vessel at its own, flexible disposal. A research vessel that can be frequently and quickly used is necessary for time series measurements (monitoring) and process-based observational programmes, but also for regular research and education. Moreover, it is one of the factors that make the Institute visible and attractive as a partner in cooperation.

Some of the experts are of the opinion that replacing the old research vessel by a new one could be too expensive. Therefore, less expensive options for providing 220 days of ship-time on an appropriate vessel could be investigated. These options could include some forms of public-private partnership with broader use of the ship, the foundation of a consortium which would own the ship, purchase of an existing vessel, charter, or leasing models.

Currently, around 42% of the total number of academic and higher management staff are employed on **temporary contracts**. The proportion of researchers on temporary contracts is satisfactory.

The Institute's **overhead** is acceptable given the size and capacity of the Institute. A few of the experts see some possibilities to further reduce the overhead. The IOW should check these possibilities. After thorough scrutiny, more efficient and cheaper administrative organisation might be achieved. This includes the high ratio of technicians to scientists (including post-docs and doctoral students). A lower ratio of technicians to scientists would almost certainly improve

the efficiency and scientific output. Therefore, the IOW should check whether the ratio is adequate.

In several cases, the **turnover of academic personnel** has been so rapid that the relevant expertise has hardly left any lasting imprint on capacity-building in the IOW research profile. Even though this fact reflects the quality of IOW research and the attractiveness of the IOW faculty for other research institutions and universities, it may prevent to develop a consistent research profile. Care has to be taken to improve this situation. The rules on employment duration relating to excellent scientists in non-permanent positions should be adjustable according to the individual scientific impact.

Currently, 32 permanent positions (11 scientists and 21 technicians) at the IOW are financed by a contract with the **Federal Maritime and Hydrographic Agency (BSH)**. The BSH will reduce its financial support – starting in 2008 with 11 positions no longer financed. This support is partly earmarked for monitoring, long-term investigations in the open Baltic Sea, which the German Science Council recommended continuing both in 1991 and 1998. The continuation of these investigations is an essential pillar of the ecosystem approach and necessary to maintain the IOW's leading role in the Baltic Sea. The existing time-series database provides oceanographic measurements reaching back several decades. It forms an essential component of long-term climate change studies in the Baltic region. Due to its importance, the unique monitoring programme should be maintained and the loss of six positions (four scientists and two technicians) should be compensated by additional institutional funding.

Beyond it, the IOW should be able to handle its budgetary problem and has, therefore, to develop a strategy reflecting the changing political and financial environment and thereby improve its flexibility. This strategy should include ways to become much more open to the global scientific community with regard to cooperation and the joint acquisition of third-party funds.

## 5. Promotion of Junior Academics and Cooperation

At present, 22 **doctoral students** work at the IOW, six of them from abroad. This number has increased since the last evaluation but is still too low, even considering that, at present, the number of diploma or doctoral students provided by the university partners is low. Therefore, the IOW should strengthen its active acquisition of doctoral students. In particular, the number of foreign doctoral students should be an issue for ongoing attention.

The doctoral students should be encouraged to publish their results in peer-reviewed journals while working on their theses, not only after completion. In order to open up possibilities for publications from theses, the experts suggest extending the IOW's maternity programme to all doctoral students in order to give them a six-month term for preparing a publication. The supervisors should make more efforts to promote publishing and to give instructions to students on how to publish. Moreover, the experts would appreciate that the doctoral students get the opportunity provided by the cooperating universities to write cumulative theses.

The rules relating to the supervision of doctoral students developed by the IOW should be applied consistently and the mentoring by thesis committees should be strengthened. Moreover, the IOW should consider educating its doctoral students in a structured programme carried out together with the cooperating universities Rostock and Greifswald. In general, there should be

much more guidance for both doctoral students and post-docs. A point needing attention is that the management should increase its involvement in the career perspectives of their doctoral students and young post-docs. It is important that these people have good prospects when they leave the Institute. If this is well managed, the Institute will become even more attractive for young scientists. In this context, the recommendation of the German Science Council to hire post-docs for a maximum period of two years should be reassessed in order to remain attractive for young, talented researchers from foreign research institutes.

The IOW has close ties to Rostock University and Greifswald University. This cooperation works very well and includes, for example, joint appointments of professors, joint research activities and joint cruises and equipment. The IOW's institutional support for the universities is substantial. Many IOW researchers give lectures at Rostock University or Greifswald University. Currently, the **teaching** load of the eight professors (six at Rostock University and two at Greifswald University) is four hours per semester each plus/minus 10% depending on whether special courses are offered. Thus, the IOW significantly contributes to the bachelor and master courses offered by the universities of Rostock and Greifswald. Within this framework, students from biology, chemistry and geology could be offered training in system modelling. In this way, on the longer time scale, more modelling expertise could be brought into the Institute.

The IOW is successful in obtaining research funding together with **cooperating partners**. Particularly the acquisition of the EU funded BONUS programme (Network of Baltic Sea Research Funding Agencies) is an important step towards maintaining the leading role in Baltic Sea research among the institutes of countries bordering the Baltic. Of special importance is the good relationship with research institutions in former Eastern Bloc countries. National research projects with the universities of Rostock and Greifswald, like the successful DFG funded research group *SINCOS (Sinking Coasts - Geosphere, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea)*, should continue to be carried out. Therefore, joint applications for third party funding should be developed.

The IOW is essential, even a driving force, for common international initiatives and joint research programmes. It contributes to international scientific cooperation such as to GEOS, HELCOM or ICES to a greater extent than any other institution. Further examples of successful cooperation are the initiatives *BASYS*, *ERANET* or *GLOBEC*. The Baltic institutes actually collaborate very closely, particularly with regard to the exchange of databases and technical equipment. However, there is some concern that the number of guest researchers from other countries visiting the Institute is very low as is the number of the guest visits by IOW researchers abroad. Both figures should be increased.

There is also some concern that the IOW has not always been the user or beneficiary of the collaborative research. Leading research institutions in the marine sciences are using the excellent technology developed at the IOW. Research results developed in these collaborations has led to publications in highly-ranked international journals, but, unfortunately, these publications are not joint publications with IOW researchers. In future, the IOW should be aware that scientific collaboration has to be reflected in joint publications with lead authors from both sides of the partnership. Therefore, when starting a cooperation both institutions together need to come up with a common publication plan whereby all of the participants in the cruises and scientific studies should be included in the authorship. This should also change if the IOW staff makes greater efforts to publish, communicate and apply collaborative monitoring and research results at an earlier stage. Concerning potential overlapping with the Leibniz Institute of Marine

Sciences (IFM-GEOMAR), an assessment of these areas should be performed at both institutes so that their research mandates can be better defined and overlapping reduced.

The IOW should make contact with small and medium companies. Cooperation with these companies is very important for succeeding in getting funds, especially by joint applications for EU funds. There are a lot of funding sources to be tapped, especially with partners from Eastern European countries. Cooperation with local companies should also aim at disseminating and transferring technological knowledge and equipment developed by the IOW. Thus, the IOW may benefit commercially from its advanced position in this field.

## 6. Results and Scientific Resonance

Overall, the IOW has made remarkable progress in **research output**. All of the three research foci and cross cutting activities carry out innovative research of high quality. A number of publications in peer reviewed journals have resulted from this development. In 2004, on average each IOW researcher, excluding doctoral students, published 0.9 peer reviewed papers. Including doctoral students, the average is 0.7 peer reviewed papers per researcher. However, the productivity of the staff members differs strongly.

Nevertheless, it should be noted that, in general, the level of publications, both in numbers per researcher as well as the quality of journals to which the researchers submit their manuscripts, is not yet good enough, resulting in a lack of impact at the international level. Far too many activities result in the generation of reports or *grey literature* which is in essence ignored on the international scene. This was already observed by the 1998 evaluation, and although efforts have been made to improve the situation, these have not had the desired effect. In making this assessment, the experts take into account that the publication of *grey literature* is – at least in part – a result of the IOW's heavy monitoring commitments. It is suggested that the scientists should spend the time they need for writing articles in *grey literature* for publications in peer-reviewed international journals as well as that *grey literature* should serve as the basis of first draft for an internationally reviewed article. Among these publications regular reviews should be included. Many of the IOW's publications deal with process-related issues and phenomena that currently reside in the monitoring data record. Besides this, there is also room for theoretical, probabilistic modelling and “perspective” papers that could take a more hypothetical, synthesis, “big picture” approach to dealing with a wide variety of physical, geological, biogeochemical and ecological issues relating to the Baltic, ranging from microbial- to fisheries-level processes and issues. The momentum and thrust for doing this need to be developed further.

The number of peer reviewed publications has to be increased. In particular, research results achieved in interdisciplinary team work have to be reflected in peer reviewed journals. By internal evaluations, the Scientific Advisory Board should pay particular attention to the assessment of the publication record. The Institute's management should check the publication record at the end of each year and account on the achievement to the Scientific Advisory Board. In order to improve the publication activities the management should offer seminars to *all* scientists on how to write publications. By and large, the experts are of the opinion that the IOW researchers are much better in person than in the publications ensuing from their research or even in the Institute's material prepared for the evaluation. The IOW understates its achievements. This impression refers to all departments, research foci and cross cutting activities. It results in the IOW's overall role and value being grossly under-appreciated by peer scientific communities and the public at large.

There are several examples of exciting, novel, fundamentally important Baltic Sea research results derived from the monitoring activities. These include the findings that, firstly, nitrogen fixation appears to be a far more important “new” nitrogen source in the Baltic Sea than previously realized, secondly, chemolithotrophic (dark) CO<sub>2</sub> fixation is an under-appreciated (as much as 30% of total) source of “new” primary production when compared to the more traditional photoautotrophic (light) driven production, thirdly, physical-chemical studies emphasise the important role of North Sea water in replenishing O<sub>2</sub> in bottom waters of the Baltic Sea, and fourthly, long-term chemical studies have shed light on the relative bioavailability and biogeochemical importance of dissolved organic carbon and nitrogen in supporting microbial production and respiration (O<sub>2</sub> consumption) in the Baltic Sea. Each one of these broad findings warrants publication in a major journal, yet this has not occurred.

There are other products of the monitoring activities that are of wide interest to international research and management communities but have not been appropriately published. These include harmful algal bloom dynamics, food web linkages and their implications for fisheries, and the short and longer term ecological effects of toxic substances. In addition, there is an impressive paleo-chronological record available by which to examine and evaluate previous periods of primary production, oxic (or hypoxic) conditions. These data are important in gaining an understanding of present-day eutrophication and its potential impacts on Baltic Sea water quality and habitat conditions.

The IOW is putting a lot of innovation effort, energy and dedication into becoming a world leader institute but it needs to be more focussed on achieving this goal. Publications, outreach and effective communication of goals, ways of achieving them and products reflecting these goals need to be far more visible. The Institute needs to promote itself, its research activities, its doctoral training and its excellent location and equipment much more.

There is some concern about the attitude of the IOW management which tends to ignore the need for knowledge transfer. Most of the experts expect a Leibniz Institute to take greater account of its social responsibility in terms of fostering the transfer of knowledge to marine engineering industry but also to politics and society. Therefore, it is suggested that regular events should be organised in order to address potential users of research results. Concerning patent applications, the experts are of the opinion that the IOW is not in a position to apply successfully for patents. The market for the potentially patentable products is small. Applying for patents is difficult and expensive and it would distract the Institute’s attention from its core tasks. Therefore, it would be preferable for the Institute to publish its research results, including technical inventions and developments, thereby making them available to the marine community.

## **7. Implementation of the German Science Council’s Recommendations**

The recommendations of the German Science Council were in part implemented, others still have to be realized. The recommendations on the research strategies of the departments and research foci have been successfully adopted. As to the recommendation of the German Science Council to integrate benthic biology in the research, the experts acknowledge the IOW’s choice to concentrate on the pelagic system. Dealing with benthic biology in addition could weaken the research profile and potential.

Interdisciplinarity has been achieved to a considerable extent between the individual departments of the Institute. Unfortunately, joint papers by different department members as a



result of interdisciplinary teamwork are still missing. The number of peer reviewed publications has increased as recommended, but is still too low and has to be increased yet more.

The cooperation with universities has been strengthened: In 1998, a cooperation agreement was signed with Greifswald University, and modules for bachelor and master courses have been developed, for example. The number of guest researchers at the IOW and the number of IOW scientists abroad, however, is still limited and should be increased.

During the evaluation period, the IOW did not hire researchers on a permanent basis. The number of third-party funded researchers at the Institute has been doubled.

The IOW has not implemented the recommendation to raise the number of spin-offs or patent applications. The experts acknowledge that the Institute only develops technology for its own use because there is no market for this type of instrumentation.

Regarding the recommendations on the duration of financial support for doctoral students and post-docs, the IOW should reassess these rules.

## **8. Summary of the Evaluation Committee's Recommendations**

- The IOW is the only German institute that specifically addresses research problems related to the Baltic Sea. It is unique in its observational activities. Thus, the Institute complements the marine sciences at universities very well. The IOW is a good and in parts a very good institute with great potential.
- The IOW has strong modelling capabilities. Models should be applied to a much broader extent as a tool to test hypotheses and confront predictions with data.
- The publication record does not reflect the scientific activities and results. The IOW must publish more papers in internationally recognised peer reviewed journals and implement appropriate measures for improvement.
- The IOW should become a legally independent establishment.
- The research vessel "PROFESSOR ALBRECHT PENCK" will be decommissioned and, therefore, has to be replaced by a new, small research vessel.
- A loss of six positions (four scientists and two technicians) which will not be funded anymore by the BSH contract as of 2008 should be compensated by additional institutional funding.
- The number of doctoral students should be increased by strengthening active acquisition, for example. Mentoring should be improved. Doctoral students should be encouraged to publish their results in peer-reviewed journals while working on their theses.
- The IOW should introduce quality management including an appropriate incentive system. The Institute should promote the mobility of its researchers and become more flexible in order to cope with rapid changes in political and economical environment.
- The Scientific Advisory Board should document the results of the Institute's assessments more critically.
- The Institute needs to promote itself, its research activities, its doctoral training and its excellent location and equipment much more.

- The IOW is expected to take greater account of its social responsibility in terms of fostering the transfer of knowledge to marine engineering industry, but also to politics and society. Therefore, they should organise regular events in order to address potential users of research results.

## Appendix

### Participants:

#### 1. Evaluation Team

##### *Chairman (Member of the Senate Evaluation Committee)*

Prof. Dr. Dietrich **Wegener** University of Dortmund, Experimental Physics V

##### *Vice Chairwoman (Member of the Senate Evaluation Committee)*

Prof. Dr. Brigitte **Nixdorf** Department of Freshwater Conservation,  
Brandenburg University of Technology, Cottbus

##### *External Experts*

Prof. Dr. Jesper **Bartholdy** Institute of Geography, University of Copenhagen,  
Denmark

Prof. Dr. Hans-Jürgen **Brumsack** Institute for Chemistry and Biology of the Marine  
Environment, University of Oldenburg

Prof. Dr. Jens **Meincke** Institute of Oceanography, University of Hamburg

Prof. Dr. Thomas **Osborn** Department of Earth and Planetary Sciences,  
Johns Hopkins University, Baltimore, USA

Prof. Dr. Jörg **Ott** Department of Marine Biology, University of Vienna,  
Austria

Prof. Dr. Hans W. **Paerl** Institute of Marine Sciences,  
The University of North Carolina at Chapel Hill,  
USA

Prof. Dr. Detlef **Quadfasel** Institute of Oceanography, University of Hamburg

Prof. Dr. Michael A. **St. John** Department Biological Oceanography and  
Fisheries Science, University of Hamburg

Prof. Dr. Lucas J. **Stal** NIOO-KNAW Centre for Estuarine and Marine  
Ecology, Netherlands Institute of Ecology,  
Yerseke, The Netherlands

Prof. Dr. Hendrik **van Aken** Department of Physical Oceanography,  
Royal Netherlands Institute for Sea Research,  
Den Hooft, The Netherlands

Prof. Dr. Hans **von Storch** Meteorological Institute, University of Hamburg

##### *Federal Representative*

RegDir Frank **Reifers** Federal Ministry of Education and Research, Bonn

##### *Representative of the Federal States*

Stefan **Brandt** Ministry of Science, Research and Culture of the  
State of Brandenburg, Potsdam

#### 2. Guests

##### *Representative of the relevant Federal Department*

Dr. Hans-Ortwin **Nalbach** Federal Ministry of Education and Research, Bonn

*Representative of the relevant State Department*MinDirig Hermann **Fischer**Ministry of Education, Sciences and Culture  
Mecklenburg - Western Pomerania*Representative of the Bund-Länder Commission for Educational Planning  
and Research Promotion, Bonn*ORR'in Dr. Karin **Andrae***Representative of the Leibniz Association*Prof. Dr. Eckhard **George**Institute of Vegetable and Ornamental Crops,  
Großbeeren/Erfurt*Representative of the Advisory Committee*Prof. Dr. Gerold **Wefer**marum - Center for Marine Environmental Sciences  
at the University of Bremen**Representatives of Cooperating Institutions**

The following representatives of cooperating institutions took part in a one hour interview:

Prof. Dr. Bo Barker **Jørgensen**Head of the Max Planck Institute for Marine  
Microbiology, BremenProf. Dr. Fritz W. **Köster**Danish Institute for Fisheries Research, Department  
of Marine Fisheries, Charlottenlund, DenmarkProf. Dr. Stanislaw **Massel**Director of the Institute of Oceanology,  
Polish Academy of Science, Sopot, PolandProf. Dr. Niels-Peter **Rühl**Vice-President of the Federal Maritime and  
Hydrographic Agency of Germany, HamburgProf. Dr. Maria-Theresia **Schafmeister**Institute for Geography and Geology,  
Ernst Moritz Arndt University of GreifswaldProf. Dr. Gerd **Röpke**

Prorector of the University of Rostock

17. Oktober 2006

**Anlage C: Stellungnahme der Einrichtung zum Bewertungsbericht**

**Leibniz-Institut für Ostseeforschung Warnemünde  
an der Universität Rostock (IOW)**

The management and staff of IOW thank the chairman and the Evaluation Committee for the positive and factual atmosphere during the entire evaluation. The remark that IOW has followed the recommendations of the Wissenschaftsrat from 1997/98, the confirmation of considerable progress in science approach and implementation as well as the differentiated recommendations on further improvement of the Institute's work are appreciated by IOW.

IOW would have liked to discuss the statement with its Scientific Advisory Board, however, time given for this statement was too short for such procedure.

The positive remarks on our work and achievements in scientific output as described in the report are taken as confirmation that the Institute has chosen the right measures for improvements. The very clear recommendations are accepted by the Institute, actions leading in the direction of the recommendations have been initiated partly before and also already after the evaluation in November 2005.

The praise on our models and modelling potential underpins well our efforts to create a continuously improved model-environment in order to apply the models increasingly on interdisciplinary research questions. The advice to encompass also higher trophic levels of the food-web with our models meets our conceptual framework for future development and wider application of the models.

We fully accept the urging to publish more of the results in peer reviewed journals. Measures and incentives have been developed and have led to an increase in publication over the years, which is ongoing. From 2004 to 2005 publications in peer review journals rose from 57 to 86 (of which 30% were with authors from different sections, i.e. interdisciplinary), nevertheless, against this background we will revise our internal quality management where needed.

The recommended change of IOW into a legally independent establishment has been discussed with *Land* and *Bund* in the previous years. We envisage that IOW becomes a *Stiftung öffentlichen Rechts* by begin of 2008.

In particular, IOW does appreciate the recommendations on our staff development (an increase of six positions in the institutional funding as compensation for the eleven positions lost through reduction of fundamental research tasks in the contract with BSH) and on the replacement of our small research vessel PROF. A. PENCK. This compensation as well as the access to a modern small ship are paramount to meet the standards set by the recommendations of the Evaluation Committee.

The Committee's recommendation to increase the number of doctoral students will be seriously considered. The number of doctoral students by active acquisition will be determined partly by the institutional funds and partly by success in third party funding. New rules for supervision and mentoring have been introduced two years ago. IOW will by itself and with partners install graduate education schemes. We will seek also advice as to how many doctoral students may be optimal for IOW.

Two years ago IOW started with a series of seminars on the research foci, which aim at improving the quality of research, identifying research results ready for publication, selecting topics for presentation at internationally important symposia/congresses, closer coupling of the doctoral students into the Institute's research activities and future planning. With these measures we want to foster better promotion of research and higher education.

The Committee did send a reminder for better outreach to the engineering industry, politics and society. The IOW fully agrees with the statement that its work is not too well suited for

patent applications. Shortly after the evaluation in 2005, the IOW got strongly involved in the revitalisation of the Research Focus: *Maritime Systems and Marine Processes* of Rostock University. This focus comprises various faculties of the university (natural, law, social sciences and engineering sciences). We joined a local so-called *Maritime Allianz*, which developed from an INTERREG-Programme and serves to facilitate information flux and transfer between industry, agencies and science. We will use these connections to present the technical and scientific results of IOW to a much broader auditorium than previously.

For a better outreach to society/politics IOW implemented the cross cutting activity Coastal Seas and Society (in 2002) to conduct research on issues put forward by governance and policy bodies as well as to translate research result into products for these bodies, such as maps and impact assessments. All disciplines and every research focus participate and serve these activities. There is no single staff person employed for this cross cutting activity, however, between 10 and 15% of the work power of IOW are devoted to this cross cutting activity according to our time registering system.

Moreover, through the contract with BSH, which includes environmental assessments and work on recommendations in the HELCOM framework, we are closely related to politics and society. The transfer of scientific results to society will become considerably more effective and informative with the improvement of the prognostic capacity of our models.

IOW will discuss its plans for implementation of the recommendations with its Scientific Advisory Board and its Board of Governors in detail in January and February 2007, respectively.