

MEDITERRANEAN ACTION PLAN

MED POL



UNITED NATIONS ENVIRONMENT PROGRAMME



WORLD HEALTH ORGANIZATION

EPIDEMIOLOGICAL STUDIES RELATED TO ENVIRONMENTAL QUALITY CRITERIA
FOR BATHING WATERS, SHELLFISH-GROWING WATERS AND EDIBLE MARINE
ORGANISMS (ACTIVITY D)

ETUDES EPIDEMIOLOGIQUES RELATIVES AUX CRITERES DE LA QUALITE DE
L'ENVIRONNEMENT POUR LES EAUX SERVANT A LA BAIGNADE, A LA
CULTURE DE COQUILLAGES ET A L'ELEVAGE D'AUTRES ORGANISMES
MARINS COMESTIBLES (ACTIVITE D)

FINAL REPORT ON PROJECT ON RELATIONSHIP BETWEEN MICROBIAL QUALITY OF
COASTAL SEAWATER AND HEALTH EFFECTS (1983-86)

RAPPORT FINAL SUR LE PROJET SUR LA RELATION ENTRE LA QUALITE MICROBIENNE
DES EAUX MARINES COTIERES ET LES EFFETS SUR LA SANTE (1983-86)

MAP TECHNICAL REPORTS SERIES No.20

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This volume is the twentieth issue of the Mediterranean Action Plan Technical Report Series.

This Series will collect and disseminate selected scientific reports obtained through the implementation of the various MAP components: Pollution Monitoring and Research Programme (MED POL), Blue Plan, Priority Actions Programme, Specially Protected Areas and Regional Oil Combating Centre.

Ce volume constitue le vingtième numéro de la série des Rapports techniques du Plan d'action pour la Méditerranée.

Cette série permettra de rassembler et de diffuser certains des rapports scientifiques établis dans le cadre de la mise en oeuvre des diverses composantes du PAM: Programme de surveillance continue et de recherche en matière de pollution (MED POL), Plan Bleu, Programme d'actions prioritaires, Aires spécialement protégées et Centre régional de lutte contre la pollution par les hydrocarbures.

GENERAL INTRODUCTION

The United Nations Environment Programme (UNEP) convened an Intergovernmental Meeting on the Protection of the Mediterranean (Barcelona, 28 January - 4 February 1975), which was attended by representatives of 16 States bordering on the Mediterranean Sea. The meeting discussed the various measures necessary for the prevention and control of pollution of the Mediterranean Sea, and concluded by adopting an Action Plan consisting of three substantive components:

- Integrated planning of the development and management of the resources of the Mediterranean Basin (management component);
- Co-ordinated programme for research, monitoring and exchange of information and assessment of the state of pollution and of protection measures (assessment component);
- Framework convention and related protocols with their technical annexes for the protection of the Mediterranean environment (legal component).

All components of the Action Plan are interdependent and provide a framework for comprehensive action to promote both the protection and the continued development of the Mediterranean ecoregion. No component is an end in itself. The Action Plan is intended to assist the Mediterranean Governments in formulating their national policies related to the continuous development and protection of the Mediterranean area and to improve their ability to identify various options for alternative patterns of development and to make choices and appropriate allocations of resources.

MED POL - Phase I (1976-1980)

The Co-ordinated Mediterranean Research and Monitoring Programme (MED POL) was approved as the assessment (scientific/technical) component of the Action Plan.

The general objectives of its pilot phase (MED POL - Phase I), which evolved through a series of expert and intergovernmental meetings, were:

- to formulate and carry out a co-ordinated pollution monitoring and research programme taking into account the goals of the Mediterranean Action Plan and the capabilities of the Mediterranean research centres to participate in it;
- to assist national research centres in developing their capabilities to participate in the programme;
- to analyse the sources, amounts, levels, pathways, trends and effects of pollutants relevant to the Mediterranean Sea;
- to provide the scientific/technical information needed by the Governments of the Mediterranean States and the EEC for the negotiation and implementation of the Convention for the Protection of the Mediterranean Sea against Pollution and its related protocols.
- to build up consistent time-series of data on the sources, pathways, levels and effects of pollutants in the Mediterranean Sea and thus to contribute to the scientific knowledge of the Mediterranean Sea.

MED POL - Phase I initially consisted of seven pilot projects (MED POL I - VII), which were later expanded by additional six pilot projects (MED POL VIII - XIII), some of which remained in a conceptual stage only.

MED POL - Phase I was implemented in the period from 1975 to 1980. The large number of national research centres designated by their Governments to participate in MED POL (83 research centres from 15 Mediterranean States and the EEC), the diversity of the programme and its geographic coverage, the impressive number of Mediterranean scientists and technicians (about 200) and the number of co-operating agencies and supporting organizations involved in it, qualifies MED POL as certainly one of the largest and most complex co-operative scientific programmes with a specific and well-defined aim ever undertaken in the Mediterranean basin.

The overall co-ordination and guidance for MED POL - Phase I was provided by UNEP, acting as the secretariat of the Mediterranean Action Plan (MAP). Co-operating specialized United Nations Agencies (ECE, UNIDO, FAO, UNESCO, WHO, WMO, IAEA, IOC) were responsible for the technical implementation and day-to-day co-ordination of the work of national research centres participating in the pilot projects.

MED POL - Phase II (1981 - 1990)

The Intergovernmental Review Meeting of Mediterranean Coastal States and First Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution, and its related protocols (Geneva, 5-10 February 1979), having examined the status of MED POL - Phase I, recommended that during the 1979/80 biennium a Long-term pollution monitoring and research programme should be formulated.

Based on the recommendations made at various expert and intergovernmental meetings, a draft Long-term (1981 - 1990) Programme for Pollution Monitoring and Research in the Mediterranean (MED POL - Phase II) was formulated by the Secretariat of the Barcelona Convention (UNEP), in co-operation with the United Nations Agencies which were responsible for the technical implementation of MED POL - Phase I, and it was formally approved by the Second Meeting of the Contracting Parties of the Mediterranean Sea against pollution and its related protocols and Intergovernmental Review Meeting of Mediterranean Coastal States of the Action Plan held in Cannes, 2-7 March 1981.

The general long-term objectives of MED POL - Phase II were to further the goals of the Barcelona Convention by assisting the Parties to prevent, abate and combat pollution of the Mediterranean Sea Area and to protect and enhance the marine environment of the Area. The specific objectives were designed to provide, on a continuous basis, the Parties to the Barcelona Convention and its related protocols with:

- information required for the implementation of the Convention and the protocols;
- indicators and evaluation of the effectiveness of the pollution prevention measures taken under the Convention and the protocols;
- scientific information which may lead to eventual revisions and amendments of the relevant provisions of the Convention and the protocols and for the formulation of additional protocols;

- information which could be used in formulating environmentally sound national, bilateral and multilateral management decisions essential for the continuous socio-economic development of the Mediterranean region on a sustainable basis;
- periodic assessment of the state of pollution of the Mediterranean Sea.

The monitoring of, and research on, pollutants affecting the Mediterranean marine environment reflects primarily the immediate and long-term requirements of the Barcelona Convention and its protocols, but also takes into account factors needed for the understanding of the relationship between the socio-economic development of the region and the pollution of the Mediterranean Sea.

For this purpose, monitoring was organized on several levels:

- monitoring of sources of pollution providing information on the type and amount of pollutants released directly into the environment;
- monitoring of nearshore areas, including estuaries, under the direct influence of pollutants from identifiable primary (outfalls, discharge and coastal dumping points) or secondary (rivers) sources;
- monitoring of offshore areas (reference areas) providing information on the general trends in the level of pollution in the Mediterranean;
- monitoring of the transport of pollutants to the Mediterranean through the atmosphere, providing additional information on the pollution load reaching the Mediterranean Sea.

Research and study topics included initially in the MED POL - Phase II were:

- development of sampling and analytical techniques for monitoring the sources and levels of pollutants. Testing and harmonization of these methods at the Mediterranean scale and their formulation as reference methods. Priority will be given to the substances listed in the annexes of the Protocol for the prevention of pollution of the Mediterranean Sea by dumping from ships and aircraft and the Protocol for the protection of the Mediterranean Sea against pollution from land-based sources (activity A);
- development of reporting formats required according to the Dumping, Emergency and Land-Based Sources Protocols (activity B);
- formulation of the scientific rationale for the environmental quality criteria to be used in the development of emission standards, standards of use or guidelines for substances listed in annexes I and II of the Land-Based Sources Protocol in accordance with Articles 5, 6 and 7 of that Protocol (activity C);
- epidemiological studies related to the confirmation (or eventual revision) of the proposed environmental quality criteria (standards of use) for bathing waters, shellfish-growing waters and edible marine organisms (activity D);
- development of proposals for guidelines and criteria governing the application of the Land-Based Sources Protocol, as requested in Article 7 of that Protocol (activity E);

- research on oceanographic processes, with particular emphasis on surface circulation and vertical transport. Needed for the understanding of the distribution of pollutants through the Mediterranean and for the development of contingency plans for cases of emergency (activity F);
- research on the toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity of selected substances listed in annexes of the Land-Based Sources Protocol and the Dumping Protocol (activity G);
- research on eutrophication and concomitant plankton blooms. Needed to assess the feasibility of alleviating the consequences and damage from such recurring blooms (activity H);
- study of ecosystem modifications in areas influenced by pollutants, and in areas where ecosystem modifications are caused by large-scale coastal or inland engineering activity (activity I);
- effects of thermal discharges on marine and coastal ecosystems, including the study of associated effects (activity J);
- biogeochemical cycle of specific pollutants, particularly those relevant to human health (mercury, lead, survival of pathogens in the Mediterranean Sea, etc.) (activity K);
- study of pollutant-transfer processes (i) at river/sea and air/sea interface, (ii) by sedimentation and (iii) through the straits linking the Mediterranean with other seas (activity L);

As in MED POL - Phase I, the overall co-ordination and guidance for MED POL - Phase II is provided by UNEP as the secretariat of the Mediterranean Action Plan (MAP). Co-operating specialized United Nations Agencies (FAO, UNESCO, WHO, WMO, IAEA, IOC) are responsible for the technical implementation and day-to-day co-ordination of the work of national centres participating in monitoring and research.

The first eight volumes of the MAP Technical Reports Series present the collection of final reports of the Principal Investigators who participated in the relevant pilot projects (MED POL I - MED POL VIII). The ninth volume of the MAP Technical Reports Series is the final report on the implementation of MED POL - Phase I, prepared, primarily, on the basis of individual final reports of the principal investigators with the co-operation of relevant United Nations Agencies (FAO, UNESCO, WHO, WMO, IAEA, IOC).

From the tenth volume onwards, the MAP Technical Report Series contains final reports on research projects, assessment documents, and other reports on activities performed within the framework of MED POL Phase II, as well as documentation originating from other components of the Mediterranean Action Plan.

This twentieth volume of the MAP Technical Report Series contains the final report on the first research project to be completed within the framework of MED POL Phase II in Activity D - "Epidemiological studies related to the confirmation (or eventual revision) of the proposed environmental quality criteria (standards of use) for bathing waters, shellfish-growing waters and edible marine organisms". The other final reports on projects will appear in future issues of the series.

INTRODUCTION

Le Programme des Nations Unies pour l'environnement (PNUE) a convoqué une réunion intergouvernementale sur la protection de la Méditerranée (Barcelone, 28 janvier - 4 février 1975) à laquelle ont pris part des représentants de 16 Etats riverains de la mer Méditerranée. La réunion a examiné les diverses mesures nécessaires à la prévention et à la lutte antipollution en mer Méditerranée, et elle s'est conclue sur l'adoption d'un Plan d'action comportant trois éléments fondamentaux:

- Planification intégrée du développement et de la gestion des ressources du bassin méditerranéen (élément "gestion");
- Programme coordonné de surveillance continue, de recherche, d'échange de renseignements et d'évaluation de l'état de la pollution et des mesures de protection (élément "évaluation");
- Convention cadre et protocoles y relatifs avec leurs annexes techniques pour la protection du milieu méditerranéen (élément juridique).

Tous les éléments du Plan d'action étaient interdépendants et fournissaient le cadre d'une action d'ensemble en vue de promouvoir tant la protection que le développement continu de l'écorégion méditerranéenne. Aucun élément ne constituait une fin à lui seul. Le Plan d'action était destiné à aider les gouvernements méditerranéens à formuler leurs politiques nationales en matière de développement continu et de protection de zone de la Méditerranée et à accroître leur faculté d'identifier les diverses options s'offrant pour les schémas de développement, d'arrêter leurs choix et d'y affecter les ressources appropriées.

MED POL - Phase I (1976 - 1980)

Le programme coordonné de surveillance continue et de recherche en matière de pollution de la Méditerranée (MED POL) a été approuvé au titre de l'élément "évaluation" (scientifique/technique) du Plan d'action.

Sa phase pilote (MED POL - Phase I) avait les objectifs généraux ci-dessous, élaborés au cours d'une série de réunions d'experts et de réunions intergouvernementales:

- formuler et exécuter un programme coordonné de surveillance continue et de recherche en matière de pollution en tenant compte des buts du Plan d'action pour la Méditerranée et de l'aptitude des centres de recherche méditerranéens à y participer;
- aider les centres de recherche nationaux à se rendre plus aptes à cette participation;
- étudier les sources, l'étendue, le degré, les parcours, les tendances et les effets des polluants affectant la mer Méditerranée;
- fournir l'information scientifique et technique nécessaire aux gouvernements des pays méditerranéens et à la Communauté économique européenne pour négocier et mettre en oeuvre la Convention pour la protection de la mer Méditerranée contre la pollution et les protocoles y relatifs;

- constituer des séries chronologiques cohérentes de données sur les sources, les cheminements, les degrés et les effets des polluants de la mer Méditerranée et contribuer par là à la connaissance scientifique de cette mer.

La Phase I du MED POL comportait à l'origine sept projets pilotes (MED POL I - VII) auxquels sont venus ultérieurement s'ajouter six autres (MED POL VIII - XIII) dont certains n'en sont restés qu'au stade de la conception.

La Phase I du MED POL a été mise en oeuvre au cours de la période 1975 - 1980. Le grand nombre de centres de recherche nationaux désignés par leurs gouvernements pour participer au MED POL (83 centres de recherche de 15 Etats méditerranéens et de la CEE), la diversité du programme et sa couverture géographique, l'effectif impressionnant de scientifiques et techniciens méditerranéens (environ 200) ainsi que la quantité d'organismes coopérants et d'organisations d'appui qui y étaient engagés permettent sans conteste de caractériser le MED POL comme l'un des programmes de coopération scientifique les plus vastes et les plus complexes, comportant un objectif spécifique et bien défini, qui ai jamais été entrepris dans le bassin méditerranéen.

La coordination et la direction générales de MED POL - Phase I ont été assurées par le PNUE, faisant fonction de secrétariat du Plan d'action pour la Méditerranée (PAM). Les organismes spécialisés coopérants des Nations Unies (CEE - Commission économique pour l'Europe, ONUDI, FAO, UNESCO, OMS, OMM, AIEA, COI) étaient chargés de l'exécution technique et de la coordination quotidienne des travaux des centres de recherche nationaux participant aux projets pilotes.

MED POL - Phase II (1981 - 1990)

La réunion intergouvernementale des Etats riverains de la Méditerranée chargés d'évaluer l'état d'avancement du Plan d'action et première réunion des Parties contractantes à la Convention pour la protection de la mer Méditerranée contre la pollution et aux protocoles y relatifs (Genève, 5 - 10 février 1979), ayant examiné la situation de la Phase I du MED POL, a recommandé que, durant la période biennale 1979 - 80, soit formulé un programme à long terme de surveillance continue et de recherche en matière de pollution.

Sur la base des recommandations énoncées lors des diverses réunions d'experts et réunions intergouvernementales, un projet de programme à long terme (1981 - 1990) de surveillance continue et de recherche en matière de pollution (MED POL - Phase II) a été formulé par le secrétariat de la Convention de Barcelone (PNUE), en coopération avec les organismes des Nations Unies chargés de l'exécution technique de MED POL - Phase I, et il a été officiellement approuvé lors de la deuxième réunion des Parties contractantes à la Convention pour la protection de la mer Méditerranée contre la pollution et aux Protocoles y relatifs et réunion intergouvernementale des Etats riverains de la mer Méditerranée chargée d'évaluer l'état d'avancement du Plan d'action, qui s'est tenue à Cannes du 2 au 7 mars 1981.

L'objectif général à long terme de la Phase II du MED POL était de concourir à la réalisation des objectifs de la Convention de Barcelone en aidant les Parties contractantes à prévenir, réduire et combattre la pollution dans la zone de la mer Méditerranée ainsi qu'à protéger et améliorer le milieu marin dans cette zone. Les objectifs particuliers étaient de fournir constamment aux Parties contractantes à la Convention de Barcelone et aux protocoles y relatifs:

- les renseignements dont elles avaient besoin pour appliquer la Convention et les protocoles;
- des indications et une évaluation de l'efficacité des mesures prises pour prévenir la pollution en application de la Convention et des protocoles;
- des renseignements scientifiques qui pourraient servir à réviser et modifier les dispositions pertinentes de la Convention et des protocoles et à rédiger des protocoles additionnels;
- des informations qui pourraient servir à formuler sur les plans national, bilatéral et multilatéral, les décisions de gestion, respectueuses de l'environnement, qui seraient indispensables à la poursuite du développement socio-économique de la région méditerranéenne;
- une évaluation périodique de l'état de pollution de la mer Méditerranée.

La surveillance continue des polluants affectant le milieu marin de la Méditerranée ainsi que la recherche menée à leur sujet répondent en premier lieu aux prescriptions immédiates et à long terme de la Convention de Barcelona et des protocoles y relatifs, mais elles tiennent également compte des facteurs requis pour la compréhension des relations existant entre le développement socio-économique de la région et la pollution de la mer Méditerranée.

A cette fin, la surveillance continue était organisée à plusieurs niveaux:

- surveillance des sources de pollution, qui renseigne sur la nature et la quantité des polluants directement rejetés dans l'environnement;
- surveillance des zones proches de la côte, y compris les estuaires, qui sont sous l'influence directe de polluants provenant de sources identifiables tant primaires (rejets d'eaux résiduaires, décharges et points d'immersion côtiers) que secondaires (cours d'eau);
- surveillance de zones du large (zones de référence), qui renseigne sur les tendances du degré de pollution de la Méditerranée;
- surveillance du transport dans l'atmosphère de polluants jusqu'à la Méditerranée; cette surveillance renseigne sur la charge polluante infligée à cette mer.

Les sujets de recherche et d'étude compris initialement dans le phase II du MED POL étaient:

- mise au point de techniques d'échantillonnage et d'analyse pour la surveillance des sources et des niveaux de pollution. Essai et harmonisation de ces méthodes à l'échelle méditerranéenne, et formulation de méthodes de référence. Substances figurant sur les listes de priorité des protocoles sur les opérations d'immersion et sur la pollution d'origine tellurique (activité A);

- mise au point de la présentation type des rapports à soumettre en application des protocoles relatifs à l'immersion, à la pollution résultant de situations critiques et à la pollution d'origine tellurique (activité B);
- élaboration des fondements scientifiques des critères de qualité de l'environnement qui serviront à définir des normes d'émission, des normes d'usage ou des directives concernant les substances énumérées dans les annexes I et II du protocole relatif à la pollution d'origine tellurique, conformément aux articles 5, 6 et 7 de ce protocole (activité C);
- études épidémiologiques relatives à la confirmation (ou révision éventuelle) des critères de la qualité de l'environnement (normes d'usage) proposés pour les eaux servant à la baignade, à la culture de coquillages et à l'élevage d'autres organismes marins comestibles (activité D);
- mise au point de projets de directives et de critères régissant l'application du protocole relatif à la pollution d'origine tellurique, conformément à l'article 7 de ce protocole (activité E);
- recherches sur les processus océaniques, et particulièrement sur la circulation en surface et les déplacements verticaux. Cette information est nécessaire à la connaissance de la répartition des polluants en Méditerranée et à la mise au point de plans pour parer aux situations critiques (activité F);
- recherches sur la toxicité, la persistance, la bioaccumulation et le caractère cancérigène et mutagène de certaines substances énumérées dans les annexes du protocole relatif à la pollution d'origine tellurique et du protocole relatif aux opérations d'immersion (activité G);
- recherches sur l'eutrophisation et les floraisons de plancton qui l'accompagnent. Cette information est nécessaire pour évaluer la possibilité de prévenir les effets et les dégâts causés par ces floraisons périodiques (activité H);
- étude des modifications de l'écosystème dans les zones soumises à l'influence des polluants et dans celles où ces modifications sont dues à d'importantes activités industrielles sur la côte ou à l'intérieur des terres (activité I);
- effets des pollutions thermiques sur les écosystèmes marins et côtiers, y compris l'étude des effets connexes (activité J);
- cycle biogéochimique de certains polluants intéressant particulièrement la santé (mercure, plomb, survie des organismes pathogènes dans la mer Méditerranée, etc.) (activité K);
- étude des processus de transfert des polluants (i) aux points de contact entre les cours d'eau et la mer et entre l'air et la mer, (ii) par sédimentation et (iii) à travers les détroits qui relie la Méditerranée aux mers voisines (activité L).

Comme lors de la Phase I du MED POL, la coordination et la direction générales de la Phase II étaient assurées par le PNUE, par l'intermédiaire du secrétariat du Plan d'action pour la Méditerranée (PAM). Les organismes spécialisés coopérants des Nations Unies (FAO, UNESCO, OMS, OMM, AIEA, COI) étaient chargés de l'exécution technique et de la coordination quotidienne des travaux des centres de recherche nationaux participant au programme de surveillance continue et de recherche.

Les huit premiers volumes de la Série des rapports techniques du PAM rassemblent les rapports finaux de chercheurs responsables qui ont participé aux projets pilotes correspondants (MED POL I - MED POL VIII). Le neuvième volume de cette même Série se compose du rapport final sur la mise en oeuvre de la Phase I du programme MED POL, établi essentiellement sur la base des rapports finaux individuels des chercheurs responsables avec la coopération des organismes compétents des Nations Unies (FAO, UNESCO, OMS, OMM, AIEA, COI).

A partir du dixième volume, la série des rapports techniques du PAM comprend les rapports finaux sur les projets de recherche, l'état d'avancement des documents et autres rapports sur les activités exécutées dans le cadre de la Phase II du MED POL, ainsi que la documentation provenant d'autres composantes du Plan d'Action pour la Méditerranée.

Le présent volume, le vingtième de la série des rapports techniques du PAM, comprend le rapport final sur le premier projet de recherche à mener à terme dans le cadre de la Phase II du MED POL, dans l'Activité D - Etudes épidémiologiques relatives à la confirmation (ou révision éventuelle) des critères de la qualité de l'environnement (normes d'usage) proposés pour les eaux servant à la baignade, la culture de coquillages et à l'élevage d'autres organismes marins comestibles. Les autres rapports finaux sur des projets figurent dans les prochaines publications de la série.

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EPIDEMIOLOGICAL RESEARCH ON THE RELATIONSHIP BETWEEN MICROBIAL
QUALITY OF COASTAL SEAWATER AND MORBIDITY AMONG BATHERS
ON THE MEDITERRANEAN ISRAELI BEACHES

by

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A B S T R A C T

A pilot-scale prospective epidemiological study was conducted on three Mediterranean beaches. The objective of the study was to examine the findings from previous studies that swimming in sewage-polluted waters carries with it a measurable risk of infectious disease and that this risk is correlated with the levels of at least one faecal indicator in the bathing water.

Two beaches (Gordon and Sheraton) were chosen because of their proximity (3000 to 5000 m) to the Tel Aviv sewage outfall, and their relative state of pollution in terms of their bacterial content. The third beach (Rishon Lezion) was considered as clean, because of its distance from wastewater sewage outfall. All three beaches meet the bacterial criteria for bathing beaches of the Israeli Ministry of Health and are generally within the WHO guide standards.

The essentials of the study design were as follows. The families of bathers were contacted at the beaches, and only those families with at least one child below the age of 10 years and with an available telephone were recruited and interviewed for this study. A questionnaire was completed at this interview which included a telephone number, socio-demographic factors and the swimming status of the family members. A second interview (follow-up) was conducted over the telephone about 3-4 days after the initial interview at the beach. The interviewee was asked whether he/she or his/her children who had been at the beach had suffered from enteric, respiratory, skin and ear symptoms.

Water samples were drawn when and from where the bathers had been in the water on the day of the beach interview. A total of 78 samples of seawater were obtained in 1983, and 16 samples in 1984. These were collected twice per day, in the morning and in the afternoon. The samples were tested on the same day for concentrations of faecal coliforms, faecal streptococci, enterococci, E. coli, Staphylococcus aureus and Pseudomonas aeruginosa. Due to technical reasons, the results for faecal streptococci were found to be unreliable, and therefore no conclusions could be based on this particular bacterial indicator.

The intestinal bacterial indicator densities were higher at beaches located close to the sewage outfall than at the Rishon Lezion beach ($P < 0.05$ for differences between Gordon and Rishon Lezion beaches). No differences were found for Staphylococcus and Pseudomonas densities between study beaches. A total of 609 families consisting of 2,231 persons were interviewed in 1983 (99% success rate) and a total of 154 families consisting of 482 persons were interviewed in 1984 (92% success rate). Of these, 25% were 0-4 years old. Of the total study population, 64% were defined as "swimmers" : a person whose head had been immersed in the water, who had swallowed seawater, or whose face had been splashed by waves. Due to the small population size in 1984, the results of this report are based on the 1983 bathing season only.

The risk of enteric symptomatology was found to be significantly higher among swimmers than among non-swimmers for the most polluted (Gordon) beach but not for the least polluted (Rishon Lezion) beach for the 0 to 4 year old age group and all ages.

There was a significant excess in the rates of enteric symptoms (vomiting, abdominal pain, nausea and diarrhoea) in the 0 to 4 year old age group among swimmers relative to non-swimmers when the densities of E. coli, enterococci and staphylococci in seawater were "high", but not when they were "low". Trial days were divided in those with "high" or "low" bacterial densities prior to and independently of the morbidity analysis. Statistically significant Pearson correlations were found between the incidence of swimming-associated enteric symptom rates and enterococcal and staphylococcal densities in seawater ($r = 0.45$ and $r = 0.50$, respectively).

A significant excess was also found for respiratory symptoms (heavy cough, cold, throat infection) and skin infections among swimmers as compared with non-swimmers, in the 0 to 4 year old age group, but this excess was not associated with bacterial densities in seawater. No excess of enteric and respiratory symptoms and skin infections was detected for other age groups. No excess of ear infections or highly credible enteric symptoms was detected in any age group.

1. INTRODUCTION

There has been a dearth of epidemiological studies in the Mediterranean area suitable for establishing sound water quality criteria and "standards of use" for coastal water at public bathing beaches. Thus, the Long-term Programme of Pollution Monitoring and Research in the Mediterranean Sea (MED POL Phase II) has established the high-priority need for "Epidemiological Studies Related to Environmental Quality Criteria" (Activity "D") with particular reference to epidemiological studies on evaluation of microbial standards for recreational areas, including evaluation of existing interim MED POL environmental quality criteria.

The Mediterranean has only 1% of the world's sea surface, while the population of its shores is now in excess of 100 million, and a further 100 million tourists arrive each year. It has been estimated that it takes nearly 100 years for its water to be renewed. Extensive analyses carried out over the last decade have shown that considerable areas of the Mediterranean are polluted by sewage, industrial wastewater and oil spills.

Sewerage systems for the disposal of urban faecal wastes into nearby fresh and marine waters have existed for many years. In theory, all diseases that are spread by the faecal-oral route and whose aetiological agents are shed in the faeces of ill individuals or carriers can be contacted by swimming in sewage-polluted water. These disorders include:

- (1) bacterial diseases: salmonellosis, shigellosis, cholera and gastroenteritis;
- (2) viral diseases such as infectious hepatitis, and illnesses by other enteric viruses (Coxsackieviruses A and B, echoviruses, rotaviruses, Norwalk agent and adenoviruses); and
- (3) diseases caused by a variety of protozoan and metazoan species, e.g. amoebic dysentery, giardiasis and ascariasis.

A much more limited spectrum of diseases, including typhoid fever, shigellosis and acute gastroenteritis have been clearly shown to be both swimming-associated and pollution-related from the analysis of outbreak reports, although these have been single outbreaks of infectious hepatitis and Coxsackie A and B disease, which were presumed to be the result of swimming in sewage-polluted water.

The results from previous prospective epidemiological studies (Cabelli, 1980; Dufour, 1984; Foulon *et al.*, 1983) clearly show that the most common waterborne disease which is both swimming-associated and sewage pollution-related is an acute gastroenteritis with a short incubation period, short duration and benign nature. This also is the most common waterborne illness, at least in the USA, and serologic epidemiology as applied to outbreaks of this illness has shown the Norwalk-like viruses to be the most common aetiological agents.

The level of faecal pollution of bathing seawaters, measured by the concentrations of bacterial indicators, has been found to be positively correlated with the incidence of enteric disease among swimmers (Cabelli *et al.*, 1979, 1982, 1983; Foulon *et al.*, 1983; Shuval, 1985). This association was also found in fresh water (Seyfried *et al.*, 1985a,b). In many

of the above studies, an excess of various diseases was found among swimmers over non-swimmers, regardless of the microbial quality of the water. Another potential source of infection is the spray from polluted seawater containing pathogenic bacteria and viruses, which may penetrate the respiratory system (Baylor et al., 1977). Since in bathing water the entire body is exposed to infection, illnesses associated with the eye, ear, skin and upper respiratory tract may be even more common than gastrointestinal disorders, as observed by Stevenson (1953) and Mujeriego et al. (1982). As the aetiological agents of these illnesses do not necessarily originate in the intestinal tract, they cannot be predicted by indicators of faecal contamination and, therefore, criteria and standards involving additional bacterial indicators may be required to prevent their transmission by the water.

The increased use of public beaches for swimming and other aquatic activities has led health authorities in many countries to develop microbial standards for ensuring that waters are safe for swimming. Health criteria, water quality guidelines (WHO/UNEP, 1977) and standards for primary contact with coastal seawaters are based on mandatory and recommended upper density limits for faecal indicators. These guidelines often suffer from inadequate supporting epidemiological data. If sufficient data were available, the guidelines could be based on a criterion that is a mathematical relationship between the incidence or risk of disease among swimmers and water quality, as measured by the density of an appropriate indicator (Cabelli, 1983). Taking into consideration social, economic, medical and public health factors, the "acceptable risk" can be determined, and it would be used to extrapolate guidelines from the criteria used to generate an acceptable limit on water quality. The guidelines, expressed as the limits on water quality, can be promulgated as legal standards (Shuval, 1975; Cabelli et al., 1975).

Several epidemiological studies were performed in order to investigate the relationship between the microbial quality of coastal seawater and morbidity among bathers. Shuval (1985), in his review of the literature on the morbidity associated with bathing water pollution, summarises some 100 works for the period 1909-1985. Some important recent epidemiological studies on the morbidity of bathers associated with seawater pollution are described below.

Mujeriego et al. (1982) conducted an epidemiological study on 24 beaches in Spain with a total of 20,918 questionnaires filled in directly on the beach. Questionnaires included information about:

- (1) the demographic data and bathing habits;
- (2) the subjective qualitative opinion of bathers on beach and seawater quality; and
- (3) information on the health status of bathers. The bacteriological quality of seawater was not checked on the day of the beach interview.

The following conclusions were drawn by the authors:

- (1) there appeared to be a real public health hazard associated with recreational activities on coastal waters of unsatisfactory quality;

- (2) the most frequent health ailments observed among recreationists were skin infections (2% morbidity rate) followed by ear and eye infections (1.5% morbidity rate);
- (3) intestinal infections had morbidity rates below 1% and were not the main public health concern on the coastal areas studied;
- (4) the habit of immersing the head into the water when swimming was significantly associated with ear and eye infections; and
- (5) microbiological limits in terms of faecal coliforms alone did not seem to provide consistent public health protection, and concentrations of faecal streptococci represented an additional limitation of interest.

Foulon et al. (1983) performed a study on 5 beaches. The method used was a beach interview, followed by an answer card given to the interviewee with the listed symptoms occurring within the first 30 days after returning home. Four thousand nine hundred and twenty-one (4921) individuals were questioned on the beach, and 1532 individuals returned an answer card. Water samples were collected and bacteriological analyses of total coliforms, faecal coliforms and faecal streptococci were performed. The results of this study indicated that there was a difference between:

- (1) the incidence of conjunctivitis and skin infections among bathers and non-bathers;
- (2) the incidence of colds, abdominal discomfort, nausea and pruritis between those who immersed the head in water and those who did not.

The differences between polluted and non-polluted beaches were not important.

One of the best-planned studies according to epidemiological criteria was performed by Cabelli et al. (1983). In this study a direct, linear relationship between swimming-associated gastrointestinal illness and the quality of the bathing water was found. The relevant information on demography, swimming status and morbidity was performed by the initial beach interview and by the subsequent telephone follow-up survey (8-10 days after the beach interview). Water samples were collected periodically on trial days, and tested for the following bacterial indicators of water quality: enterococci, E. coli, Klebsiella, Enterobacter, total coliforms, Clostridium perfringens, Pseudomonas aeruginosa, faecal coliforms, Aeromonas hydrophila and Vibrio parahaemolyticus. Enterococci were found to be the best indicator of all bacteria examined as their levels in the water correlated best with the rates of swimming-associated gastroenteritis.

Another study, conducted in freshwater by Dufour, 1984, showed that there was a direct linear relationship between highly credible gastrointestinal illness and bacterial concentration of enterococci and E. coli in the bathing water. However, the criteria developed for bathing in fresh water are not applicable to marine bathing waters.

2. OBJECTIVES

The objectives of the present study were:

1. To determine the relationship between the concentration of bacterial indicator organisms - total coliforms, faecal coliforms, E. coli, faecal streptococci, enterococci, Staphylococcus aureus and Pseudomonas aeruginosa - and defined symptoms of enteric, respiratory, skin and ear diseases among swimmers and non-swimmers exposed to varying levels of bacterial contaminations at bathing beaches.
2. To find the best bacterial indicator to predict a swimming-associated gastrointestinal morbidity.

3. MATERIALS AND METHODS

The design of this pilot-scale prospective epidemiological study, conducted in Israel was similar to that of Cabelli et al. (1983). It followed the recommendations for prospective epidemiological-microbiological studies described in "Health Criteria and Epidemiological Studies Related to Coastal Water Pollution" (WHO, 1977). Guidelines for the Conduct of "Week-end Type" Epidemiological-Microbiological Studies for Developing Recreational Water Quality Criteria are shown in Appendix 1.

1. Study seasons

Studies were conducted during two bathing seasons (May-August 1983 and June-August 1984), mostly during week-ends. The study in 1983 started at the beginning of the bathing season, in order to include bathers who came to the beach for the first time that season.

2. Study beaches

Several Mediterranean beaches in Tel-Aviv areas were surveyed in order to locate relatively "polluted" and relatively "non-polluted" (control) beaches, according to bacteriological tests of seawater and their proximity to wastewater discharges. Three beaches were chosen for the study: Gordon, Sheraton and Rishon LeZion (see Figure 1). The first two were chosen because of their proximity (5 km) from the source of raw sewage dumping in Tel-Aviv and the relative pollution of their water in terms of bacterial content. The Rishon LeZion beach (15 km south of raw sewage dumping in Tel-Aviv) on the other hand, was considered relatively clean in view of the absence of sewage outfalls in the vicinity. All beaches were officially approved for bathing by the Israeli Ministry of Health.

3. Environmental data

Seawater and air temperature, seawater pH and flag colour (indicator of the permissibility of bathing) were recorded on each beach. Data on wind direction and wave height were obtained from the Meteorological Service, Beit Dagon. The recording form for environmental data is shown in Appendix 2.

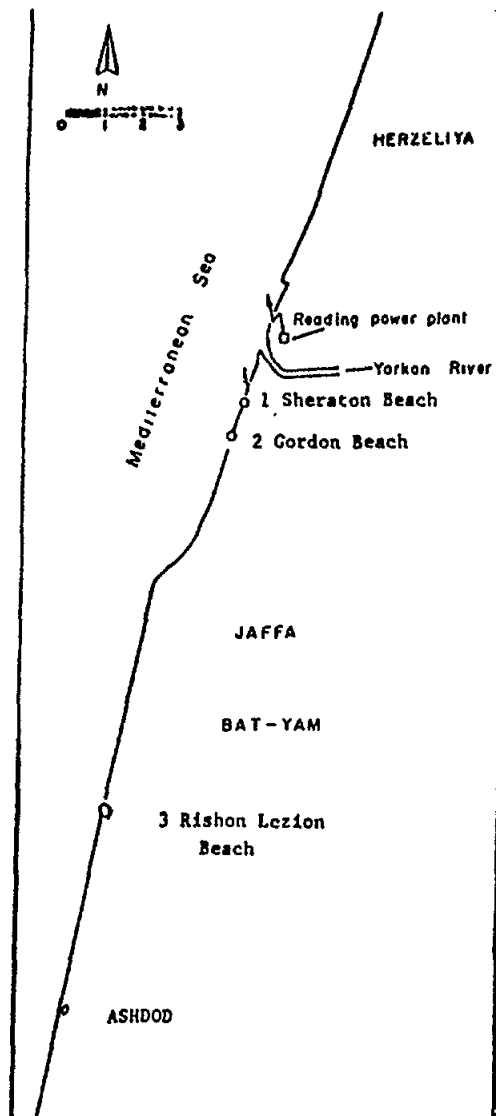


Fig.1 Beaches from which bacteriological samples were taken

4. Bacteriological tests

Water samples were taken for bacteriological tests twice a day (once in the morning and once in the afternoon) during the day of the beach interview at points along the beach, where bathers swim. The samples were kept on ice, shipped to the laboratory, and tested within 6 hours of sampling in order to avoid changes in bacterial counts. In 1983, several water samples were also tested after being kept at 5 °C for 24 hours after sampling. In the 1983 bathing season, a total of 78 samples of seawater (39 days of sampling), and in the 1984 bathing season, a total of 16 samples (8 days of sampling) were collected.

The following bacteriological tests were conducted in the 1983 and 1984 bathing seasons according to reference methods as indicated in Table A (for details see Appendix 3):

Table A

Microbiological methods used in this study

Bacterial indicators	Symbol	Bathing season	Reference
1. Total coliforms (mTC)	TC	1983, 1984	WHO, 1982, Reference Method No.3
2. Faecal coliforms	FC	1983, 1984	WHO, 1982, Reference Method No.3
3. <u>E. coli</u>		1983	Dufour and Cabelli, 1975
4. Thermotolerant coliforms	mTEC	1983	Dufour and Cabelli, 1975
5. Faecal streptococci	FS	1983, 1984	WHO, 1982, Reference Method No.4
6. Enterococci	Ent	1983	Levin <u>et al.</u> , 1975
7. <u>Pseudomonas aeruginosa</u>	Pseud	1983, 1984	Brodsky and Ciebin, 1978 Levin and Cabelli, 1972 Dutka and Kwan, 1977
8. <u>Staphylococcus aureus</u>	Staph	1983, 1984	Mintzer-Morgenstern and Katzenelson, 1980

5. Participants in the study

Potential participants were recruited by interview at the beach, and an effort was made to recruit only families that (a) included at least one child below the age of 10 years and (b) had access to a telephone. The mother was usually chosen as the interviewee. A total of 615 families were interviewed during the bathing season of 1983, and a total of 167 families during the bathing season of 1984. Of these families, a total of 609, comprising 2,231 individuals, participated in the study in 1983, and a total of 167 families, comprising of 484 individuals, participated in the study in 1984.

6. Definition of bathers and swimmers

A "bather" was defined in this study as any person present at the bathing beach, regardless of swimming status. A "swimmer" in this study was defined as a bather whose head had been immersed in the water, who had swallowed seawater, or whose face had been splashed by waves.

7. Morbidity symptoms

The following morbidity symptoms were studied:

Enteric (Gastrointestinal)	:	vomiting, diarrhoea, abdominal pain, nausea
Respiratory	:	sore throat, severe cough, running nose
General	:	earache or ear discharge, fever (over 37.5°C)

Morbidity symptoms were considered highly credible if fever was recorded together with morbidity symptoms and/or a person was absent from work/school/kindergarten, and/or visited nurse or physician, and/or had lab tests performed.

8. Questionnaires

Two questionnaires were prepared: one to be conducted on the beach and another for the follow-up by telephone some 3-5 days after the beach interview.

The questionnaires on the beach (see Appendix 4) with an explanatory letter (see Appendix 5) on the research were administered to families of bathers. Families already interviewed during the same bathing season were not reinterviewed. Families of bathers without telephones were not interviewed, but their addresses were recorded on the special recording form (see Appendix 6). The number of refusals were also recorded. The interviewer was given precise instructions for collecting answers involving categorisation of swimmers and non-swimmers, and for observing some of the children of the interviewed family to verify the swimmer categorisation (for quality assurance).

The beach questionnaire included information on demographic data (age, socioeconomic status, etc.) and swimming status of bathers during the day of the beach interview and for the week prior to the beach interview. The beach questionnaire also included questions as to whether bathers visited any beach or suffered from any morbidity symptoms mentioned above during the week prior to the beach interview.

The telephone interview collected the information on the morbidity symptoms of the bathers interviewed on the beach (the questionnaire is reproduced in Appendix 7), and was conducted about 3 days following the beach interview. If the family was not reached after the first telephone call, it was called again at least 3 times and the number of attempts was recorded. Special forms for time tables for telephone contact with families were prepared (Appendix 8).

9. Coding of data for the computer analysis

Data on temperature, wind direction, wave height and bacteriological tests of seawater was coded according to a special code sheet (Appendix 9) for each visit to the beach. The beach and telephone interview questionnaires were also coded on a special code sheet (Appendix 10).

10. Statistical analysis of data

10.1 Incidence rates and relative risks

Table 1 shows the classification of subjects according to disease experience and the exposure to an aetiological factor.

Table 1

Typical classification of subjects in a prospective study

Exposure (swim)	Disease		Total	
	+	-		
+	a	c	a + c	
-	b	d	b + d	
Total	a+b	c+d	a+b	c+d

The incidence rate among swimmers and non-swimmers was $a/(a+c)$ and $b/(b+d)$. Relative risk clearly expressed the strength of association between exposure and the disease involved. Relative risk was computed as the ratio of the incidence rate of the disease among swimmers to the corresponding rate among non-swimmers (Mantel and Haenszel, 1959), namely:

$$\text{Relative risk} = [a/(a+c)] / [b/(b+d)]$$

10.2 Standard errors of incidence rates

The standard errors were calculated as follows:

If the rate of a symptom in a group is r , and N is the total population in this group, then the standard error (SE) = $r(100-r)/N$.

10.3 Determination of statistical significance between incidence rates

The significance of differences between the incidence rates were defined as follows:

If SE is the standard error, and R is the morbidity symptom incidence rate, then the significance of differences between the incidence rates of groups i and j will be:

$$Z = (R_i - R_j) / \sqrt{(SE_i)^2 + (SE_j)^2}$$

The P values of Z are found in the table of cumulative normal distribution.

Data analysis involved calculation of morbidity symptom incidence rate per 100 persons, swimmers and non-swimmers, for each beach and all beaches cumulatively, according to the various bacterial concentrations found in the seawater.

4. WORKING HYPOTHESIS

This study was designed to test the working hypothesis that there is an increase in the incidence rate of enteric diseases associated with exposure of bathers in the 0 to 0 and especially 0 to 4-year age groups to wastewater polluted seawater. If this is true, then at any given beach:

1. Swimmers in polluted seawater will show higher incidence rates of enteric symptoms than non-swimmers;
2. Swimmers in non-polluted seawater will show similar incidence rates of enteric symptoms as non-swimmers;
3. Swimming-associated rates (swimmers minus non-swimmers) of enteric symptoms in polluted seawater will be higher as compared with swimming-associated rates in non-polluted seawater;
4. Non-swimmers at beaches with polluted seawater will show higher incidence rates of enteric symptoms, as compared with non-swimmers at beaches with non-polluted seawater, since the pathogen pathway could be via the aerosolised polluted seawater or by contact with contaminated sand or solid or sewage origin on the beach;
5. Differences in incidence rates of respiratory diseases, if they exist, between swimmers and non-swimmers will not be related to the pollution of seawater, since they are assumed to be related to swimming, but not associated with the quality of the seawater.

5. RESULTS

1. Meteorological and sea conditions

Measurements of certain meteorological and hydrographic parameters were made when the water samples were collected. These included wave height, wind direction, water pH and water temperature. Tables 2a and 2b summarise these data for the three beaches studied during the 1983 and 1984 bathing seasons. A total of 78 water samples were tested for all beaches in 1983, and a total of 16 in 1984. Sampling was performed from May to August for Gordon and Sheraton beaches, and from May to July for Rishon LeZion beach in the 1983 bathing season, while in the 1984 bathing season the water samples were drawn in June-July on Gordon and Sheraton beaches, and in June-August for Rishon LeZion beach. At all three beaches, the wind direction was west, and occasionally north-west in 1983, and west/south-west in 1984.

Table 2a

Environmental variables for the three beaches studied in the 1983 bathing season

Variable		Gordon	Sheraton	Rishon LeZion
pH	mean	8.0	8.1	8.1
	SD	0.21	0.22	0.14
	CV	0.03	0.03	0.02
	min.	7.6	8.7	8.4
	max.	8.4	8.7	8.4
Water temperature °C	mean	26.7	26.5	25.2
	SD	2.1	2.9	2.2
	CV	0.36	0.43	0.40
	min.	23.0	23.0	21.0
	max.	30.0	31.0	28.0
Wave height in cm	Mean	65	67	81
	SD	23	29	32
	CV	0.36	0.43	0.40
	min.	50	0	50
	max.	100	100	150
No. of samples		33	21	24
Sampling period		May-August	May-August	May-July
SD - standard deviation			min. - minimum	
CV - coefficient of variation			max. - maximum	

Table 2b

Environmental variables for the three beaches studied in the 1984 bathing season

Variable		Gordon	Sheraton	Rishon LeZion
Water temperature °C	mean	26.9	28.1	29.0
	SD	0.2	1.1	1.4
	min.	26.5	24.0	25.0
	max.	27.0	27.0	28.0
Wave height in cm	mean	75	75	58
	min.	50	50	0
	max.	100	100	100
No. of samples		4	6	6
Sampling period		June-July	June-July	June-August
SD - standard deviation		min. - minimum	max - maximum	

No significant differences in water temperature or wave height were found between the three beaches in the 1983 bathing season. pH values were measured for the 1983 bathing season only and were similar at all three beaches (mean pH 8.1). Mean water temperature was around 26 °C for both 1983 and 1984 bathing seasons. Mean wave heights were 65 to 75 cm for Gordon, 67 and 75 cm for Sheraton, and 81 and 58 cm for Rishon LeZion during the 1983 and 1984 bathing seasons respectively. It should be noted that sampling was performed on different days at the Rishon LeZion beach, while at Sheraton and Gordon beaches samples were generally collected on the same day.

2. Seawater bacteriological quality

2.1 1983 Bathing season

Appendices 11a-11e show the log mean, median, standard error, maximum and minimum CFU/100 ml, the number of samples, and the frequency distribution for faecal coliforms (FC - mFC), faecal streptococci (FS), enterococci (Ent), E. coli and thermotolerant coliforms (mTEC) for the three beaches individually and collectively for the 1983 bathing season. From the data obtained, it can be seen that Rishon LeZion beach, located 15 km south of the Tel-Aviv sewage plant, consistently showed the lowest concentrations of each of the bacterial indicators tested in comparison to the two other beaches, which are situated close (5 km) to the Tel-Aviv sewage plant. The frequency distribution also shows a higher proportion of 101-1000 CFU/100 ml for Gordon and Sheraton beaches, as compared with Rishon LeZion beach, for these bacteria. The differences between the concentrations of each of the bacterial indicators on the three study beaches were found to be highly significant ($P < 0.01$). All the bacterial concentrations found in this study fall within UNEP/WHO standards of water quality.

Appendices 11f-11h show the log mean, median, minimum, maximum and number of samples tested for total coliforms (TC), Pseudomonas aeruginosa (Pseud) and Staphylococcus aureus (Staph) for the 1983 bathing season. It should be noted that the number of samples tested for these bacteria were much smaller than those shown in Appendices 11a-11e (total of 76-77 samples tested for FC, Ent, E. coli, FS, and 16-20 samples for TC, Pseud, Staph). For these indicator bacteria no difference in densities was found between the three beaches. However, for total coliforms, the maximum count was found to be the highest for Rishon LeZion beach.

Table 3 summarises the bacterial densities (log means) by study beaches and shows the significance of differences of bacterial densities between beaches. For FC, thermotolerant coliforms (m-TEC), E. coli, FS and Ent there was a significant ($P < 0.05$) difference between Gordon and Rishon LeZion, though no difference was found between Gordon and Sheraton or Sheraton and Rishon LeZion for any bacterial density.

Table 4 shows the range and median and number of sampling days for bacterial densities in seawater in the 1983 bathing season defined as "high" and "low" for the purpose of morbidity analysis of bathers. The cutoff was defined before and independently from the morbidity analysis in order to have, if possible, approximately the same number of sampling days for "low" and "high".

Table 3

Distribution of bacterial densities (log means CFU/100 ml) in seawater by bathing beaches for the 1983 bathing season

Bacteria	<u>Densities/100 ml</u>			<u>Significance of differences between beaches</u>		
	<u>Beach</u>					
	Gordon	Sheraton	Rishon	Gordon vs Sheraton	Sheraton vs Rishon	Gordon vs Rishon
Faecal coliforms	117	38	16	ns	ns	0.05
<u>E. coli + Klebsiella</u>	49	21	6	ns	ns	0.05
<u>E. coli</u>	30	9	5	ns	ns	0.05
Faecal streptococci	67	49	19	ns	ns	0.05
Enterococci	41	15	10	ns	ns	0.05
Total coliforms	80	42	71	ns	ns	ns
<u>Pseudomonas</u>	5	7	4	ns	ns	ns
<u>Staphylococcus</u>	25	22	27	ns	ns	ns

Table 4

Levels of bacterial densities in seawater for the 1983 bathing season

Bacteria	<u>Bacterial levels CFU*/100 ml</u>					
	<u>"low"</u>			<u>"high"</u>		
	Samples(No)	range	median	Samples(No)	range	median
Faecal coliforms	16	0-50	9	21	51-650	138
Faecal streptococci	25	0-50	19	17	51-395	106
Enterococci	20	0-24	7	22	25-268	49
<u>E. coli</u>	24	0-24	5	17	25-268	49
<u>Pseudomonas</u>	9	0- 9	3	4	10- 45	14
<u>Staphylococci</u>	9	0-24	10	10	25- 70	44

2.1.1 Correlation between bacterial indicators

Table 5 shows the Pearson correlation coefficients, with significance levels, between five bacterial indicator concentrations for the three beaches together performed for the 1983 bathing season. In every case, the correlations between bacterial indicators were high, positive and significant at $P < 0.01$.

The lowest correlation was found between mTEC and Ent ($r = .56$), and the highest correlation was between E. coli and mTEC ($r = .95$), as well as between E. coli and FC ($r = .88$).

Table 5

Pearson correlation coefficients matrix between the logs of bacteria indicator counts for three study beaches ^{1,2}, 1983 bathing season

	Faecal coliforms	Faecal streptococci	Enterococci	Thermotolerant coliforms
Faecal streptococci	.71 (70)*			
Enterococci	.74 (67)	.80 (76)		
Thermotolerant coliforms	.83 (67)	.62 (76)	.56 (72)	
<u>E. coli</u>	.88 (67)	.65 (75)	.61 (72)	.95 (75)

1. Zero concentrations were excluded for the bacterial indicators shown in this table. However, the coefficients of correlations between bacterial indicators including and excluding zero concentrations were similar.

2. The correlations were significant at $p < 0.01$ level in all cases.

* No. of cases in parentheses.

2.1.2 Comparison between faecal coliforms and enterococci tests 6 and 24 hrs after sampling

Table 6 presents a comparison of two sets of tests for bacterial indicators (i.e., FC and Ent), performed in the 1983 bathing season. The first test was done 6 hours after sampling, and the second after storage of the sample for 24 hr at 5 °C. This table shows log means, minimum and maximum CFU/100 ml, numbers of samples, and percent of die-away.

Table 6

Comparison of bacterial indicator concentrations (CFU/100 ml) tested on the same day of sampling and after being stored 24 hours at 5 °C (1983 bathing season)

	Faecal coliform tested		Enterococci tested	
	Same day	after 24 hr	Same day	after 24 hr
Log mean	76	52 (32%)*	26	22 (15%)*
Minimum	3	6	2	2
Maximum	557	694	184	160
No. of samples	19	19	22	22
T-value	2.6 (P = 0.02)		1.7 (P = 0.10)	

* Percent of die-away

A T-test demonstrates the significant decrease in bacterial concentration (at $p < 0.02$) of the second test performed for FC as compared to the first test (log means of 52 and 76 CFU/100 ml, the die-away was 32%). It is worth mentioning that of the 19 pairs, 15 (79%) showed a decrease of 10% or more in the levels of FC. No significant differences were found between the two tests for Ent (means 26 and 22 CFU/100 ml), which represents a 15% bacterial die-away. However, of the 22 pairs, 13 (59%) showed a decrease of 10% or more in the levels of Ent.

2.2 1984 Bathing season

Appendices 12a-12e show the log mean, median, maximum and minimum CFU/100 ml, the number of samples for total coliforms (TC), faecal coliforms (FC), faecal streptococci (FS), Pseudomonas aeruginosa (Pseud), and Staphylococcus aureus (Staph), for all three beaches separately and together for the 1984 bathing season. Because of budgetary limitations, only the above bacterial indicators could be tested in 1984. The data shown in these appendices are summarised in Table 7, which shows the log mean and significance of differences between beaches for each bacteria parameter studied. Rishon LeZion beach showed the lowest densities for TC, FC and FS. For TC and FS, significant differences were found between Gordon and Rishon LeZion beaches. However, no significant differences between beaches were found for Pseud and Staph.

Table 7

Distribution of bacterial densities (log means CFU/100 ml) in seawater by bathing beaches for the 1984 bathing season

Bacteria	Densities/100 ml Beach			Significance of differences between beaches		
	Gordon	Sheraton	Rishon	Gordon vs Sheraton	Sheraton vs Rishon	Gordon vs Rishon
Faecal coliforms	380	121	17	ns	ns	<0.05
Faecal streptococci	992	4146	949	ns	ns	ns
Total coliforms	1547	197	29		ns	<0.05
<u>Pseudomonas</u>	5	4	1	ns	ns	ns
<u>Staphylococcus</u>	5	3	2	ns	ns	ns

Faecal streptococci (FS) concentrations in seawater (tested with KF medium) in 1984 were much higher than those in 1983, although the concentration of faecal coliforms (FC) remained approximately the same (see Appendix 13). Microscopical confirmation of "typical" red colonies that grew on KF streptococcus agar at 35 °C (according to the method employed) and were sub-cultured to brain-heart infusion, proved that a considerable percentage of them were gram negative bacilli or micrococci, making the FS counts with KF medium in seawater unreliable. Identification of these bacteria

was still in progress at the time of termination of the project, and the results therefore had to be left for future publication. For this reason, the data on faecal streptococci were eventually disregarded in the morbidity analysis.

3. Demography

Of 615 families interviewed on the beach in the 1983 bathing season, 609 (99%) families were reached by telephone for the health interview; of the 167 families interviewed on the beach in the 1984 bathing season, 154 (92%) families were reached by telephone for the health interview.

Table 8 shows the distribution of the study population by beaches and by age groups for 1983 and 1984. The age distribution was similar between bathing beaches. In the 1983 bathing season the interviews included 609 families with 2231 individuals, and in 1984, 154 families with 480 individuals. In both bathing seasons 40% of the population were interviewed at Gordon beach, 17% at Sheraton and 33% at Rishon LeZion. Twenty-five percent (25%) of all bathers (both seasons) belonged to the 0- to 4-year age group; 27% to the 5- to 10-year age group and 41% to the 19+ age group.

Table 8

Distribution of study population by beaches and age groups
(1983 and 1984 bathing seasons)

Age/Beach	1983				1984			
	Gordon	Sheraton	Rishon	All	Gordon	Sheraton	Rishon	All
0- 4 N	208	159	157	524	24	57	61	131
%	21	29	23	23	24	31	31	28
5- 9 N	217	155	161	533	20	52	40	112
%	22	28	23	24	20	28	20	24
10-18 N	118	44	49	211	17	14	18	49
%	12	8	7	10	17	8	9	10
19+ N	455	189	319	936	38	60	79	178
%	45	35	47	43	39	33	40	38
All N	998	547	689	2231	98	183	198	480*
%	100	100	100	100	100	100	100	100

* Information on 2 cases was missing

Table 9 shows the distribution of the study population by month of interview. In both seasons, most of the population was interviewed in July (40% in the 1983 and 70% in the 1984 bathing seasons). In 1983 the interviews started in May, and 10% of the total were held during this month. In 1984, interviews started in June.

Table 9

Distribution of study population by months of interview
(1983 and 1984 bathing seasons)

Month	1983		1984	
	No. of persons	%	No. of persons	%
May	226	10	-	-
June	605	27	90	19
July	897	40	340	70
August	500	23	52	11
Unknown	3	0		
Total	2233	100	482	100

Table 10a shows the distribution of the whole study population by age group and swimming status for the 1983 and 1984 bathing seasons. In both seasons 60% or more of the study population were swimmers (65% for 1983 and 60% for 1984).

Table 10a

Distribution of swimmers and non-swimmers (No.) by age groups
(bathing seasons 1983 and 1984)

Swimming status	Age				
	0-4	5-9	10-18	19+	All
	<u>1983</u>				
Swimmers	325	463	197	462	1447
Non-swimmers	199	70	14	501	784
	<u>1984</u>				
Swimmers	90	88	40	69	287
Non-swimmers	52	24	10	108	194

Table 10b shows the distribution of the study population analysed for morbidity by bacterial indicator densities, by age groups, beaches and swimming status. The population is smaller since only individuals present on the beaches on those days for which reliable assays of bacteria in seawater were available were included in the analysis. This table shows that the distribution of swimmers by age groups was about the same on all the study beaches.

The distribution of swimmers and non-swimmers by bathing beaches was similar. The percentage of swimmers (about 70%) and non-swimmers (about 30%) in the 0 to 4 year old age group was similar for Gordon and Sheraton. For Rishon LeZion there were about the same percentage of swimmers (50%) and non-swimmers (50%).

Table 10b

Distribution of swimmers and non-swimmers (No.) by age groups and bathing beaches (bathing season 1983)*

Beach	Swimming status	Age				All
		0-4	5-9	10-18	19+	
Gordon	sw	135	193	110	247	685
	nsw	71	23	6	193	293
Sheraton	sw	98	117	30	53	298
	nsw	37	17	3	98	157
Rishon LeZion	sw	70	427	39	122	348
	nsw	69	66	3	159	257
All	sw	303	737	179	422	1331
	nsw	177	106	12	450	705

* Numbers are shown only for bathers included in the morbidity analysis

Table 11 shows the distribution of the study population by swimming status and sex for 1983 and 1984. In both seasons the percentage of swimmers among male bathers was higher than that among the female bathers (77% as against 56% for 1983, and 71% as against 53% in 1984).

Table 11

The distribution of swimmers and non-swimmers by sex (bathing seasons 1983, 1984)

Swimming status		1983			1984		
		Males	Females	All	Males	Females	All
Swimmers	No.	711	736	1447	120	166	286
	percent*	49	51	100	25	75	100
	percent**	77	56		72	53	
Non-swimmers	No.	210	574	784	47	147	194
	percent*	27	73	100	24	76	100
	percent**	23	44		28	47	

* Percent row;

** Percent column

Table 12 shows the distribution of the study population by country of mother's origin for 1983 and 1984. This distribution is shown for each beach separately and together for 1983 and for all beaches together for 1984. Most of the population (80%, 83% for 1983, 1984, respectively) was Israeli-born.

Table 12

The distribution of the study population by mother's country of origin (1983 and 1984 bathing seasons*)

Country of origin	Bathing season					
		1983				1984
		Gordon	Sheraton	Rishon	All	All
Israel	No.	789	461	539	1780	397
	%	80	86	79	80	83
Asia	No.	63	16	37	116	7
	%	6	3	5	5	1
Africa	No.	33	16	51	100	11
	%	3	3	7	5	2
Europe, America	No.	107	44	59	210	67
	%	11	8	9	10	14
Total	No.	992	537	686	2215*	482
	%	100	100	100	100	100

* Information on 16 cases was missing

Table 13 shows the distribution of families in the study population by beach and by social status of the mother for the 1983 and 1984 bathing seasons. The social status was defined by the commonly used English system of social status classification, with some modifications for Israel. Most of the mothers were not working and were of middle and high social status. The social status of the population was similar for the three study beaches.

4. Swimming-related health risk

The first question to be answered in this pilot-scale prospective study was which diseases are swimming-related. Appendices 14a-14o show the swimming-related incidence rates for all symptoms studied for all bathers for the 0-4, 5-9, 10-17, 18+ age groups and all ages for the 1983, the 1984 and the 1983+ the 1984 bathing seasons for all beaches together. This preliminary analysis showed that the total morbidity was higher among swimmers than among non-swimmers. Table 14 shows the swimming-related health risk and incidence rates for the 0 to 4 year old age group and for all ages for the 1983 bathing season only for symptoms with significant differences in incidence rates between swimmers and non-swimmers for total enteric, total respiratory and "sick" symptoms. It can be seen from Table 14 that total enteric, total respiratory and "sick" symptoms showed a significant difference for the 0 to 4 year old age group and for all ages between swimmers and non-swimmers. Highly credible total enteric symptoms did not show significant differences

for the 0 to 4 year old age group, although for highly credible total respiratory symptoms there were significant differences for this age group. Relative risk (RR) for all these symptoms ranged from 1.3 to 1.4 for both the 0 to 4 year old age group and all ages. No significant differences for total enteric symptoms were found for any other age groups. No significant differences were found for highly credible enteric symptoms for any age group.

Table 13

The distribution of families by mother's social status and beaches
(1983 and 1984 bathing seasons)

Mother's social status		Bathing season and beaches							
		1983				1984			
		Gordon	Sheraton	Rishon	All	Gordon	Sheraton	Rishon	All
High	No.	30	9	10	49	10	9	5	32
	%	11	6	6	8	30	14	8	20
High- middle	No.	63	39	44	147	11	22	18	51
	%	24	26	26	25	33	35	28	31
Middle	No.	58	27	54	138	2	7	7	16
	%	22	18	31	23	6	11	11	10
Low	No.	10	0	3	13	0	2	0	2
	%	4	0	2	2	0	3	0	1
Does not work	No.	100	72	60	232	10	21	32	63
	%	37	48	34	39	30	33	50	39
Student	No.	4	4	2	10	0	2	2	4
	%	2	2	1	2	0	3	3	3
Total	No.	265	150	174	589*	33	63	64	162
	%	100	100	100	100	100	100	100	100

* Due to technical reasons some families are excluded

The analysis of the swimming-related incidence rates was also performed for those bathers who did not visit any beach or swimming pool a week prior to the beach interview and for those bathers that did not have any of the morbidity symptoms under study for a week prior to the health interview (see Appendices 14). The results of these two morbidity analyses were similar to those of all bathers described in Table 14.

Table 14

Relative risk (RR) and incidence rates per 100 persons among swimmers and non-swimmers of the 0 to 4 year old age group and all ages for selected symptoms and diseases for the 1983 bathing season

Symptoms & diseases	Incidence rates/100 persons		RR	P*
	Swimmers	Non-swimmers		
Age group: 0-4				
Number of persons	325	199		
Total enteric	16.3	10.6	1.5	0.03
Total respiratory	18.5	13.1	1.4	0.03
"Sick" (any symptom)	37.2	27.6	1.3	0.01
Highly credible total enteric	7.4	6.5	1.1	NS
Highly credible total respiratory	7.7	4.0	1.9	0.04
Age group: all ages				
Number of persons	1444	780		
Total enteric	9.1	6.4	1.4	0.02
Total respiratory	8.6	5.9	1.4	0.03
"Sick" (any symptom)	19.3	13.8	1.4	0.001

* Level of significance of differences of incidence rates between swimmers and non-swimmers.

5. Analysis of swimming-associated morbidity by bacterial seawater pollution

5.1 Analysis of swimming-associated morbidity by bathing beaches

Another question to be answered in this study was whether swimming-associated morbidity is related to bathing water pollution. The swimming-associated health risk was compared for all the study population separately for bathing beaches with significant differences of bacterial densities - Gordon and Rishon LeZion (see Table 3). Tables 15 and 16 show the incidence rates, relative risk (RR) and rate difference for swimming-associated (swimmers minus non-swimmers) symptoms for the 0 to 4 year old age group and all ages for the 1983 bathing season for selected symptoms for these two beaches. These tables also show the difference and ratio of swimming-associated rates between these two beaches. Table 15 shows that throat irritation, total respiratory and highly credible total respiratory, diarrhoea, total enteric, earache and "sick" were significantly swimming-associated for the "polluted" Gordon beach, while only earache and "sick" were significantly swimming-associated for "clean" Rishon LeZion beach. Relative risk (RR) was the highest for throat irritation (3.6) highly credible respiratory (4.4) and earache (6.0) for Gordon beach. For other symptoms RR ranged from 0.9 to 2.6. The difference and ratio for swimming-associated rates for Gordon and Rishon LeZion were the highest for cough, highly credible respiratory, diarrhoea, total enteric and fever. Table 16 shows that swimming-associated diarrhoea, total enteric, total respiratory

and fever symptoms showed the significant difference for the 0 to 4 year old age group for Gordon beach and earache for Rishon LeZion beach. For this age group for Gordon beach RR was the highest for nausea (15.0), vomiting (3.7) and highly credible respiratory symptoms (3.4) and for Rishon LeZion for earache (57.0). In general for these two beaches RR ranged from 0 to 2.5.

Table 15

Swimming-associated incidence rates (swimmers minus non-swimmers) per 100 persons for Gordon (G) and Rishon LeZion (R) beaches for all ages for the 1983 bathing season

Symptom	Swimming-associated incidence rates				Relative risk	
	Gordon	Rishon	G-R	G/R	Gordon	Rishon
Cough	1.4	0.2	1.2	7.0	1.7	1.1
Cold	1.6	2.4	-0.8	0.7	1.4	1.8
Throat irritation	1.8***	0.5	1.3	3.6	3.6	1.2
Total respiratory	2.9*	2.6	0.2	1.1	1.6	1.4
HC ¹ respiratory	2.2***	0.6	1.6	3.7	4.4	1.1
Vomiting	0.6	0.2	0.4	3.0	1.4	1.5
Abdominal pain	1.4	0.7	0.7	2.0	1.4	1.2
Nausea	0.6	>0.7	<-0.1	0.9	1.4	>2.8
Diarrhoea	2.9*	-1.1	4.0	∞	1.8	0.7
Total enteric	3.7*	1.5	2.2	2.5	1.6	1.3
HC ¹ enteric	0.8	0.2	0.6	4.0	1.3	1.1
Fever	2.2*	0.2	2.0	11.0	2.6	1.1
Skin	-0.5	0.6	-1.1	∞	0.9	1.3
Earache	1.5**	2.0***	<-0.1	<0.9	6.0	>5.0
Sick	4.8***	4.6*	0.2	1.0	1.3	1.4

Differences of rates between swimmers and non-swimmers significant:

* at $P < 0.05$

** at $P < 0.01$

*** at $P < 0.005$

1 HC = highly credible

Table 16

Swimming-associated incidence rates (swimmers minus non-swimmers) per 100 persons for Gordon (G) and Rishon LeZion (R) beaches for the 0 to 4 year old age group, for the 1983 bathing season

Symptom	Swimming-associated incidence rates				Relative risk	
	Gordon	Rishon	G-R	G/R	Gordon	Rishon
Cough	3.3	5.7	-2.4	0.6	1.6	1.8
Cold	4.3	8.5	-4.2	0.5	1.3	2.1
Throat irritation	0.2	1.5	-1.3	0.1	1.1	2.1
Total respiratory	5.9*	-8.4	-2.5	0.7	1.4	1.6
HC ¹ respiratory	6.8*	5.7	1.1	1.2	3.4	1.7
Vomiting	3.8	0.0	3.8	∞	3.7	0.0
Abdominal pain	3.2	-0.1	3.3	∞	1.8	1.0
Nausea	1.5	0.0	1.5	>15	15.0	-
Diarrhoea	8.5*	-3.0	11.5	2.8	2.5	0.7
Total enteric	10.1*	2.7	7.4	3.7	2.0	1.2
HC ¹ enteric	4.7	-3.0	7.7	∞	2.2	0.7
Fever	4.7	-0.1	4.8	∞	2.1	1.0
Skin	-1.1	4.2	-5.3	∞	0.9	2.4
Earache	0.8	5.7	-4.9	0.1	1.6	>57.0
Sick	10.5	11.1	-0.6	0.9	1.3	1.5

Differences of rates between swimmers and non-swimmers significant:

* at $P < 0.05$

** at $P < 0.01$

*** at $P < 0.005$

1 HC = highly credible

The comparison of the symptom rates for the most heavily polluted beach (closest to a known wastewater discharge and highest faecal indicator levels), Gordon, with those for the least polluted beach (most distant from a known wastewater discharge and lowest faecal indicator levels), Rishon LeZion, showed that only enteric symptoms consistently were both swimming-associated and pollution-related. Furthermore, the mean density for all the faecal indicators except total coliforms (and not *P. aeruginosa* and *S. aureus*) were significantly greater at Gordon than at Rishon LeZion, suggesting that the former but not the latter correlated best with the disease rates. A more definitive approach was sought to determine the faecal indicator whose level in the bathing waters correlated best with swimming-associated disease rates. Two such approaches were taken: 1. comparison of the overall symptom rates for those days with "high" indicator levels in the water with those with "low" indicator levels and, 2. regression analysis of the rates of total enteric symptoms against the indicator levels in water by day and beach. Data from all three beaches were used in these analyses.

5.2 Preliminary analysis by "high" and "low" bacterial densities

The morbidity analysis for the 1983 and 1984 bathing seasons was performed by age groups (0-4, 5-9, 10-17, 18+ and all ages), bacterial density: "high" and "low" (measured by median or log mean or the highest bacterial density) and swimming status of bathers (swimmers and non-swimmers). It should be noted that the cut-off of bacterial densities on "high" and "low" was performed independently of the morbidity analysis. Morbidity analysis was performed for all symptoms recorded separately, enteric symptoms, respiratory symptoms and for all individuals having at least one symptom recorded ("sick"). A separate analysis was done for highly credible enteric, respiratory and "sick" symptoms (having high fever and/or visited physician or nurse and/or had laboratory tests performed).

Appendix 15 describes the analyses of morbidity of bathers performed in this study. The distribution of all morbidity symptoms among bathers is shown by "high" and "low" bacterial densities in seawater separately for each of the six bacterial indicators. The bacterial densities in most of these tables were calculated as the log mean of bacterial densities of two water samples drawn on the day of sampling. The analysis of morbidity according to "high" and "low" bacterial densities was performed for all bathers (Table MSPA is shown in Appendices 16a-16n for FC, enterococci and E. coli for the 0 to 4 year old age group and all ages for the 1983, and for FC for the 1984 bathing season), for the bathers that did not go to any beach for the week prior to the interview (Table MSPB is shown in Appendices 17a-17b for enterococci for the 0 to 4 year old age group and for all ages for 1983), and for the bathers that were not sick in the week prior to the interview (Table MSPD is shown in Appendices 18a-18d, for enterococci for the 0 to 4 year old age group and for all ages for 1983).

A separate analysis of morbidity of all bathers was performed by the highest bacterial concentration determined during the bather's stay at the beach (Table MSPE is shown in Appendices 19, for enterococci for the 0 to 4 year old age group and all ages for the 1983). The analysis for highly credible morbidity symptoms was performed by "high" and "low" bacterial indicator concentrations measured by log mean (Table MSPF is shown in Appendix 20, for enterococci for the 0 to 4 year old age group and all ages for 1983).

Since the difference between swimmers and non-swimmers in the incidence rates for any symptom for all bathers (Appendix 16) were found to be similar to those for bathers that were not sick on the day of the interview (Appendix 18) and to those that did not go to any beach/pool for the week prior to the interview (Appendix 17), the data for all bathers are presented in this report, as the total population size was the highest with significant differences between swimmers and non-swimmers. Tables 17a and 17b summarise App.16-18 and shown the incidence rates, relative risk (RR) and rate difference (RD) for enteric and respiratory symptoms among bathers of 0 to 4 year old age group for different groups of bathers, by enterococci levels in seawater for the 1983. It can be seen that no difference between swimmers and non-swimmers was found for "high" level of enterococci for respiratory symptoms for any group of bathers. For the enteric symptoms, the most significant difference between swimmers and non-swimmers was found for all bathers. For the other bacterial indicators, the most significant differences were also found for all bathers.

Table 17a

Incidence rates of enteric symptoms, relative risk (RR) and rate difference (RD) among bathers of the 0 to 4 year old age group by enterococci densities for the 1983 bathing season

Study population	Enterococci densities	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
All bathers	"low"	10.7	9.2	1.1	1.7	NS
	"high"	22.1	12.9	1.7	9.2	0.03
Bathers who did not visit any beach one week prior to interview	"low"	6.7	12.0	0.6	-5.3	NS
	"high"	18.4	10.1	1.8	8.3	0.06
Bathers who did not have any enteric symptom one week prior to beach interview	"low"	8.8	6.3	1.4	1.5	NS
	"high"	18.8	12.1	1.5	6.7	0.08
All bathers (highest bacterial concentration during the bathing time)	"low"	11.1	10.4	1.1	0.7	NS
	"high"	20.9	12.9	1.6	8.0	0.04

* Level of significance of differences of incidence rates between swimmers and non-swimmers.

Table 17b

Incidence rates of respiratory symptoms, relative risk (RR) and rate difference (RD) among bathers of the 0 to 4 year old age group by enterococci densities for the 1983 bathing season

Study population	Enterococci densities	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
All bathers	"low"	17.6	10.5	1.7	7.1	0.05
	"high"	19.2	14.9	1.3	4.3	NS
Bathers who did not visit any beach one week prior to interview	"low"	12.2	10.0	1.2	2.2	NS
	"high"	19.4	17.4	1.1	2.0	NS
Bathers who did not have any enteric symptom one week prior to beach interview	"low"	11.1	13.3	0.8	-2.2	NS
	"high"	12.7	16.2	0.8	-3.5	NS
All bathers (highest bacterial concentration during the bathing time)	"low"	22.2	11.9	1.9	10.3	0.03
	"high"	17.6	13.9	1.3	3.7	NS

* Level of significance of differences of incidence rates between swimmers and non-swimmers.

Appendices 21a-21j show the incidence rates/100 persons for enteric (App.21a-21d), respiratory (App.21e-21h) and any of the studied symptoms (sick) (App.21i-21l) for 0-4, 5-9, 18+ and all age groups for the 1983 bathing season for all bathers by "high" and "low" densities of faecal coliforms (FC), enterococci (ent), E. coli, Pseudomonas aeruginosa (pseud) and Staphylococcus aureus (staph) for swimmers and non-swimmers for 1983. Appendix 21m shows the incidence rates for highly credible enteric symptoms for 0-4, 5-9, 18+ and all age groups for the 1983 bathing season for all bathers by "high" and "low" densities of enterococci.

Tables 18-22 summarise the incidence rates among bathers shown in Appendices 21a-21m for enteric, respiratory and "sick" as well as for ear and skin symptoms, and also show the relative risk (RR), rate difference (RD) and level of significance of difference of rates between swimmers and non-swimmers for these symptoms for all ages for "high" and "low" FC, E. coli, Ent, Staph and Pseud levels in seawater for 1983. Significant differences of enteric symptoms incidence rates were found for "high" levels of FC and Staph. Incidence rates of respiratory symptoms were found to be significantly higher among swimmers than among non-swimmers for "low" levels of FC, Ent and Staph, and for "high" and "low" levels of E. coli. No significant differences were found between swimmers and non-swimmers for skin symptoms. Significant differences were found for ear infections for "high" levels of Ent, and "low" levels of Staph. The significant differences were found for "sick" symptoms for "low" and "high" levels of FC, E. coli, and Ent, and "low" levels of Pseud and Staph.

Table 18

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (all ages) by faecal coliform (FC) density in seawater

Symptoms	Bacterial density	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	8.1	6.7	1.2	1.4	NS
	"high"	9.5	6.8	1.4	2.7	0.05
Respiratory	"low"	8.9	3.8	2.2	5.1	0.02
	"high"	8.3	6.6	1.3	1.7	NS
Skin complaints	"low"	3.1	2.4	1.3	0.7	NS
	"high"	3.5	2.8	1.2	0.7	NS
Earache	"low"	1.2	1.4	0.9	-0.2	NS
	"high"	2.3	0.2	11.5	2.1	0.001
"Sick"	"low"	17.7	12.9	1.4	4.8	0.005
	"high"	20.4	15.2	1.3	5.2	0.001
Number of persons **	"low"	418	210			
	"high"	866	427			

* Level of significance of differences of incidence rates between swimmers and non-swimmers (NS - not significant).

** This number is lower than total population since some tests for this bacterial indicator is missing.

Table 19

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (all ages) by E. coli density in seawater

Symptoms	Bacterial density*	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	8.3	5.7	1.4	2.3	NS
	"high"	10.2	7.7	1.3	2.5	NS
Respiratory	"low"	9.1	5.7	1.6	3.4	0.03
	"high"	8.1	5.4	1.5	2.7	0.05
Skin complaints	"low"	3.0	3.5	0.8	-0.5	NS
	"high"	3.6	1.5	2.4	2.1	0.01
Earache	"low"	1.2	0.9	1.3	0.3	NS
	"high"	2.5	0.3	8.3	2.2	0.001
"Sick"	"low"	18.0	14.8	1.3	3.2	NS
	"high"	21.1	13.7	1.5	7.4	0.001
Number of persons *	"low"	662	317			
	"high"	669	388			

* For footnotes see Table 18

Table 20

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (all ages) by Enterococci density in seawater

Symptoms	Bacterial density*	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	7.6	5.1	1.5	2.5	NS
	"high"	10.4	8.0	1.3	2.4	NS
Respiratory	"low"	9.6	5.1	1.8	4.5	0.01
	"high"	7.8	5.8	1.3	2.0	NS
Skin complaints	"low"	3.1	1.7	1.8	1.4	NS
	"high"	3.5	2.9	1.2	0.6	NS
Earache	"low"	1.6	1.0	1.6	0.6	NS
	"high"	2.0	0.2	10.0	0.8	0.01
"Sick"	"low"	18.2	12.2	1.5	6.0	0.02
	"high"	20.3	15.6	1.3	4.7	0.02
Highly credible enteric	"low"	4.0	2.4	1.7	1.6	NS
	"high"	3.7	3.6	1.0	0.1	NS
Number of persons *	"low"	550	294			
	"high"	781	411			

* For footnotes see Table 18

Table 21

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (all ages) by Staphylococci density in seawater

Symptoms	Bacterial level	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	8.2	7.5	1.1	0.7	NS
	"high"	8.4	4.8	1.7	3.6	0.05
Respiratory	"low"	9.9	7.0	1.4	2.9	NS
	"high"	5.9	6.1	1.0	-0.2	NS
Skin complaints	"low"	2.7	2.5	1.1	0.2	NS
	"high"	3.0	2.4	1.2	0.6	NS
Earache	"low"	1.9	0.0	-	1.9	0.01
	"high"	1.7	0.6	2.8	1.1	NS
"Sick"	"low"	18.9	13.4	1.4	5.5	0.05
	"high"	16.7	14.5	1.1	2.2	NS
Number of persons *	"low"	365	201			
	"high"	526	165			

* For footnotes see Table 18

Table 22

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (all ages) by Pseudomonas density in seawater

Symptoms	Bacterial level	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	8.3	5.6	1.5	2.7	NS
	"high"	8.5	9.7	0.9	-1.2	NS
Respiratory	"low"	8.0	6.3	1.3	1.7	NS
	"high"	5.1	6.5	0.8	-1.4	NS
Skin complaints	"low"	3.5	2.3	1.5	1.2	NS
	"high"	0.9	6.5	0.1	-5.6	NS
Earache	"low"	1.7	0.00	-	1.7	NS
	"high"	0.9	0.0	-	0.9	NS
"Sick"	"low"	18.0	12.0	1.4	6.0	0.02
	"high"	14.5	22.6	0.6	-8.1	NS
Number of persons *	"low"	687	302			
	"high"	117	31			

* For footnotes see Table 18

Tables 23-27 summarise the incidence rates among bathers shown in Appendices 21 for enteric, respiratory and "sick" as well as for ear and skin symptoms and also shows the relative risk (RR) and rate difference (RD) for these symptoms for the 0 to 4 year old age group for "high" and "low" FC, E. coli, Ent, Staph and Pseud levels in seawater. No significant differences between swimmers and non-swimmers were found for ear infections, or for enteric and respiratory symptoms by Staph and Pseud densities. Significant differences were found for skin symptoms for "low" levels of Ent; for enteric and "sick" for "high" levels of Ent and Staph; for "sick" for "high" and "low" levels of Ent and for "low" level of Pseud; and for respiratory symptoms for "low" levels of Ent.

Table 23

Incidence rates, relative risk (RR) and rate difference (RD) among bathers of the (0-4 year old age group) by enterococci density in seawater

Symptoms	Bacterial level	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	10.7	9.2	1.2	1.5	NS
	"high"	22.1	12.9	1.7	9.2	0.03
Respiratory	"low"	17.6	10.5	1.7	7.1	0.05
	"high"	19.2	14.9	1.3	4.3	NS
Skin complaints	"low"	3.1	1.7	1.8	1.4	0.04
	"high"	3.5	2.9	1.2	0.6	NS
Earache	"low"	3.8	3.9	1.0	-0.1	NS
	"high"	2.9	1.0	2.9	1.9	NS
"Sick"	"low"	32.8	26.3	1.2	6.5	NS
	"high"	42.4	30.7	1.4	11.7	0.03
Highly credible enteric	"low"	6.9	5.3	1.3	0.4	NS
	"high"	6.3	7.9	0.8	-1.6	NS
Number of persons *	"low"	131	76			
	"high"	172	101			

* For footnotes see Table 18

Table 24

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (0-4 year old age group) by faecal coliforms density in seawater

Symptoms	Bacterial level	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	12.3	13.7	0.9	-1.4	NS
	"high"	13.7	12.0	1.6	7.0	0.05
Respiratory	"low"	16.0	7.8	2.0	8.2	NS
	"high"	20.1	14.8	1.4	5.3	NS
Skin complaints	"low"	11.3	3.7	3.0	7.6	0.01
	"high"	6.0	5.6	1.1	0.4	NS
Earache	"low"	1.9	5.9	1.0	-4.0	NS
	"high"	4.3	0.9	4.8	3.4	0.03
"Sick"	"low"	33.0	29.4	1.1	3.6	NS
	"high"	41.8	30.6	1.4	11.2	0.05
Number of persons *	"low"	106	184			
	"high"	51	108			

* For footnotes see Table 18

Table 25

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (0-4 year old age group) by E. coli density in seawater

Symptoms	Bacterial level	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	13.4	9.9	1.3	3.5	NS
	"high"	20.8	12.5	1.7	8.3	0.05
Respiratory	"low"	17.4	16.0	1.1	1.4	NS
	"high"	19.5	10.4	1.9	9.1	0.05
Skin complaints	"low"	10.7	6.2	1.7	4.5	NS
	"high"	5.2	3.1	1.7	2.1	NS
Earache	"low"	3.4	3.7	0.9	-0.3	NS
	"high"	3.2	1.0	3.2	2.2	0.04
"Sick"	"low"	35.6	34.6	1.0	10.0	NS
	"high"	40.9	24.0	1.7	15.1	0.0001
Number of persons *	"low"	146	81			
	"high"	154	96			

* For footnotes see Table 18

Table 26

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (0-4 year old age group) by Staphylococci density in seawater

Symptoms	Bacterial level	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	13.2	16.7	1.2	-3.5	NS
	"high"	20.2	11.1	1.8	9.1	0.05
Respiratory	"low"	18.7	12.5	1.5	6.2	NS
	"high"	18.2	16.7	1.1	1.5	NS
Skin complaints	"low"	7.7	6.3	1.8	1.4	NS
	"high"	7.1	2.8	2.5	4.3	NS
Earache	"low"	2.2	0.0	-	2.2	NS
	"high"	1.0	0.0	-	1.0	NS
"Sick"	"low"	34.1	27.1	1.3	7.0	NS
	"high"	40.4	36.1	1.1	4.4	NS
Number of persons *	"low"	91	48			
	"high"	99	36			

* For footnotes see Table 18

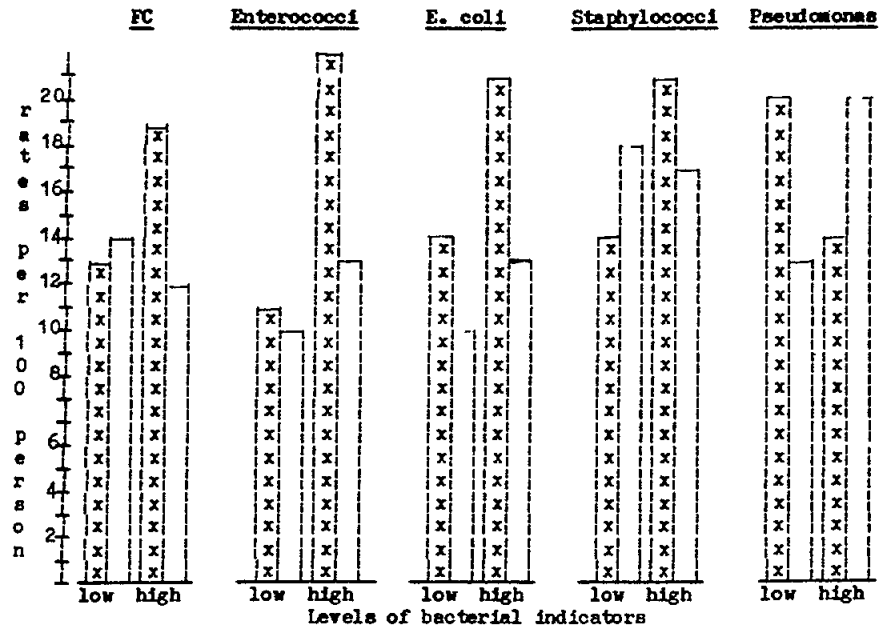
Table 27

Incidence rates, relative risk (RR) and rate difference (RD) among bathers (0-4 year old age group) by Pseudomonas density in seawater

Symptoms	Bacterial level	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
Enteric	"low"	19.6	14.7	1.3	4.9	NS
	"high"	13.0	20.0	0.7	-7.0	NS
Respiratory	"low"	21.0	13.3	1.6	7.7	NS
	"high"	13.0	40.0	0.3	-27.0	NS
Skin complaints	"low"	8.7	5.3	1.6	3.2	NS
	"high"	4.3	0.0	-	4.3	NS
Earache	"low"	1.4	0.0	-	1.4	NS
	"high"	0.0	0.0	-	0.0	NS
"Sick"	"low"	41.3	30.7	1.4	10.6	0.06
	"high"	30.4	60.0	0.5	29.6	NS
Number of persons *	"low"	138	75			
	"high"	23	5			

* For footnotes see Table 18

Figures 2 and 3 show the graphical representation of enteric and respiratory symptom incidence rates and by swimming status by "high" and "low" density levels of FC, Ent, E. coli, Staph and Pseud (App.16).

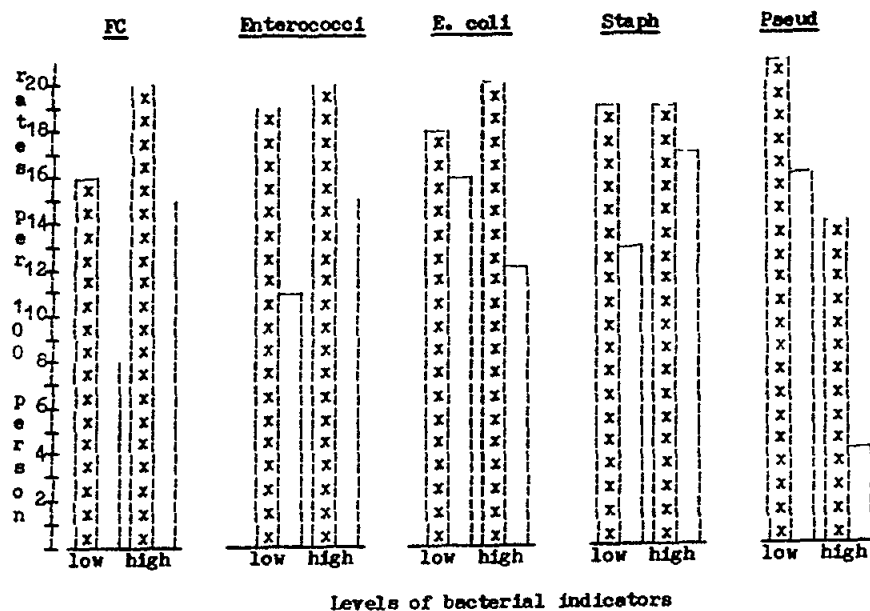


☒ swimmers (sw) ☐ non-swimmers (nsw)

Bacteria	Population by levels of bacteria				Significance of differences ¹	
	"low"		"high"		sw vs nsw for "high"	"high" vs "low" for sw
	sw	nsw	sw	nsw		
Faecal coli-forms	106	51	184	108	NS	NS
Enterococci	131	76	172	101	*	**
<u>E. coli</u>	149	81	154	96	*	*
Staphylococci	91	48	99	36	*	NS
Pseudomonas	138	75	23	5	NS	NS

1 - * Significant at the P<0.05 level; ** Significant at the P<0.005 level. No significant differences were found between swimmers and non-swimmers at "low" bacterial levels, or between non-swimmers at "high" vs "low" bacterial levels.

Fig.2 Incidence of enteric symptoms per 100 persons among bathers of the 0 to 4-year-old age group according to "low" and "high" levels of bacterial indicators.



[x] swimmers (sw) [] non-swimmers (nsw)

For number of cases see Figure 2.

Significant differences at $P < 0.05$ were found only between swimmers and non-swimmers at "low" levels of enterococci and "high" levels of E. coli.

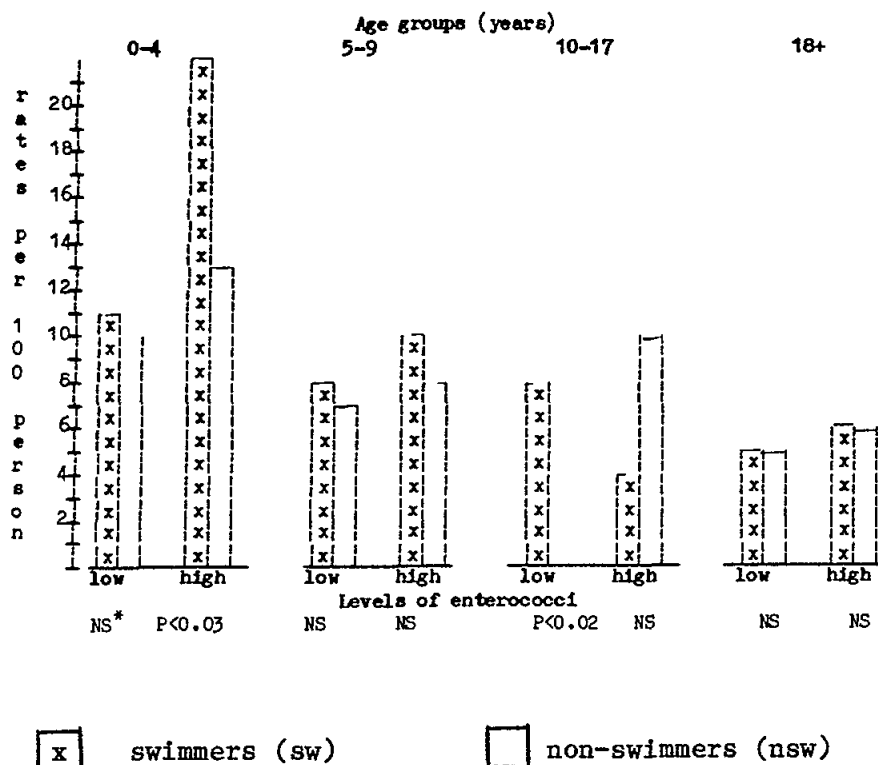
Fig.3 Incidence of respiratory symptoms per 100 persons among bathers of the 0 to 4-year-old age group according to "low" and "high" levels of bacterial indicators in seawater.

Appendices 22-27 show the graphical representation of enteric and respiratory symptom incidence rates for swimmers and non-swimmers, by "high" and "low" concentrations of faecal coliforms, faecal streptococci, enterococci and E. coli, based on Appendices 16-18 for the 0- to 4 age group. The level of significance of differences of incidence rates between swimmers and non-swimmers within each level of bacterial content in seawater, and between swimmers as well as between non-swimmers at different levels of bacterial content in seawater are indicated in each figure. In the 0 to 4 age group there was an excess in incidence rates of enteric symptoms in swimmers as compared with non-swimmers for "high" level of ent and FS. There were also significant differences for FS and E. coli between swimmers in "high" vs "low" bacterial content in seawater for the 1983 bathing season.

Appendices 28-29 show the graphical representation of the incidence rates for enteric and respiratory symptoms already shown in App.21-26 by enterococci and faecal coliform levels for the 0- to 4 age group (Appendices 15-18) for the 1983 bathing season.

Appendices 30-33 show the graphical representation of skin symptoms (0-4 age group) and ear infections (0-4 and all ages) for all bathers (App.16) by swimming status and "high" and "low" FC, Ent, Pseud and Staph levels in seawater for the 1983 bathing season. In the 1984 bathing season no skin and ear infections were recorded in any age group.

Table 28 shows the enteric symptom incidence rates, relative risk and rate difference by age groups by enterococci levels in seawater for the 1983 bathing season. The highest incidence rates and the highest levels of significance of differences between rates were found for the 0-4 age group. Figure 4 shows the graphical representation of Table 28.



* Level of significance of differences between swimmers and non-swimmers (NS = non-significant). Significant differences were found between swimmers in "high" vs "low" indicator density in the 0 to 4 year olds ($P < 0.004$). No significant differences were found between non-swimmers at "high" vs "low" indicator density.

Enterococci: "low" = 0 to 24 CFU/100 ml; "high" = 25 to 410 CFU/100 ml
CFU - colony forming units

Age group (years)	No. of swimmers		No. of non-swimmers	
	"low"	"high"	"low"	"high"
0-4	131	172	76	101
5-9	145	270	16	40
10-17	64	115	2	10
18+	166	256	193	257

Fig.4 Incidence of enteric symptoms per 100 persons among bathers by age groups according to "low" and "high" levels of enterococci density in seawater.

Table 28

Incidence rates of enteric symptoms, relative risk (RR) and rate difference (RD) among bathers by age groups, by enterococci densities in seawater

Age group years	Enterococci densities	Incidence rates/100 persons		RR	RD	P*
		Swimmers	Non-swimmers			
0 - 4	"low"	10.7	9.2	1.1	0.5	NS
	"high"	22.1	12.9	1.7	1.7	0.03
5 - 9	"low"	7.6	6.3	1.2	1.3	NS
	"high"	9.9	7.5	1.3	2.4	NS
10 - 17	"low"	7.8	0.0	-	7.8	0.02
	"high"	4.0	10.0	0.4	-6.0	NS
18+	"low"	4.8	4.1	1.2	0.7	NS
	"high"	5.9	5.4	1.1	0.5	NS
All	"low"	8.1	6.7	1.2	1.4	NS
	"high"	9.5	6.8	1.4	0.7	NS

* Level of significance of differences of incidence rates between swimmers and non-swimmers (NS - not significant)

From all the above tables, figures and appendices it can be seen that:

1. There was a significantly higher rate of enteric symptoms among swimmers of all ages at "high" faecal coliform and staphylococci density levels. In the 0 to 4-year-old age group there was a significantly higher rate of enteric symptoms, the most prominent being diarrhoea (60-70%), among swimmers as against non-swimmers at "high" levels of enterococci, E. coli and staphylococci. However, a separate analysis of highly credible enteric symptoms according to "high" and "low" bacterial densities did not show any significant differences between swimmers and non-swimmers of the 0 to 4 year old age group or of any other age group.
2. The incidence of respiratory symptoms was higher among swimmers than non-swimmers, regardless of bacterial density in seawater.
3. There were no significant differences in skin symptoms between swimmers and non-swimmers at "high" bacterial densities.
4. There were significant differences in the incidence of ear infections between swimmers and non-swimmers of all ages at "high" levels of faecal coliforms, E. coli and enterococci; and also between swimmers and non-swimmers of the 0 to 4 year old age group at "high" levels of faecal coliforms and E. coli.
5. Significant differences were found in the incidence of "sick" symptoms between swimmers and non-swimmers of all ages at "low" and "high levels of faecal coliforms and enterococci at "high" levels of E. coli, and at "low" levels of pseudomonas and staphylococci. Among the 0 to 4 year old age group

significant differences were noted only at "high" levels of faecal coliforms, E. coli and enterococci. This indicates that there is a swimming-associated risk which is unrelated to bacterial densities in seawater.

5.3 Correlation between swimming-associated morbidity and bacterial densities

Tables 29-31 show the Pearson coefficients of correlation between the difference of morbidity symptoms incidence rates per 100 persons (total and highly credible enteric and respiratory) between swimmers and non-swimmers (swimming-associated health risk) and logs of bacterial indicator densities (enterococci, E. coli, faecal coliforms, pseudomonas and staphylococci) in seawater for the 0 to 4 and 0 to 9 year old age groups and for all ages. The high and statistically significant correlation was found for the swimming-associated health risk for the enteric symptoms in the 0 to 4 year old age group and staphylococci and enterococci densities ($r=0.50$ at $P=0.05$, $r=0.45$ at $P=0.03$, respectively); and in the 0 to 9 year old age group for staphylococci and pseudomonas ($r=0.70$ at $P=0.002$ and $r=0.61$ at $p=0.01$, respectively). For highly credible enteric symptoms, only faecal coliforms showed a statistically significant correlation ($r=0.57$ at $P=0.03$). No significant correlation coefficients were found for other bacterial indicators in any age group.

It can be seen from Table 30 that no correlation was found between the swimming-associated health risk for the respiratory symptoms of swimmers and non-swimmers and any bacterial indicator densities for any age group; therefore the scattergrams for respiratory symptoms are not shown. For skin and ear symptoms the number of cases was too small for a similar analysis to be made.

Table 29

Pearson coefficients of correlation (r) between swimming-associated morbidity (incidence rates per 100 persons of swimmers minus those of non-swimmers) for enteric symptoms and logs of bacterial indicator densities in seawater by age groups

Bacterial indicator	0-4 years		0-9 years		All ages	
	No. of samples	r	No. of samples	r	No. of samples	r
Faecal coliforms	20	0.39	22	0.28	22	0.06
<u>E. coli</u>	22	0.34	25	-0.07	26	-0.15
Enterococci	22	0.45*	25	0.10	26	-0.00
<u>Pseudomonas</u>	12	0.06	13	0.16*	14	-0.05
<u>Staphylococcus</u>	13	0.50*	15	0.70**	16	0.35

* Significant at $P < 0.05$; ** Significant at $P < 0.005$

Table 30

Pearson coefficients of correlation (parametric) (r) between swimming-associated morbidity (incidence rates per 100 persons of swimmers minus those of non-swimmers) for highly credible enteric symptoms and logs of bacterial indicator densities in seawater by age groups

Bacterial indicator	0-4 years		0-9 years		All ages	
	No. of samples	r	No. of samples	r	No. of samples	r
Faecal coliforms	12	0.57*	18	0.27		
<u>E. coli</u>	15	0.39	21	0.20		
Enterococci	15	0.44	21	-0.00	24	-0.10
<u>Pseudomonas</u>	6	0.65	10	0.25	13	-0.26
<u>Staphylococcus</u>	7	0.32	12	0.19	15	0.23

* Significant at $P < 0.05$

Table 31

Pearson coefficients of correlation (parametric) (r) between swimming-associated morbidity (incidence rates per 100 persons of swimmers minus those of non-swimmers) for respiratory symptoms and logs of bacterial indicator densities in seawater by age groups

Bacterial indicator	0-4 years		0-9 years		All ages	
	No. of samples	r	No. of samples	r	No. of samples	r
Faecal coliforms	16	-0.06	19	0.16	21	0.06
<u>E. coli</u>	19	-0.05	23	0.14	21	0.10
Enterococci	19	-0.15	23	-0.09	21	-0.21
<u>Pseudomonas</u>	11	0.10	12	-0.13	13	-0.25
<u>Staphylococcus</u>	13	-0.20	13	-0.40	15	0.48*

* Significant at $P < 0.05$

Table 32 shows non-parametric (Kendall and Spearman) coefficients of correlation between swimming-associated morbidity and logs of bacterial indicator densities by age groups. For the 0 to 4 year old age group these coefficients of correlation for enterococci were lower than Pearson coefficients of correlation but all were statistically significant. For the same age group the highest and the most significant (0.45 at $P < 0.015$ and 0.61 at $P < 0.01$ for Kendall and Spearman coefficients of correlation, respectively) were the correlations for staphylococci. These correlations were also found to be significant for faecal coliforms and E. coli. No significant non-parametric correlations were found for the 0 to 9 year old age group or for all ages.

Table 32

Non-parametric coefficients of correlation between swimming-associated morbidity (incidence rates per 100 persons of swimmers minus those of non-swimmers) for enteric symptoms and logs of bacterial indicator densities in seawater by age groups

Bacterial indicator	0-4 years			0-9 years			All ages		
	No. of samples	r1	r2	No. of samples	r1	r2	No. of samples	r1	r2
Faecal coliforms	22	0.26*	0.35*	24	0.12	0.18	24	-0.03	-0.06
<u>E. coli</u>	23	0.24*	0.34*	25	0.08	0.17	25	-0.02	0.01
Enterococci	23	0.25*	0.37*	26	0.04	0.02	26	0.05	0.05
Pseudomonas	12	0.22	0.29	12	0.30	0.28	12	0.20	0.27
Staphylococcus	14	0.45**	0.61**	16	0.46**	0.63*	16	0.23	0.36

* Significant at $P < 0.05$; ** Significant at $P < 0.01$
r1 = Kendall; r2 = Spearman coefficients of correlation

Appendices 34a-34h present scattergrams and regression lines for those bacteria whose densities (logs) showed positive and mostly statistically significant correlation coefficients with swimming-associated health risks (see Table 29). These figures were performed for the three beaches studied ("A" = Gordon, "B" = Sheraton and "C" = Rishon LeZion, on each figure). Each figure shows (bottom left) the number of samples (N), Pearson coefficient of correlation (R), its level of significance (P(R)) and a linear regression equation.

Appendices 34a-34d show scattergrams and regression lines of swimming-associated health risks for enteric symptoms (incidence rates) by the logs of enterococcal, E. coli, coliform and staphylococcal densities in seawater for the 0-4 year old age group. It should be noted that up to certain densities (different for each bacteria), the incidence rate of enteric symptoms was higher among non-swimmers than among swimmers. For enterococci, E. coli, faecal coliforms and staphylococci, these values correspond to 8 CFU/100 ml (0.9 log), 6 CFU/100 ml (0.8 log), 32 CFU/100 ml (1.5 log) and 11 CFU/100 ml (1.0 log), respectively.

Appendices 34e-34f show scattergrams and regression lines of swimming-associated health risks for enteric symptoms (incidence rates) by logs of pseudomonas and staphylococcal densities in seawater for the 0 to 9 year old age group.

Appendices 34g-34h show scattergrams and regression lines of swimming-associated health risks for highly credible enteric symptoms by enterococcal (Pearson coefficient of correlation not significant) and faecal coliform densities in seawater for the 0 to 4 year old age group. No significant coefficients of correlation were found for highly credible enteric symptoms by staphylococcal densities in seawater.

6. DISCUSSION

Conventional indicators for evaluating the bacterial quality of seawater are total coliforms, faecal coliforms and, to some extent recently, faecal streptococci. Some investigators prefer to use E. coli instead of faecal coliforms; other test only for enterococci among the faecal streptococci, using a selective medium that does not facilitate the growth of Streptococcus bovis, S. equinus, S. salivarius and S. mitis (Cabelli, 1977). Since the presence of the aforementioned bacteria indicates mainly faecal contamination, i.e. the possible presence of enteric pathogens, it was considered they alone might not suffice for assessing the bacterial quality of bathing water. It was therefore decided to monitor two additional organisms, namely coagulase-positive Staphylococcus aureus and Pseudomonas aeruginosa, in order to determine which of these could serve as additional criteria for correlating the bacterial quality of seawater with health effects of bathing.

The seawater in three beaches monitored in the summers of 1983 and 1984 complied with accepted bacteriological standards based on faecal coliforms as in previous years (Yoshpe-Purer, 1981; Fattal et al., 1983).

The analysis of the results indicated that there was a swimming-associated morbidity, and that morbidity was associated with seawater bacterial densities. A significant difference for enteric morbidity symptoms between swimmers and non-swimmers was found for the Gordon beach, but not for Rishon LeZion. There was a significant difference in most of the densities of the bacterial indicators for these two beaches. There was a significant relationship between the presence of staphylococci, enterococci and E. coli (but not of faecal coliforms) and symptoms of enteric (gastrointestinal) morbidity, particularly among the 0 to 4 year old children at "high" levels of bacterial density. Positive statistically significant coefficients of correlation (Pearson) were found between swimming-associated morbidity for enteric symptoms and enterococcal ($r=0.45$ at $P=0.03$) and staphylococcal ($r=0.50$ at $P=0.05$) densities at seawater.

It was found that staphylococci showed a significant and consistent relationship with enteric symptoms in the 0 to 4 year old age group and for all ages at "high" densities and showed positive significant correlations with swimming-associated enteric symptoms in the 0 to 4 and 0 to 9 year old age groups. These results are in agreement with the general conclusion of Seyfried et al. (1985a,b) that total staphylococci appeared to be a consistent indicator in predicting total morbidity rates among swimmers in freshwater.

The staphylococcal densities are assumed to be associated with swimmer density in the sea and not with external wastewater pollution, and may indicate that enteric pathogens washed from swimmers' bodies may also serve as a source of infection for other swimmers. Coagulase-positive staphylococci per se are not enteric pathogens, and their main origin in seawater is usually not from sewage contamination but from the bathers themselves, who harbour the bacteria in wounds, skin, nasal membranes, hair follicles and other parts of the body (Bergey's Manual, 1975), and shed them under all conditions of swimming (Robinton and Mood, 1966). This is borne out by the fact that a similar density of them was found in all three beaches. At this time no logical explanation can be provided as to why a significant correlation with swimming-associated morbidity was found only with enteric diseases, and not with skin or other symptoms, as might be expected. Seyfried et al. (1985b), who examined 123 samples of lake water with a geometric mean of 150 total

staphylococci per 100 ml of water, found that they did relate with eye and skin illnesses, while other bacterial indicators did not. Due to the limited nature of the present study and the fact that the analysis presented here is only a preliminary one, it is considered that this question requires further investigation.

The correlation between enterococcal density and enteric symptoms among swimmers as against non-swimmers was much less pronounced than that found by Cabelli et al. (1979, 1982, 1983). There are two main differences between the latter findings and those of the present study:

(a) In the present study, no statistical difference was found between swimmers and non-swimmers for highly credible enteric symptoms, although in Cabelli's work these gave the highest correlation with enterococcal densities in seawater ($r=0.96$). The study population, however, comprised a smaller number of individuals than in Cabelli's work. There were also differences between conditions prevailing in Israel and those in the USA, i.e. (i) gastrointestinal disorders are considered to be more severe diseases in the USA, (ii) there is a higher percentage of working mothers in Israel, where children do not stay at home as much as in the USA, and (iii) there was a doctors' strike during the study period in 1983, and the doctor could only be visited for the severe cases.

(b) In the present study, the 0 to 4 year old age group was the most susceptible, while the most susceptible group according to the Cabelli study was the 0 to 9 year old age group. Also, a much higher correlation was found in Cabelli's study. This may be due to differences in swimming behaviour, levels of endemic enteric disease transmission, and immunity of populations in the areas studied.

It was found that the incidence rate of respiratory symptoms was higher among swimmers than among non-swimmers, but did not correlate with bacterial indicator density. This indicates that the respiratory symptom morbidity was not influenced by the bacterial seawater pollution, but by the act of swimming.

A preliminary analysis of results obtained indicated that, as already suggested by Favero (1985), the specific bacteriological systems to be used in assessing the quality of recreational water, regardless of whether or not it is exposed to external sources of wastewater pollution, should not rely merely on bacteria derived from the intestinal tract, but should include microorganisms derived from the upper respiratory tract, skin and other parts of the human body, such as staphylococci.

7. CONCLUSIONS

1. All densities of bacterial indicators tested at the three beaches were within UNEP/WHO and Israel Ministry of Health guidelines for bathing water quality.

2. The Rishon Lezion beach, located at a distance of 15 km from the outfall sewer, showed the lowest density for each of the bacterial indicators of faecal pollution (faecal coliforms, enterococci, E. coli) as compared with that of the two other study beaches (located 5 km from the outfall sewer). The differences in these bacterial indicator densities were significant between Gordon and Rishon Lezion beaches.

3. There were no differences in the seawater densities of Pseudomonas aeruginosa and Staphylococcus aureus (the geometric means were about 5 and 24 CFU/100 ml, respectively) at the three study beaches.

4. For enteric and respiratory symptoms significant differences were found between swimmers and non-swimmers for the Gordon beach (highest bacterial densities) for all ages and the 0 to 4 year old age group. For all ages the differences for fever and earache were also significant for this beach between swimmers and non-swimmers.

5. In the highly susceptible 0 to 4 year old age group, there was a significant excess of enteric symptom incidence rates among swimmers, as compared with that of non-swimmers, at "high" enterococcal E. coli and staphylococcal densities in seawater. Statistically significant positive Pearson correlations were found between incidence of the swimming-associated enteric symptoms and both enterococcal densities (for the 0 to 4 year old age group) and staphylococcal densities (for the 0 to 4 and for 0 to 9 year old age groups).

6. In general, the incidence rate of respiratory symptoms and that of all symptoms together ("sick") were higher among swimmers than among non-swimmers, but did not correlate with the bacterial indicator density in seawater.

7. No significant differences in skin symptoms were found between swimmers and non-swimmers of the 0 to 4 year old or all age groups at "high" bacterial indicator densities, except for E. coli for all ages.

8. Significant differences were found between swimmers and non-swimmers of all ages in the incidence of ear infections at "high" levels of faecal coliforms, E. coli and enterococci; and at "high" levels of faecal coliforms and E. coli in the 0 to 4 year old age group.

9. Consistent with the findings from previous prospective epidemiological studies conducted at marine bathing beaches, only enteric symptoms (vomiting, diarrhoea, nausea and abdominal pain) were found to be both swimming-associated and pollution-related. Other symptomatology, however, was found to be associated with swimming per se.

10. It is not possible to conclude at this time as to the indicator organism whose levels in bathing water is best correlated with the rate of swimming-associated enteric disease, since different analytic approaches toward the examination of the data produced different conclusions. This was not unexpected because of the limited size of the study population and the limited quantity of microbiological measurements necessitated by funding restrictions for this relatively small-scale study.

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A P P E N D I C E S
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APPENDIX I

GUIDELINES FOR THE CONDUCT OF "WEEK-END TYPE" EPIDEMIOLOGICAL-MICROBIOLOGICAL STUDIES FOR DEVELOPING RECREATIONAL WATER QUALITY CRITERIA

The following model is intended as a guide in the design and conduct of prospective, controlled epidemiological-microbiological studies whose objective is the development of health effects recreational water quality criteria. The desired criteria are quantitative relationships of the dose-response type between untoward health effects attributable to the recreational use of water, e.g. swimming, and the water quality as measured by some microbiological, chemical or physical indicator of its pollution (usually by municipal sewage wastes).

It is assumed that a situation exists in which hydrographic, pollution and beach-usage conditions complicate the epidemiological design, that there is marked day-to-day variability in pollution levels at the beaches, and that swimmers visit different beaches on different days during a given 1-2 week period. This design is based on the one used by the United States Environmental Protection Agency (5, 6). A second design in which the conditions noted above are not assumed and which is directed at special study groups (tourists and campers) is given in Annex II.

1. Features of the study design

(1) Swimming is defined as the significant exposure of the head to water.

(2) Participants for the study are recruited at the beach, preferably as family groups. In addition, whenever possible, groups on organised outings should be identified and recruited as substudy groups.

(3) Studies are conducted at "week-ends".

(4) During phase I and II¹, trials are conducted simultaneously at at least two beaches, one "barely acceptable" (i.e. with the lowest water quality at which swimming is not prohibited and the other "relatively unpolluted", i.e. with the highest water quality at which the demographic composition of the population is similar to that at the "barely acceptable" beach).

(5) As a consequence of items 1-4 above:

(a) There are four study populations, namely swimmers and non-swimmers at two beaches.

(b) The data collected can be analysed for the entire swimming season or segregated and examined by trial (week-end).

(c) Taken as a whole, the non-swimming controls belong to the same groups as the swimmers. Since all the participants have been at the beach, a swimming-associated symptom rate can be obtained by subtracting the rate for non-swimmers from that for swimmers.

¹ The phasing of the study is described below.

(d) Illness information is obtained some 7-10 days after a week-end trial, in the form of symptomatology, and relating to symptoms which develop in the week following the exposure.

(e) At the very least, the water should be examined for E. coli and enterococci by membrane filter procedures.

2. Phasing

The study should be conducted in three phases: phase I - pretest; phase II - comparison of a barely acceptable with a relatively unpolluted beach; and phase III - examination of beaches along a pollution gradient.

2.1 Phase I - Pretest

2.1.1 Objectives

The objectives of the pretest are:

(a) To determine the suitability of tentatively selected beaches as regards population density, demographic distribution, family groupings, rate of mid-week swimming, numbers of swimmers as compared with non-swimmers, and pollution levels at the beaches.

(b) To test the epidemiological techniques as regards cooperation at the beach interview, the availability of home telephones (questionnaires sent by post have been found to be of little use), and the return rate on follow-up interviews.

(c) To obtain an estimate of the background (non-swimmer) illness rate (needed in estimating the sample size for the phase II and III trials).

(d) To test the reliability of the information to be obtained on beach activity.

(e) To test the microbiological methodology and refine the sampling schedule. Several beaches tentatively identified as "barely acceptable" and "relatively unpolluted" should be examined.

2.1.2 Tentative selection of beaches

Available information on pollution levels, beach usage, bathing habits and demography should be used in selecting the beaches to be examined for suitability during phase I (Pretest). Within-day and between-day variations in E. coli and Enterococcus densities should be examined.

2.1.3 Reliability of beach activity information

Just prior to the pretest trials, the reliability of the information to be obtained on beach activity should be tested as follows. Teams of observers should go to the beaches. Each observer should focus on a single family group, noting which members enter the water, which immerse their heads in it, if possible, which swallow water, and the type and duration of activity in the water. At the end of the day, he should ask an adult member of the family to describe the activity of each member. Comparison of answers and observations

should make it possible to estimate the reliability of the information to be obtained in the actual trials.

2.1.4 Sample size

A total of about 600 usable responses at each beach (about 125 families) should be obtained over 2-3 week-ends. A usable response is defined as the information obtained from a respondent who was not a mid-week swimmer and from whom follow-up information was obtained. Obviously, records should be kept of the numbers of people whose responses were not usable and why those responses were rejected.

2.2 Phase II - Comparison of a "barely acceptable" with a "relatively unpolluted" beach

2.2.1 Sample size

This may be as large as 8000-12000 participants distributed between the four study populations. The exact number required should be determined from the analysis of the pretest data, and depends on: (1) the expected background (non-swimmer) illness rate; and (2) the magnitude of the excess incidence among swimmers as compared with non-swimmers which, if it exists, should be detected by the study. The Table provides a guide in determining the minimum number of persons to be included in the study for each of the swimmer and non-swimmer groups on each beach.

Minimum sample size for each swimmer and non-swimmer group on each beach

Incidence among non-swimmers (%)	Excess incidence among swimmers to be detected		
	30%	50%	100%
1	21 100	8 500	2 600
2	10 700	4 200	1 300
3	7 100	2 800	850
4	5 300	2 100	600
5	4 200	1 600	500
10	2 000	750	250

Note: Based on $\alpha = 5\%$ (probability of type-one error) and $\beta = 10\%$ (probability of type-two error).

For example, if the expected background illness rate is 5% and if an excess incidence of 30% or more (i.e. an incidence rate of 6.5% or higher) among swimmers is to be detected, at least 4 200 swimmers and 4 200 non-swimmers should be studied on the beach.

2.3 Phase III - Examination of beaches along a polluted gradient

The objective of this phase of the study is to produce the data which, with those available from phases I and II, will define the indicator-illness ratios (criteria). Ideally, the trials should be conducted at beaches situated along a pollution gradient produced by a single pollution source or cluster of sources. Often this is not possible, but two alternative procedures are then available: (1) trials can be conducted at a number of beaches whose pollution levels, as measured by the water quality indicators, fall on a gradient but which have different sources of pollution; or (2) trials (at week-ends) can be conducted at a beach which shows considerable day-to-day variability in the indicator density. The trials can then be analysed by regression analysis, in which each trial provides a point on the expected indicator-illness regression line.

3. Protocol

3.1 Recruitment and information to be collected

Beach interview participants should be recruited as family groups about the time they are preparing to leave the beach. Contact should be established with an adult member of the family. The interviewer should introduce him/herself, present his/her identification, explain the purpose of the study and request the participation of the subject family in the study. The interviewer should then ask the subject if he/she or any member of the family has been swimming mid-week just prior to the trial. If the answer is yes, that individual should be rejected from the study. If this is true of most of the children in the family group, the family should be excluded and the interview terminated. The interviewer should then obtain the following information:

(a) Name, address (local and permanent), telephone number, relationship of respondent to other members of the group (all of whose telephone numbers and addresses should be obtained).

(b) Demographic and swimming activity information on each member of the group; head wet; when in water; total time in water; whether water was swallowed; relevant health information; why non-swimmers are not swimming.

(c) The interviewer should observe the bathing suit and hair of each member of the group to see whether they are wet.

3.2 Sampling and assay

As this is a general protocol, it will have to be modified, depending on local conditions (hydrography, climatology, beach usage, etc.). As far as possible, the sampling and analytical procedures described at the Copenhagen (1975) and Rovinj (20) meetings should be followed. However, because of the special nature of this study, the following should be carried out instead of, or in addition to those procedures:

(1) Samples should be collected at 2-4 sites where the population is densest and at 100-300 m intervals on each site.

- (2) Samples should be collected every two hours from about 10-11 a.m. to 4-5 p.m.
- (3) Samples should be cooled with ice and returned to the laboratory for assay within six hours.
- (4) As far as possible, membrane filter methods should be used.
- (5) The required indicators for this study are E. coli and enterococci. Other water quality indicators may be included, depending on local conditions and logistic considerations.
- (6) It is recommended that, for E. coli and enterococci, the mTEC (21) and mE(22) methods be used.
- (7) Measurements should be made of water temperature, pH, salinity and turbidity, and possibly of certain nutrients, such as total soluble carbon and nitrogen. Surf activity should be noted; air temperature, speed and direction should be measured.
- (8) The information from a sanitary survey, including the location of outfalls, and the required hydrographic information should be available.

3.3 Reminder letter

A letter should be sent as soon as possible after the trial, and preferably on the following day, to remind those recruited at the beach that: (i) they are participants; (ii) they should watch for symptoms; and (iii) if they are ill, they should contact a physician whose telephone number is provided.

3.4 Follow-up questionnaire

The follow-up inquiry should be conducted by telephone or personal interview some 7-10 days after the week-end trial (questionnaires sent by post are generally unproductive). If the proportion of participants with telephones is less than 50%, telephone questionnaires should be abandoned. If the return on the follow-up inquiry is less than 75%, a sample of the appropriate population will have to be located and questioned. The information to be obtained is as follows:

- (1) Whether participants went swimming mid-week following a week-end trial (those who did so should be excluded from the study).
- (2) Additional demographic information (particularly on socioeconomic status).
- (3) Symptomatology: This information should be obtained by questions on symptoms subsequent to the trial, and on symptoms or illness in the week prior to the trial, and questions designed to indicate the severity of the illness, i.e. whether the participant was hospitalised, visited a physician, received medication, remained home from school or work, or stayed in bed. The symptoms covered should include the following:

Gastrointestinal

vomiting
diarrhoea
stomach ache)
nausea) colic

Respiratory

sore throat
running nose
bad cough
pain in chest

General

skin lesions (rash)
sunburn
red or runny eyes
earache or discharge
fever (more than 38 °C)
headache (severe, several days)

APPENDIX 2

Environmental Health Laboratory
Hebrew University of Jerusalem, Israel
POB 1172, Telephone 02-247414

Research on Morbidity and Bacteriological Quality of Seawater
Bacteriological Testing of Seawater

Date: _____ Day of week: _____

Name of beach: _____

Colour of flag: _____ White=swimming allowed, Red=swimming allowed
with caution, Black=swimming forbidden)

Time sample taken: _____

Sample temperature: _____

Wind direction: _____ Wave height (cm): _____ Air temperature: _____

Time of sample arrival in laboratory: _____

Time of sample plating: _____ Sample pH: _____

Growth medium	Tests on day of sampling	
	Sample volume (ml)	No. of bacteria on plate
bacteria		CFU/100 ml*
FC (WHO reference method)		
Faecal coliforms		
ME		
Enterococci		
	Urease	
m-TEC	(-) (+)	
E. coli +		
Klebsiella		
mPA-c		
Pseudomonas		
aeruginosa		
Morgenstern &		
Katzenelson		
Staphylococcus		
aureas		

* CFU = Colony Forming Units

APPENDIX 3

Bacteriological sample methods

Seawater was diluted and filtered (millipore filters) immediately upon arrival to laboratory. Dilutions were made in phosphate working buffer.

Phosphate Buffer

Buffer Stock

NaH ₂ PO ₄	28.81 g
or NaH ₂ PO ₄ .H ₂ O	30.4 g
Na ₂ HPO ₄	125.0 g
or Na ₂ HPO ₄ .7H ₂ O	236.0 g
Deionized water	1000 ml

Mix and heat to dissolve. Autoclave.

<u>Working Buffer</u>	<u>1 litre</u>	<u>5 litres</u>
stock buffer solution	20 ml	100 ml
NaCl	8.5 g	42.5 g
Deionized water	980 ml	4900 ml

Mix and autoclave. Larger volumes must be autoclaved for longer time. Dufour et al., 1981. Appl. Environ. Microbiol., 41:1152-1158.

mTEC Medium for testing E. coli and Klebsiella

Proteose Peptone No.3	5 g	
Yeast Extract	3 g	
Lactose	10 g	
NaCl	7.5 g	
K ₂ HPO ₄	3.3 g	
KH ₂ PO ₄	1 g	
Sodium lauryl sulphate	0.2 g	
Sodium deoxycholate	0.1 g	
Deionized water		1000 ml

Mix and add:

Brom Cresol Purple 0.08 g - weigh into large tube, add 10 ml H₂O, add 1N NaOH until it turns purple (vortex) and then add 1N HCl until it turns orange - vortexing to mix. Add to media and rinse tube with media.

Brom Phenol Red 0.08 g - weigh into large tube, add 10 ml H₂O. Add 1N NaOH (vortex) by drops until it is in solution. Add to media and rinse tube with media.

Adjust pH of media to 7.3 ± 0.1. Add agar 1.5%. Autoclave 15 min. Cool to 50 °C. Dispense 4-4.5 ml into 50 x 9 mm plates using a sterile Cornwall syringe. Store in foil covered basket in cold room. Will keep for approximately 1 month.

ANNEX 3 (continued)

Plates were incubated at 35 °C (+ 0.5 °C) for 2 hours in incubator and thereafter for 22 hours more in waterbath 44.5 °C (+0.2 °C). After 24 hours all yellow colonies were counted (E. coli and Klebsiella). Thereafter filters were lifted carefully from agar and placed on pads saturated with urease reagent. After 15 minutes colonies still yellow were counted (E. coli).

Urease Reagent for mTEC for testing only E. coli

Urea	2.0 g
Phenol Red	10 mg
Distilled water	100 ml

Mix, adjust pH to 5.0 ± 0.2. Will be straw coloured. Store in foil covered bottle at 6 to 8 °C for no more than 1 week. Can be stored longer if filter-sterilised. If turns pinkish, add more 1N HCl.

Dufour and Cabelli, 1975. Appl. Microbiol., 29:826.

Millipore filters were used for testing faecal streptococci and enterococci in two different media:

(a) KF Medium (Difco) for faecal streptococci. KF Medium was incubated for 48 hours at 35 °C. All orange and red coloured colonies were counted.

(b) mE Medium-modified, for enterococci. mE Medium-modified was incubated for 36 hours at 41 °C. All blue-black colonies were counted.

mE Media - modified for testing enterococci

	<u>1000 ml</u>	<u>250 ml</u>
Agar	15 g	3.75 g
Peptone	10 g	2.5 g
Yeast Extract	30 g	7.5 g
NaCl	15 g	3.75 g
Sodium azide	0.15 g	0.0375 g
Actidione (cycloheximide)	0.05 g	0.0125 g
Deionized water	1000 ml	250 ml

Autoclave: 15 min. cool to 50 °C.

Add aseptically:

1. Nalidixic acid	0.24 g	0.06 g
2. Triphenyl tetrazolium chloride	0.02 g	0.005 g
3. Indoxyl-B-D-Glucoside	0.75 g	0.1875 g

1. Weigh into sterile tube, add 3 ml sterile water. Add 0.2 ml 10N NaOH, vortex. Add to cooled media and rinse tube with media.

2. Weigh into sterile tube. Add to cooled media and rinse tube with media.

ANNEX 3 (continued)

3. Weigh into sterile tube. Add 5 ml 95% Ethanol. Dissolve and add 5 ml sterile water, vortex. Add to media and rinse tube with media. Swirl to mix. Dispense 4 ml into 50 x 9 mm plates using sterile Cornwall syringe. Store inverted in foil basket in cold room. Will keep approximately one month. Adjust pH to 7.1 ± 0.1 using pH paper.
Levin et al., 1975. Appl.Microbiol., 30:66-71.

mPA-c medium for testing Pseudomonas aeruginosa

The mPA-c medium, which is the Brodsky and Ciebin modification of the original m-PA medium introduced by Levin and Cabelli and improved by Dutka and Kwan.

Brodsky, M.H. and Ciebin, B.W., 1978. Appl.Environ.Microbiol., 36:36-42.

Levin, M.A. and Cabelli, V.J., 1972. Appl.Microbiol., 24:864-870.

Dutka, B.J. and Kwan, K.K., 1977. Appl.Environ.Microbiol., 33:240-245.

4-S agar for testing Staphylococcus aureus, coagulase positive

Mintzer-Morgenstern, L., and Katzenelson, E., 1980. J. Food Protection, 45:218-222.

The agar base of this medium was later modified by Mintzer-Morgenstern and Yoshpe-Purer to contain plate count agar plus 5% NaCl (instead of 4 ingredients + 5% NaCl). Unpublished yet.

APPENDIX 4

Hebrew University of Jerusalem
POB 1172 Telephone 02-247414

Research on Morbidity and Bacteriological Quality of
Seawater at Bathing Beaches

Personal Questionnaire - At the Beach

Name of respondent: _____ Date: _____
Family name: _____ Day of week: _____
Family number: _____ Beach name: _____
Address: _____ Time of interview: _____

Who is the respondent? a-mother; b-father; c-grandmother; d-other. detail _____

1. Do you have a telephone at home? (Write the number) _____
If not, can you be called at work? (First priority for the mother's telephone at work. If the answer is negative, say "Thank you and good-bye").
If yes, what is the telephone number at work? _____
When can we call you? Date _____, time _____
2. What time did you reach the beach today? _____
3. What time do you plan to leave the beach today? _____
(See telephone questionnaire, Question 1 for exact time of leaving the beach).
4. Have all of the family members here at the beach swum today? _____
(For description of "swam" see Question 6 in this questionnaire)
5. How did you come to the beach? a-Private family vehicle, b-Public transport, c-Friend's vehicle, d-other, detail _____
6. Write in Table 1 (next page) the information on family members who are at the beach today (employment and education of parents only should be recorded). Write in Table 1 which family members who are at the beach today swam, dipped his head in the water or had waves sweep over his head or face? A positive answer is "1" in Table 1 under the column for "Did he swim?", a negative answer is "0", and the reason should be recorded.

APPENDIX 4 (continued)

7. During the last week, has any family member, who is at the beach today, swum in any beach or pool? If yes, list his name in Table 3, insert "1" if he swam, or "0" if he did not swim, and also note the name of the beach or pool. In case none of the family was at any beach/pool, write "No".

Table 3

Details on swimming of family members during the last week

	1	2	3	4	5	6	7	8
Family member								
Swim								
Beach/pool name								

9. Table 4 lists the names of family members at the beach today, the number of visits to beaches in general and to this beach during this bathing season.

Table 4

Visits to the beaches by the family members

Name	No. of visits to beaches to date (inclusive)	Number of visits to this beach
1		
2		
3		
4		
5		
6		
7		
8		

APPENDIX 5

Hebrew University of Jerusalem
POB 1172 Telephone 02-247414

EXPLANATORY LETTER FOR INTERVIEWEE

Research on morbidity and bacteriological quality of
seawater at bathing beaches

The Hebrew University-Hadassah Medical School is conducting a medical project investigating whether a connection exists between morbidity and the microbiological quality of seawater at bathing beaches. Due to the national and international significance of this research, the World Health Organization has agreed to fund the project together with the partial support of the Environmental Protection Service of the Ministry of the Interior in Jerusalem.

Two beaches where bathing is permitted have been selected for this research. Samples of seawater will be taken from these beaches for bacteriological tests of the sanitary quality of seawater used for bathing. In addition, families with children who are bathing at these beaches will be requested to fill out a short questionnaire at the seashore and a telephone questionnaire which should determine whether there were any symptoms or disease for several days after visiting the seashore.

Obviously, the details provided to the interviewers will be confidential and will not be used for any purpose outside of the above research.

Your participation in this project will not take much of your time but the success of this research certainly depends to a large extent on your willingness to help, and on precise answers to the questions.

Ms Edna Olevsky-Peleg is responsible for this project and she will be interviewing you both at the beach and on the telephone. We will be most grateful for your assistance in meeting this challenge.

Thanking you in advance for your co-operation,

Dr B. Fattal
Project Manager

To continue the interview which we conducted at the beach, I will telephone you as arranged on _____ at _____ o'clock.

APPENDIX 6

Environmental Health Laboratory
Hebrew University of Jerusalem, Israel
POB 1172, Telephone 02-247414

Research on Morbidity and Bacteriological Quality of Sea-water
List of families without telephones

Day of week: _____ Name of beach: _____
Date: _____

No.	Address
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

APPENDIX 7

Environmental Health Laboratory
 Hebrew University of Jerusalem, Israel
 POB 1172, Telephone 02-247414

Telephone interview

Family name: _____ Date: _____
 Respondant name: _____ Day of week: _____
 Family code: _____

Who is the respondant? a-mother; b-father; c-grandmother; d-other, detail _____

1. When did you leave the beach on the day of the interview? _____
2. Write in Table 1 who, of those interviewed on the beach, has since the interview visited any beach or pool. White whether he/she swam, and the name of the beach or pool (insert "1" under his name if he swam or "0" if he did not swim). If the answer is negative insert "No".

Table 1

Family members who have been to beach/pool since the interview

	1	2	3	4	5	6	7	8
Family member who was at the beach								
Did he swim?								
Name of beach/pool								

3. In Table 2, write who, of those interviewed, developed any of the listed symptoms since the interview. For a positive answer insert "1" under the appropriate symptom. for a negative answer insert "0" under the other symptoms. Fill in columns 12, 13, 14 in the same way.

Table 2

Symptoms developed by the family members since the beach interview

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Name	Heavy cough	Cold	Throat infec-	Vomit- ing	Stomach ache	Nausea	Diar- hrea	Fever	Skin sores	Ear- ache	Have you seen a doctor for	Have you been tested for Troat/	Has the patient been home- bound? Note No. of days	
											Yes/ No	Troat/ stool	No. of days	

APPENDIX 9

Hebrew University of Jerusalem
Environmental Health Lab.
P.O.B. 1172 Telephone 02-247414

Research of Morbidity and Bacteriological Quality of Sea-water
Bacteriological Testing of Sea-water

Code Sheet	Line No.	Beach Name	Date of sampling			Time at which a sample was taken at beach	
			day	month	year	hours	minutes
/ 5 /	0 / 1 /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
1	2 - 3	4 - 5	6 - 11			12 - 15	

1. Name of beach (squares 4-5)
Prepare the list and codes for beaches

2. Day of the week / / /
16

3. Colour of flag (swimming permission - indicator of wave height)
(1) White/Blue-white (2) Red / / /
17
(3) Black (9) Unknown

4. Water sample temperature when drawn at the beach (°C) / / /
18 19

5. Wind direction
(1) West (2) East (3) North
(4) South (5) South-east (6) South-west
(7) North-east (8) North-west (9) Unknown / / /
20

6. Wave height (cm) / / / / / /
21 - 23

7. Air temperature at the beach (°C) / / / / / /
24 - 25

8. Time of arrival at laboratory / / / / / /
26 - 29

10. Temperature of sample at the time of arrival at lab (°C) / / / / / /
30 - 31

APPENDIX 9 (continued)

11. Time of sample plating	<u> / / / / / /</u> 32 - 35
12. Sample pH	<u> / / / / / /</u> 36 - 37

<u>(Medium)</u> Bacterial	<u>bacterial counts</u> CFU/100 ml*
(FC - WHO reference method) Faecal coliforms	<u> / / / / / /</u> 38 - 40
(ME) Enterococci	<u> / / / / / /</u> 41 - 43
(m-TEC) <u>E.coli</u> + <u>Klebsiella</u>	<u> / / / / / /</u> 44 - 46
(m-TEC) <u>E.coli</u>	<u> / / / / / /</u> 47 - 49
(mPA-c) Pseudomonas aeruginosa	<u> / / / / / /</u> 50 - 52
(Mintzer-Morgenstern & Katzenelson) Staphylococcus aureus	<u> / / / / / /</u> 53 - 55

* CFU - colony forming units

APPENDIX 10

Environmental Health Lab.
Hebrew University of Jerusalem
P.O.B. 1172, Jerusalem 91010

Research of Morbidity and Bacteriological Quality of Sea-water
at Bathing Beaches

/ 1 /	/ 1 /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
1 /	2 /	3 - 7				8 - 9		10 - 15						
Title	line	Family No.				Beach		Date						

Type of interview (square no.1): (1) Beach interview
(2) Telephone interview

Family number (squares 3-7): prepare list and codes for the beaches

Date (squares 10-15): Including day, month, year

Question 1 - Respondent's code: / / /
16 - 17 /

(01) Mother (04) Babysitter
(02) Father (05) Other
(03) Relative (06) Unknown

Question 2 - Address: Prepare codes for cities and special codes for tourists / / /
18 - 19 /

Question 3 - Time of interview: Exact hour that interview started (hour and minutes)

If interview started at a certain hour and continued later on, the hour refers to the second time, during which all the interview lasted without a break / / / / /
20 - 23 /

Question 4 - Day of week: (1) Sunday (2) Monday (7) Saturday / / /
24 /

Question 5 - Do you have a telephone at home?

(1) There is a phone at home / / /
25 /
(2) No phone at home, but the parents have one
(3) No phone at home, but there is one at friends/neighbours
(4) No phone at home, but there is one at the wife's place of work
(5) No phone at home, but there is one at the husband's place of work
(6) No phone at home, but there is one someplace other than in 2-5
(7) There is no possibility to call
(8) Refuse to answer

Question 6 - What time did you reach the beach? Hour and minutes

(9999) Unknown / / / / /
26 - 29 /

APPENDIX 10 (continued)

Question 7 - Was the questionnaire filled out at one time or was there a break in its completion?

- | | |
|--|--------|
| (1) Filled out at one time | / / |
| (2) There was a break and the questionnaire was completed afterwards | / 30 / |

Question 8 - What time do you plan on leaving the beach today (estimated time)?

(9999) Unknown / / / / /
31 - 34

Question 9 - How did you reach the beach?

- | | |
|----------------------------|--------|
| (1) Private family vehicle | / / |
| (2) Public transportation | / 35 / |
| (3) Friend's vehicle | |
| (4) By foot | |
| (5) Other | |

Question 10 - Father's employment/vocation
Prepare list of codes of occupations

/ / / / /
36 - 37

Question 11 - Father's education

- | | | |
|----------------------------------|------------------------|--------|
| (0) No education | (1) Primary education | / / |
| (2) Finished primary school only | (3) High school | / 38 / |
| (4) Above high school education | (5) Academic education | |
| (8) Refuse to answer | (9) Unknown | |

Question 5 - If he/she did not swim, list the reason
Prepare the list and codes of reasons

/ / / / /
25 - 26

Table 2 - List of symptoms the family member has today or had yesterday (Question 6 below)

Question 6 - Whether he/she has today or had yesterday one of the following symptoms:

- | | | |
|-----------------------|-----------------------|-------------|
| (00) No symptoms | | / / / / / |
| (01) Heavy cough | (07) Diarrhoea | / 27 - 32 / |
| (02) Cold | (08) Fever | |
| (03) Throat infection | (09) Skin sores | |
| (04) Vomiting | (10) Earache | |
| (05) Stomach ache | (98) Refuse to answer | |
| (06) Nausea | (99) Unknown | |

List up to three symptoms (27-28) - symptom 1; (29-30) - symptom 2; (31-32) - symptom 3.

APPENDIX 10 (continued)

Table 7 - Whether he/she was at any beach or pool during the last week?

(0) no (1) yes (9) unknown /
33

Question 8 - Did he/she swim?

(0) He/she did not swim (1) He/she swam /
(9) Unknown 34

Question 9 - Where did he/she swim?

Prepare the list of codes of beaches / /
(10) Swimming pool 35 - 36

Table 4 - Visits to the beaches by family members (Questions 10-11)

Question 10 - Number of visits to any beach to date (inclusive)

(01) One visit / / /
(02) Two visits.. and so on 37 - 38
(98) Refuse to answer
(99) Unknown

Question 11 - Number of visits to this beach:

As appears in question 10 above / / /
39 - 40

Question 12 - Mother's employment/vocation:

See question 10 / / /
39 - 40

Question 13 - Mother's education

See Father's education, according to question 11 above /
41

The following information has to be coded for each one of the family members:

<u> </u> / <u> </u> / <u> </u> / 1	<u> </u> / <u> </u> / <u> </u> / 2	<u> </u> / <u> </u> / <u> </u> / <u> </u> / 3 - 7	<u> </u> / <u> </u> / <u> </u> / <u> </u> / 8 - 9	<u> </u> / <u> </u> / <u> </u> / <u> </u> / 10 - 15	<u> </u> / <u> </u> / <u> </u> / Date
Title	line	Family No.	Beach	Date	

Table 1 - Information on family members and swimming (Questions 1-5 below)

Question 1 - Name and sex of the family member (bather) on the beach today

Respondent's code / / /
(01) Mother 16 - 17
(02) Father
(10-19) Running no. of male children in family
(20-29) Running no. of female children in family

APPENDIX 10 (continued)

Question 2 - Birthdate (only month (18-19) and year (20-21) of birth)*

(0000) Unknown / / / / / /
(9999) Refuse to answer 18 - 21 /

* If age appears, translate to year of birth according to date of interview while month of birth is 00.

Question 3 - Country of birth

Prepare list of codes for the countries / / /
 22 - 23 /

Question 4 - Whether he/she swam on the day of the interview?

(0) Did not swim according to respondent / / /
(1) Swam according to respondent but the interviewer did not 24 /
verify with the member
(2) Swam according to respondent and the interviewer verified
this
(3) Did not swim according to respondent but the interviewer
found that he/she did
(8) Refuse to answer

Environmental Health Laboratory
Hebrew University of Jerusalem
POB 1172, Jerusalem 91010, Israel

/ 1 / 1 / / / / / / / / / / / / /
 1 / 2 / / 3 - 7 / 8 - 9 / / 10 - 15 /
Title line Family No. Beach Date

Question 1 - Respondent's code:

(01) Mother (04) Babysitter
(02) Father (05) Other
(03) Relative (06) Unknown

/ / /
 16 - 17 /

Question 2 - Day of week:

(1) Sunday (2) Monday (7) Saturday (9) Unknown / / /
 18 /

Question 3 - When did the family leave the beach on the day
of the interview (at beach)

Write hour (19-20) and minutes (21-22) / / / / / /
(9999) Unknown 19 - 22 /
(9998) Refuse to answer
(0000) No answer

APPENDIX 10 (continued)

/ 1 / 1 /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
1 / 2 /	3 - 7	8 - 9	10 - 15				
Title line	Family No.	Beach	Date				

Table 1 - Family members who have been to beach/pool since the interview
(Questions 1-4 below)

Question 1 - Name and sex of the family member (bather) who was at the beach at the day of beach interview

(01) Mother	/ / /
(02) Father	16 - 17 /
(10-19) Running no. of male children in family	
(20-29) Running no. of female children in family	

Question 2 - Whether he/she has been to the beach or pool since the interview?

(0) No	(1) Yes	(9) Unknown	/ / /
			18

Question 3 - Did he/she swim?

(0) Did not swim	(1) Swam	/ / /
(8) Refuses to answer	(9) Unknown	19

Question 4 - Name of beach/pool

Prepare list and codes of beaches	/ / /
(10) Pool	20 - 21 /

Table 2 - Symptoms developed by family members since the beach interview
(Questions 5-8 below)

Question 5 - Whether he/she developed one of the following symptoms since the day of the beach interview?

(00) No symptoms	/ / / / / / / /	
(01) Heavy cough	(07) Diarrhoea	22 - 27
(02) Cold	(08) Fever	
(03) Throat infection	(09) Skin sores	
(04) Vomiting	(10) Earache	
(05) Stomach ache	(98) Refuse to answer	
(06) Nausea	(99) Unknown	

List up to three symptoms (22-23) - symptom 1; (24-25) - symptom 2; (26-27) - symptom 3.

Question 6 - Has he/she seen a doctor?

(0) Did not see doctor	(1) Saw doctor	/ / /
(2) Had medical help - nurse/pharmacy	(8) Refuse to answer	28
(9) Unknown		

APPENDIX 10 (continued)

Question 7 - Have you been tested for it?

- | | | |
|----------------------------|-----------------------------------|-----------|
| (0) No test done | (1) Throat test | / |
| (2) Urine test | (3) Stool test | <u>29</u> |
| (4) Throat and urine tests | (5) Throat and stool tests | |
| (6) Urine and stool tests | (7) Throat, urine and stool tests | |
| (8) Refuse to answer | (9) Unknown | |

Question 8 - Was the patient homebound? (list no. of days)

- | | |
|--------------------------------------|----------------|
| (00) Not homebound | / |
| (01) Patient was homebound for a day | <u>30 - 31</u> |
| (98) Refuse to answer | |
| (99) Unknown | |

APPENDIX 11a

Distribution of faecal coliforms - surface water (CFU/100 ml) by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches				
Log mean	117	38	16	46				
Median	138	47	14	79				
Standard error	0.14	0.24	0.17	0.44				
Maximum	640	650	169	650				
Minimum	1	1	2	1				
Frequency distribution								
	No.	%	No.	%	No.	%	No.	%
0-10	2	7	3	18	8	36	13	19
11-100	7	24	9	53	11	50	27	40
101-1000	20	69	5	29	3	14	28	41
No. of samples	29		17		22		68	

F value (3 beaches) = 10.04 (P=0.002)

APPENDIX 11b

Distribution of faecal streptococci - water surface (CFU/100 ml) by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches				
Log mean	67	49	19	41				
Median	62	41	18	42				
Standard error	0.10	0.13	0.13	0.19				
Maximum	500	710	270	710				
Minimum	7	5	3	3				
Frequency distribution								
	No.	%	No.	%	No.	%	No.	%
0-10	2	6	2	9	8	33	12	15
11-100	17	52	13	62	14	59	44	57
101-1000	14	42	6	29	2	8	22	28
No. of samples	33		21		24		78	

F value (3 beaches) = 6.62 (P=0.001)

APPENDIX 11c

Distribution of enterococci-water surface (CFU/100 ml) by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches				
Log mean	41	15	10	20				
Median	48	19	13	29				
Standard error	0.10	0.31	0.22	0.29				
Maximum	450	410	400	450				
Minimum	1	0	0	0				
Frequency distribution								
	No.	%	No.	%	No.	%	No.	%
0-10	3	9	5	25	12	50	20	26
11-100	25	76	11	55	9	38	45	58
101-1000	5	15	4	20	3	12	12	16
No. of samples	33		20		24		7	

F value (3 beaches) = 4.59 (P=0.013)

APPENDIX 11d

Distribution of E. coli - water surface (CFU/100 ml) by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches				
Log mean	30	9	5	13				
Median	32	17	5	14				
Standard error	0.11	0.16	0.24	0.33				
Maximum	599	133	183	559				
Minimum	0	1	0	0				
Frequency distribution								
	No.	%	No.	%	No.	%	No.	%
0-10	7	21	8	42	14	58	29	38
11-100	22	67	8	42	9	38	39	51
101-1000	4	12	3	16	1	4	8	11
No. of samples	33		19		24		76	

F value (3 beaches) = 6.90 (P=0.002)

APPENDIX 11e

Distribution of E. coli + Klebsiella - water surface (CFU/100 ml) by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches				
Log mean	49	21	6	21				
Median	44	22	7	25				
Standard error	0.11	0.31	0.23	0.40				
Maximum	750	216	193	750				
Minimum	0	1	0	0				
Frequency distribution								
	No.	%	No.	%	No.	%	No.	%
0-10	4	12	3	17	14	58	21	28
11-100	20	61	12	66	9	38	41	55
101-1000	9	27	3	17	1	4	13	17
No. of samples	33		18		24		75	

F value (3 beaches) = 12.17 (P=0.00001)

APPENDIX 11f

Distribution of total coliforms - water surface (CFU/100 ml) by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	80	42	71	66
Median	81	30	58	80
Maximum	325	1000	3303	3303
Minimum	16	24	41	16
No. of samples	10	6	4	20

APPENDIX 11g

Distribution of Pseudomonas aeruginosa - water surface (CFU/100 ml)
by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	5	7	4	5
Median	5	7	3	5
Maximum	45	46	12	46
Minimum	0	0	2	0
No. of samples	10	2	4	16

APPENDIX 11h

Distribution of Stahylococcus aureus - water surface (CFU/100 ml)
by beaches for 1983 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	25	22	27	24
Median	34	16	27	32
Maximum	70	210	69	210
Minimum	4	5	11	4
No. of samples	10	5	4	19

APPENDIX 12a

Distribution of total coliforms - water surface (CFU/100 ml) by beaches
for 1984 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	1547	197	29	156
Median	1545	130	38	108
Maximum	5800	700	250	5800
Minimum	650	80	2	2
No. of samples	4	6	6	16

APPENDIX 12b

Distribution of faecal coliforms - water surface (CFU/100 ml) by beaches
for 1984 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	380	121	17	77
Median	379	66	21	56
Maximum	800	660	250	660
Minimum	140	48	2	2
No. of samples	4	6	6	16

APPENDIX 12c

Distribution of faecal streptococci - water surface (CFU/100 ml) by beaches
for 1984 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	992	4146	949	1726
Median	1400	10000	865	1530
Maximum	3000	35000	10000	35000
Minimum	380	220	110	110
No. of samples	4	6	6	16

APPENDIX 12d

Distribution of Pseudomonas aeruginosa - water surface (CFU/100 ml)
by beaches for 1984 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	4.5	4.1	1.1	2.8
Median	6.0	7.0	1.0	1.0
Maximum	30	1	1	1
Minimum	1	1	1	1
No. of samples	4	6	6	16

APPENDIX 12e

Distribution of Staphylococcus aureus - water surface (CFU/100 ml)
by beaches for 1984 bathing season

	Gordon	Sheraton	Rishon leZion	All beaches
Log mean	5.2	2.5	1.5	2.7
Median	5.0	1.0	2.0	5.0
Maximum	28	20	13	28
Minimum	1	1	2	1
No. of samples	2	6	6	14

APPENDIX 13

Faecal streptococci (FS) and faecal coliforms (FC) counts (CFU/100 ml)
in seawater for 1983 and 1984 bathing seasons*

1983			1984		
Date	FS	FC	Date	FS	FC
21.5	45	11	10.6	330	48
21.5	2	5	10.6	220	50
22.5	180	55	17.6	700	310
22.5	10	1	17.6	380	140
26.5	220	140	24.6	180	250
26.5	400	98	24.6	110	250
26.5	400	98	24.6	110	2
18.6	151	138	1.7	20000	450
18.6	166	148	1.7	35000	660
25.6	64	560	8.7	3000	600
25.6	147	430	8.7	2100	800
5.8	55	259	15.7	5000	30
5.8	112	575	15.7	>10000	15
6.8	80	565	29.7	>10000	61
6.8	121	640	29.7	>10000	73
7.8	109	32	5.8	770	10
7.8	90	570	5.8	960	10

CFU - colony forming unit

* - for 1984 all the seawater samples tested are shown, for 1983 only 16 random samples are shown

APPENDIX 14(a)

Table MSPa83 No.1

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983

Age Group (yrs): 0-4
Sex: Both

Beach: All beaches

SYMPTOMS

POPULATION NO.	SYMPTOMS												
	1	2	3	4	5	6	7	8	9	10	11	12	13
COU.	COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKI.	EAR.	ENT.	RES.	SICK	
325	30	48	8	10	26	40	22	24	10	53	60	121	
SW	9.2	14.8	2.5	3.1	8.0	.6	12.3	6.8	7.4	3.1	16.3	18.5	37.2
	1.6	2.0	.9	1.0	1.5	.4	1.8	1.4	1.5	1.0	2.0	2.2	2.7
199	11	20	5	4	15	16	15	9	5	21	26	55	
NSW	5.5	10.1	2.5	2.0	7.5	1.0	8.0	7.5	4.5	1.5	10.6	13.1	27.6
	1.6	2.1	1.1	1.0	1.9	.7	1.9	1.9	1.5	1.1	2.2	2.4	3.2
524	41	68	13	14	41	56	37	33	15	74	86	176	
BOTH	7.8	13.0	2.5	2.7	7.8	.8	10.7	6.3	6.3	14.1	16.4	33.6	
	1.2	1.5	.7	.7	1.2	.4	1.3	1.1	.7	1.5	1.6	2.1	

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(D)

Table MSPa83 No.2

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983
Beach: All beaches

Age Group (yrs): 5-9
Sex: Both

SYMPTOMS

POPULATION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
464	12	25	19	7	29	14	21	17	13	11	41	43	89
SW	2.6	5.4	4.1	1.5	6.3	3.0	4.5	3.7	2.8	2.4	8.8	9.3	19.2
	.7	1.0	.9	.6	1.1	.8	1.0	.9	.8	.7	1.3	1.3	1.8
78	4	4	2	3	3	3	3	3	1	5	5	5	10
NSW	5.1	5.1	2.6	3.8	3.8	3.8	3.8	3.8	1.3	6.4	6.4	6.4	12.8
	2.5	2.5	1.8	2.2	2.2	2.2	2.2	2.2	1.3	2.8	2.8	2.8	3.8
542	16	29	21	10	32	14	21	20	14	11	46	48	99
BOTH	3.0	5.4	3.9	1.8	5.9	2.6	3.9	3.7	2.6	2.0	8.5	8.9	18.3
	.7	1.0	.8	.6	1.0	.7	.8	.8	.7	.6	1.2	1.2	1.7

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(C)

Table MSPa83 No.3

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983
Beach: All beaches
Age Group (yrs): 10-17
Sex: Both

SYMPTOMS

POPULATION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
	COU.	COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKI.	EAR.	ENT.	RES.	SICK
195	3	4	1	1	9	5	5	5	2	1	11	6	20
SW	1.5	2.1	.5	.5	4.6	2.6	2.6	2.6	1.0	.5	5.6	3.1	10.3
	.9	1.0	.5	.5	1.5	1.1	1.1	1.1	.7	.5	1.7	1.2	2.2
14	1				1						1		1
NSW					7.1						7.1		7.1
					6.9						6.9		6.9
BOTH	3	4	1	1	10	5	5	5	2	1	12	6	21
	1.4	1.9	.5	.5	4.8	2.4	2.4	2.4	1.0	.5	5.7	2.9	10.0
	.8	.9	.5	.5	1.5	1.1	1.1	1.1	.7	.5	1.6	1.2	2.1

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(d)

Table MSPa83 No.4

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers; Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983

Age Group (yrs): 18+
Sex: Both

Beach: All beaches

SYMPTOMS

POPULATION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
SW	460	1.1	1.0	5	15	8	21	10	5	4	27	15	49
		1.3	2.4	2.2	1.1	3.3	1.7	4.6	2.2	1.1	.9	5.9	3.3
		.5	.7	.7	.5	.8	.6	1.0	.7	.5	.4	1.1	.8
NSW	489	8	5	3	16	8	16	3	8		23	15	42
		1.0	1.6	1.0	.6	3.3	1.6	3.3	.6	1.6	4.7	3.1	8.6
		.5	.5	.4	.8	.6	.8	.4	.6	1.0	.8	1.3	
BOTH	949	19	15	8	31	16	37	13	13	4	50	30	91
		1.2	2.0	1.6	.8	3.3	1.7	3.9	1.4	1.4	5.3	3.2	9.6
		.3	.5	.4	.3	.6	.6	.4	.4	.2	.7	.6	1.0

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(e)

Table MSPa83 No.5

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983
Beach: All beaches
Age Group (yrs): All ages
Sex: Both

SYMPTOMS

POPULATION NO.	SYMPTOMS												
	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 F.UO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
1444	51	88	38	23	79	24	87	54	44	26	132	124	279
SW	3.5	6.1	2.6	1.6	5.5	1.7	6.0	3.7	3.0	1.8	9.1	8.6	19.3
	.5	.6	.4	.3	.6	.3	.6	.5	.5	.3	.8	.7	1.0
780	20	32	12	10	35	10	32	21	18	5	50	46	108
NSW	2.6	4.1	1.5	1.3	4.5	1.3	4.1	2.7	2.3	.6	6.4	5.9	13.8
	.6	.7	.4	.4	.7	.4	.7	.6	.5	.3	.9	.8	1.2
2224	71	120	50	33	114	34	119	75	62	31	182	170	387
BOTH	3.2	5.4	2.2	1.5	5.1	1.5	5.4	3.4	2.8	1.4	8.2	7.6	17.4
	.4	.5	.3	.3	.5	.3	.5	.4	.3	.2	.6	.6	.8

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) F.UO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(f)

Table MSPa84 No.1

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1984

Age Group (yrs): 0-4
Sex: Both

Beach: All beaches

SYMPTOMS

POPULATION NO.	SYMPTOMS												
	1	2	3	4	5	6	7	8	9	10	11	12	13
COU.	COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKI.	EAR.	ENT.	RES.	SICK	
89	1	3	2	1	4	1	2	2	8	5	5	12	
	1.1	3.4	2.2	1.1	4.5	1.1	2.2	9.0	5.6	5.6	5.6	13.5	
	1.1	1.9	1.6	1.1	2.2	1.1	1.6	3.0	2.4	2.4	2.4	3.6	
52	3	1	3	1	1	1	1	3	2	2	6	8	
	5.8	1.9	5.8	1.9	1.9	1.9	1.9	5.8	3.8	3.8	11.5	15.4	
	3.2	1.9	3.2	1.9	1.9	1.9	1.9	3.2	2.7	2.7	4.4	5.0	
141	4	4	5	2	4	1	2	11	7	7	11	20	
	2.8	2.8	3.5	1.4	2.8	.7	1.4	7.8	5.0	5.0	7.8	14.2	
	1.4	1.4	1.6	1.0	1.4	.7	1.0	2.3	1.8	1.8	2.3	2.9	

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(g)

Table MSPa84 No.2

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers; Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1984
Beach: All beaches

Age Group (Yrs): 5-9
Sex: Both

SYMPTOMS

POPULA- TION NO.	COU.	2	3	4	5	6	7	8	9	10	11	12	13
		COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKI.	EAR.	ENT.	RES.	SICK
88	1	4	1	1	1					3	1	4	7
	1.1	4.5	1.1	1.1	1.1					3.4	1.1	4.5	8.0
	1.1	2.2	1.1	1.1	1.1					1.9	1.1	2.2	2.9
24	1		1							1		2	2
	4.2		4.2							4.2		5.6	5.6
	4.1		4.1							4.1		5.6	5.6
112	2	4	2	1	1					4	1	6	9
	1.8	3.6	1.8	.9	.9					3.6	.9	5.4	8.0
	1.3	1.8	1.3	.9	.9					1.8	.9	2.1	2.6

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(h)

Table MSPa84 No.3

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1984
Beach: All beaches

Age Group (yrs): 10-17
Sex: Both

SYMPTOMS

POPULATION NO.	SYMPTOMS													SICK					
	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FOO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13						
40														3	7.5	3	7.5	4.2	
NSW															3	6.0	3	6.0	
BOTH															3	3.4	3	3.4	

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FOO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(i)

Table MSPa84 No.4

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1984

Age Group (yrs): 18+
Sex: Both

Beach: All beaches

SYMPTOMS

POPULATION NO.	SYMPTOMS												
	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
69 SW	3	1	1		1						1	3	3
	4.3	1.4	1.4		1.4						1.4	4.3	4.3
	2.5	1.4	1.4		1.4						1.4	2.5	2.5
108 NSW	7	1	2		1	1	1				2	7	7
	6.5	.9	1.9		.9	.9	.9				1.9	6.5	6.5
	2.4	.9	1.3		.9	.9	.9				1.3	2.4	2.4
177 BOTH	10	2	3		2	1	1				3	10	10
	5.6	1.1	1.7		1.1	.6	.6				1.7	5.6	5.6
	1.7	.8	1.0		.8	.6	.6				1.0	1.7	1.7

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(j)

Table MSPa84 No.5

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1984
Beach: All beaches

Age Group (yrs): All ages
Sex: Both

SYMPTOMS

POPULATION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
	COU.	COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKI.	EAR.	ENT.	RES.	SICK
286	5	8	4	2	6	1		2		14	7	12	25
SW	1.7	2.8	1.4	.7	2.1	.3		.7		4.9	2.4	4.2	8.7
	.8	1.0	.7	.5	.8	.3		.5		1.3	.9	1.2	1.7
194	11	2	6	1	1	1	2			4	4	15	17
NSW	5.7	1.0	3.1	.5	.5	.5	1.0			2.1	2.1	7.7	8.8
	1.7	.7	1.2	.5	.5	.5	.7			1.0	1.0	1.9	2.0
480	16	10	10	3	7	2	2	2		18	11	27	42
BOTH	3.3	2.1	2.1	.6	1.5	.4	.4	.4		3.8	2.3	5.6	8.8
	.8	.7	.7	.4	.5	.3	.3	.3		.9	.7	1.1	1.3

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(k)

Table MSPa8384 No.1

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983-84

Age Group (yrs): 0-4
Sex: Both

Beach: All beaches

SYMPTOMS

POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
414	31	51	10	11	30	3	40	24	24	18	58	65	133
SW	7.5	12.3	2.4	2.7	7.2	.7	9.7	5.8	5.8	4.3	14.0	15.7	32.1
	1.3	1.6	.8	.8	1.3	.4	1.5	1.1	1.1	1.0	1.7	1.8	2.3
251	14	21	8	5	15	2	17	15	9	8	23	32	63
NSW	5.6	8.4	3.2	2.0	6.0	.8	6.8	6.0	3.6	3.2	9.2	12.7	25.1
	1.4	1.7	1.1	.9	1.5	.6	1.6	1.5	1.2	1.1	1.8	2.1	2.7
665	45	72	18	16	45	5	57	39	33	26	81	97	196
BOTH	6.8	10.8	2.7	2.4	6.8	.8	8.6	5.9	5.0	3.9	12.2	14.6	29.5
	1.0	1.2	.6	.6	1.0	.3	1.1	.9	.8	.8	1.3	1.4	1.8

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(1)

Table MSPa8384 No.2

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983-84
Beach: All beaches

Age Group (yrs): 5-9
Sex: Both

SYMPTOMS

POPULATION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
	COU.	COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKI.	EAR.	ENT.	RES.	SICK
SW	552	13	29	20	8	14	21	17	13	14	42	47	96
		2.4	5.3	3.6	1.4	2.5	3.8	3.1	2.4	2.5	7.6	8.5	17.4
		.6	.9	.8	.5	.7	.8	.7	.6	.7	1.1	1.2	1.6
NSW	102	5	4	3	3	3	3	3	1	1	5	7	12
		4.9	3.9	2.9	2.9	2.9	2.9	2.9	1.0	1.0	4.9	6.9	11.8
		2.1	1.9	1.7	1.7	1.7	1.7	1.7	1.0	1.0	2.1	2.5	3.2
BOTH	654	18	33	23	11	14	21	20	14	15	47	54	108
		2.8	5.0	3.5	1.7	2.1	3.2	3.1	2.1	2.3	7.2	8.3	16.5
		.6	.9	.7	.5	.6	.7	.7	.6	.6	1.0	1.1	1.5

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(m)

Table MSPa8384 No.3

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983-84
Beach: All beaches

Age Group (yrs): 10-17
Sex: Both

SYMPTOMS

POPULATION NO.	SYMPTOMS												
	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 F.UO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
235	1.3	1.7	1	1	9	5	5	5	2	4	11	6	23
SW	.7	.8	.4	.4	1.3	2.1	2.1	2.1	.9	1.7	4.7	2.6	9.8
						.9	.9	.9	.6	.8	1.4	1.0	1.9
24					1						1		1
NSW					4.2						4.2		4.2
					4.1						4.1		4.1
259	1.2	1.5	1	1	10	5	5	5	2	4	12	6	24
BOTH	.7	.8	.4	.4	1.2	1.9	1.9	1.9	.8	1.5	4.6	2.3	9.3
						.9	.9	.9	.5	.8	1.3	.9	1.8

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) F.UO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(n)

Table MSPa8384 No. 4

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983-84
Beach: All beaches
Age Group (yrs): 18+
Sex: Both

SYMPTOMS

POPULATION NO.	SYMPTOMS													SICK
	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 F.UO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13	
529	1.7 .6	2.3 .6	2.1 .6	5 .4	16 .7	3.0 .5	4.0 .8	1.9 .6	5 .4	4 .4	28 1.0	18 .8	52 1.3	
597	2.0 .6	1.5 .5	1.2 .4	3 .3	17 .7	2.8 .5	2.8 .7	3 .3	8 .5	1.3 .5	25 .8	22 .8	49 1.1	
1126	1.9 .4	1.9 .4	1.6 .4	8 .3	33 .5	2.9 .4	3.4 .5	1.2 .3	13 .3	4 .2	53 .6	40 .6	101 9.0 .9	

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) F.UO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 14(O)

Table MSPa8384 No.5

Epidemiological study of Mediterranean Sea Pollution
Environmental Health Laboratory, Jerusalem, Israel

Swimming associated health risk
(regardless of microbial quality of seawater)
Morbidity among all bathers: Distribution of symptoms
by: Beaches, Swimmers (SW), Non-swimmers (NSW) and age groups
(Number of cases; Rates per 100 persons and standard errors)

Bathing Season: 1983-84
Beach: All beaches
Age Group (Yrs): All ages
Sex: Both

SYMPTOMS

POPULATION NO.	SYMPTOMS													SICK
	1	2	3	4	5	6	7	8	9	10	11	12	13	
	COU.	COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKI.	EAR.	ENT.	RES.		
1730	56	96	42	25	85	25	87	56	44	40	139	136	304	
	3.2	5.5	2.4	1.4	4.9	1.4	5.0	3.2	2.5	2.3	8.0	7.9	17.6	
	.4	.6	.4	.3	.5	.3	.5	.4	.4	.4	.7	.6	.9	
974	31	34	18	11	36	11	34	21	18	9	54	61	125	
	3.2	3.5	1.8	1.1	3.7	1.1	3.5	2.2	1.8	.9	5.5	6.3	12.8	
	.6	.6	.4	.3	.6	.3	.6	.5	.4	.3	.7	.8	1.1	
2704	87	130	60	36	121	36	121	77	62	49	193	197	429	
	3.2	4.8	2.2	1.3	4.5	1.3	4.5	2.8	2.3	1.8	7.1	7.3	15.9	
	.3	.4	.3	.2	.4	.2	.4	.3	.3	.3	.5	.5	.7	

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 15

Sea pollution epidemiological study

Description of Tables for computer analysis of data

This appendix describes the tables showing the morbidity of bathers by beaches, age groups, bacterial concentrations, swimming status and bathing seasons for both sexes.

These tables were done by each study beach separately and all beaches together.

The age groups analysed are: 0-4, 5-9, 10-17, 18+, all ages.

The following bacterial indicators and ranges of their concentrations in seawater (CFU/100 ml; CFU - colony forming units) were used in these tables for the breakdown of morbidity:

1. Faecal coliforms (FC) 0-50; 51-100; 101-200; 201-1000; 1001+
2. Enterococci (Ent) 0-24; 25-50; 51-100; 101-200; 201-1000; 1001+
3. E. coli 0-24; 25-50; 51-100; 101-200; 201-1000; 1001+
4. Staphylococci (Staph) 0-24; 25-50; 51-100; 101-200; 201-1000; 1001+
5. Pseudomonas (Pseud) 0-9; 10-20; 21-50; 51-100; 101-200; 201-1000; 1001+

The "high" and "low" range of bacterial concentrations in seawater, median, maximum value and number of days of sampling are presented in the table. Usually two or more water samples were collected during the day of the beach interview. Two ways of calculation of bacterial indicator concentrations on the day when more than one water sample was drawn were proposed: 1. by maximum values, 2. by log mean.

The following tables were done using then the log mean of bacterial concentration: MSPA, MSPB, MSPC, MSPD.

Table MSPE was done using the maximum bacterial concentrations during the time of the bather's exposure to the beach.

Symptoms: Symptoms 1 to 10 indicated in questionnaire (1. heavy cough, 2. cold, 3. throat infection, 4. vomiting, 5. abdominal pain, 6. nausea.

(a)

Table MSPa (running number for each table)
Epidemiological study of Mediterranean Sea pollution
Environmental Health Laboratory, Jerusalem, Israel

Association between microbial quality of seawater and morbidity among bathers: distribution of symptoms for all bathers by concentrations of bacterial indicators in seawater (median (me), range (RN), maximum (max)), by swimmers (sw) and non-swimmers (nsw) and age groups
(number of cases, rates per 100 persons and standard errors)

Bathing season 1983
Beach:
Bacterial indicator (CFU/100 ml) (log mean)*

age group (yr)
sex: both

Bact. concentr. median, range, maximum	No. of days in field swimming	Population No.	1 to 10	Symptoms		
				enteric**	respiratory	sick***
sw			No.			
nsw			rate/100			
both			SE			

* Calculated from log mean of samples drawn on the same day

** Enteric includes persons having at least one of the following symptoms: vomiting, abdominal pain, nausea and diarrhoea

Respiratory include persons having at least one of the following symptoms: heavy cough, cold, throat infection.

*** Persons with at least one of the above listed symptoms.

(b) Tables with the same structure as tables MSPa were done for bathers who visited neither beach nor swimming pool during at least one week prior to the day of beach interview

Table MSPb (running number for each table)
Epidemiological study of Mediterranean Sea pollution
Environmental Health Laboratory, Jerusalem, Israel

Association between microbial quality of seawater and morbidity among bathers: distribution of symptoms for bathers who visited neither beach nor swimming pool during at least one week prior to the day of beach interview by the concentration of bacterial indicators in seawater (median (me), range (RN), maximum (max)), by swimmers (sw) and non-swimmers (nsw) and age groups
(number of cases, rates per 100 persons and standard errors)

(c) Tables with the same structure as tables MSPa were done for all beaches together for people who attended the beach for the first time in the bathing season. This table is to be done for 0-4 and all ages.

Table MSPc (running number for each table)
Epidemiological study of Mediterranean Sea pollution
Environmental Health Laboratory, Jerusalem, Israel

Association between microbial quality of seawater and morbidity among bathers: distribution of symptoms for bathers who made their first visit to the beach during the bathing season by the concentration of bacterial indicators in seawater (median (me), range (RN), maximum (max)), by swimmers (sw) and non-swimmers (nsw) and age groups (number of cases, rates per 100 persons and standard errors)

(d) Tables with the same structure as tables MSPa are to be done for health bathers:

Table MSPd (running number for each table)
Epidemiological study of Mediterranean Sea pollution
Environmental Health Laboratory, Jerusalem, Israel

Association between microbial quality of seawater and morbidity among bathers: distribution of symptoms for healthy bathers by the concentration of bacterial indicators in seawater (median (me), range (RN), maximum (max)), by swimmers (sw) and non-swimmers (nsw) and age groups (number of cases, rates per 100 persons and standard errors)

(e) Tables with the same structure as tables MSPa were done for all bathers using the maximum bacterial indicator concentration in case if two or more bacterial samples were tested (this is indicated in footnote)

Table MSPe (running number for each table)
Epidemiological study of Mediterranean Sea pollution
Environmental Health Laboratory, Jerusalem, Israel

Association between microbial quality of seawater and morbidity among bathers: distribution of symptoms for all bathers by the concentration of bacterial indicators in seawater (median (me), range (RN), maximum (max)), by swimmers (sw) and non-swimmers (nsw) and age groups (number of cases, rates per 100 persons and standard errors)

7. diarrhoea, 8. fever of undetermined origin (FUO), 9. skin sores, 10. earache; enteric (4-7), respiratory (1-3) and bathers having at least one symptom of 1-10 (sick).

The name of each symptom is written in each table. For each symptom the number of cases, rate per 100 persons (from the given age group), and standard error (SE) were indicated.

Each table shows the number of persons with a symptom, incidence of this symptom per 100 persons and its standard error. Standard errors (SE) were calculated as follows:

If the rate for a symptom is r and N is the total population, then:

$$SE = r(100-r)/N$$

Each table for each range of bacterial indicator shows total population as well as number of swimmers and non-swimmers.

APPENDIX 16(a)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4
 Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO. OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 7	20	131	14	17	3	2	11		10	9	14	5	14	23	43
RN = 0-24	SW		10.7	13.0	2.3	1.5	8.4		7.6	6.9	10.7	3.8	10.7	17.6	32.8
MAX = 24			2.7	2.9	1.3	1.1	2.4		2.3	2.2	2.7	1.7	2.7	3.3	4.1
"	20	76	4	6	2	2	6	1	6	7	2	3	7	8	20
	NSW		5.3	7.9	2.6	2.6	7.9	1.3	7.9	9.2	2.6	3.9	9.2	10.5	26.3
			2.6	3.1	1.8	1.8	3.1	1.3	3.1	3.3	1.8	2.2	3.3	3.5	5.1
"	20	207	18	23	5	4	17	1	16	16	16	8	21	31	63
	BOTH		8.7	11.1	2.4	1.9	8.2	.5	7.7	7.7	7.7	3.9	10.1	15.0	30.4
			2.0	2.2	1.1	1.0	1.9	.5	1.9	1.9	1.9	1.3	2.1	2.5	3.2
ME = 49	22	172	14	29	4	8	14	2	29	13	10	5	38	33	73
RN = 25+	SW		8.1	16.9	2.3	4.7	8.1	1.2	16.9	7.6	5.8	2.9	22.1	19.2	42.4
MAX = 410			2.1	2.1	1.1	1.6	2.1	.8	2.9	2.0	1.8	1.3	3.2	3.0	3.8
"	22	101	7	11	3	1	8		10	7	6	1	13	15	31
	NSW		6.9	10.9	3.0	1.0	7.9		9.9	6.9	5.9	1.0	12.9	14.9	30.7
			2.5	3.1	1.7	1.0	2.7		3.0	2.5	2.4	1.0	3.3	3.5	4.6
"	22	273	21	40	7	9	22	2	39	20	16	6	51	48	104
	BOTH		7.7	14.7	2.6	3.3	8.1	.7	14.3	7.3	5.9	2.2	18.7	17.6	38.1
			1.6	2.1	1.0	1.1	1.6	.5	2.1	1.6	1.4	.9	2.4	2.3	2.9
ME = 29	42	303	28	46	7	10	25	2	39	22	24	10	52	56	116
RN = 0+	SW		9.2	15.2	2.3	3.3	8.3	.7	12.9	7.3	7.9	3.3	17.2	18.5	38.3
MAX = 410			1.7	2.1	.9	1.0	1.6	.5	1.9	1.5	1.6	1.0	2.2	2.2	2.8
"	42	177	11	17	5	3	14	1	16	14	8	4	20	23	51
	NSW		6.2	9.6	2.8	1.7	7.9	.6	9.0	7.9	4.5	2.3	11.3	13.0	28.8
			1.8	2.2	1.2	1.0	2.0	.6	2.2	2.0	1.6	1.1	2.4	2.5	3.4
"	42	480	39	63	12	13	39	3	55	36	32	14	72	79	167
	BOTH		8.1	13.1	2.5	2.7	8.1	.6	11.5	7.5	6.7	2.9	15.0	16.5	34.8
			1.2	1.5	.7	.7	1.2	.4	1.5	1.2	1.1	.8	1.6	1.7	2.2

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(b)

Table MSPA No.11

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers:
 Distribution of symptoms for all bathers by the concentration of bacterial indicators (median (ME); range (RN); maximum (MAX)
 in seawater and by: beaches, swimmers (SW), non-swimmers (NSW) and age groups
 (Number of cases; rates per 100 persons and standard errors)

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: Enterococci (CFU/100 ml) (log mean (*))

Sex: Both

Beach: Gordon

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO. OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 7	3	9		1							1			1	2
RN = 0-24	SW			11.1							11.1			11.1	22.2
MAX = 15				10.5							10.5			10.5	13.9
"	3 NSW	7							1 14.3 13.2				1 14.3 13.2		1 14.3 13.2
"	3 BOTH	16		1 6.3 6.1					1 6.3 6.1		1 6.3 6.1		1 6.3 6.1	1 6.3 6.1	3 18.8 9.8
ME = 40	13	126	12	22	4	7	10	2	19	12	7	3	27	26	54
RN = 25+	SW		9.5	17.5	3.2	5.6	7.9	1.6	15.1	9.5	5.6	2.4	21.4	20.6	42.9
MAX = 230			2.6	3.4	1.6	2.0	2.4	1.1	3.2	2.6	2.0	1.4	3.7	3.6	4.4
"	13 NSW	64	4	9	2	1	3		3	3	5	1	6	10	21
			6.3	14.1	3.1	1.6	4.7		4.7	4.7	7.8	1.6	9.4	15.6	32.8
			3.0	4.3	2.2	1.6	2.6		2.6	2.6	3.4	1.6	3.6	4.5	5.9
"	13 BOTH	190	16	31	6	8	13	2	22	15	12	4	33	36	75
			8.4	16.3	3.2	4.2	6.8	1.1	11.6	7.9	6.3	2.1	17.4	18.9	39.5
			2.0	2.7	1.3	1.5	1.8	.7	2.3	2.0	1.8	1.0	2.7	2.8	3.5
ME = 44	16	135	12	23	4	7	10	2	19	12	8	3	27	27	56
RN = 0+	SW		8.9	17.0	3.0	5.2	7.4	1.5	14.1	8.9	5.9	2.2	20.0	20.0	41.5
MAX = 230			2.4	3.2	1.5	1.9	2.3	1.0	3.0	2.4	2.0	1.3	3.4	3.4	4.2
"	16 NSW	71	4	9	2	1	3		4	3	5	1	7	10	22
			5.6	12.7	2.8	1.4	4.2		5.6	4.2	7.0	1.4	9.9	14.1	31.0
			2.7	3.9	2.0	1.4	2.4		2.7	2.4	3.0	1.4	3.5	4.1	5.5
"	16 BOTH	206	16	38	6	8	13	2	23	15	13	4	34	37	78
			7.8	15.5	2.9	3.9	6.3	1.0	11.2	7.3	6.3	1.9	16.5	18.0	37.9
			1.9	2.5	1.2	1.3	1.7	.7	2.2	1.8	1.7	1.0	2.6	2.7	3.4

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(c)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers:
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: enterococci (CFU/100 ml)(log mean(*))

Sex: Both

Beach: Rushon LeZion

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 6 RN = 0-24 MAX = 21	9 SW	62	8	10	2	1	6		3	6	4	3	7	14	20
			12.9	16.1	3.2	1.6	9.7		4.8	9.7	6.5	4.8	11.3	22.6	32.3
			4.3	4.7	2.2	1.6	3.8		2.7	3.8	3.1	2.7	4.0	5.3	5.9
"	9 NSW	52	3	5		1	3		2	3	1		3	6	10
			5.8	9.6		1.9	5.8		3.8	5.8	1.9		5.8	11.5	19.2
			3.2	4.1		1.9	3.2		2.7	3.2	1.9		3.2	4.4	5.5
"	9 BOTH	114	11	15	2	2	9		5	9	5	3	10	20	30
			9.6	13.2	1.8	1.8	7.9		4.4	7.9	4.4	2.6	8.8	17.5	26.3
			2.8	3.2	1.2	1.2	2.5		1.9	2.5	1.9	1.5	2.6	3.6	4.1
ME = 37 RN = 25+ MAX = 82	4 SW	8	1	1			1		2		1	1	3	1	4
			12.5	12.5			12.5		25.0		12.5	12.5	37.5	12.5	50.0
			11.7	11.7			11.7		15.3		11.7	11.7	17.1	11.7	17.7
"	4 NSW	17	2		1		4		5	3	1		5	3	6
			11.8		5.9		23.5		29.4	17.6	5.9		29.4	17.6	35.3
			7.8		5.7		10.3		11.1	9.2	5.7		11.1	9.2	11.6
"	4 BOTH	25	3	1	1		5		7	3	2	1	8	4	10
			12.0	4.0	4.0		20.0		28.0	12.0	8.0	4.0	32.0	16.0	40.0
			6.5	3.9	3.9		8.0		9.0	6.5	5.4	3.9	9.3	7.3	9.8
ME = 13 RN = 0+ MAX = 82	13 SW	70	9	11	2	1	7		5	6	5	4	10	15	24
			12.9	15.7	2.9	1.4	10.0		7.1	8.6	7.1	5.7	14.3	21.4	34.3
			4.0	4.3	2.0	1.4	3.6		3.1	3.3	3.1	2.8	4.2	4.9	5.7
"	13 NSW	69	5	5	1	1	7		7	6	2		8	9	16
			7.2	7.2	1.4	1.4	10.1		10.1	8.7	2.9		11.6	13.0	23.2
			3.1	3.1	1.4	1.4	3.6		3.6	3.4	2.0		3.9	4.1	5.1
"	13 BOTH	139	14	16	3	2	14		12	12	7	4	18	24	40
			10.1	11.5	2.2	1.4	10.1		8.6	8.6	5.0	2.9	12.9	17.3	28.8
			2.6	2.7	1.2	1.0	2.6		2.4	2.4	1.9	1.4	2.8	3.2	3.8

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(d)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: enterococci (CFU/100 ml)(log mean(*))

Sex: Both

Beach: Both Sheratons

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 12	8	60	6	6	1	1	5		7	3	9	2	7	8	21
RN = 0-24	SW		10.0	10.0	1.7	1.7	8.3		11.7	5.0	15.0	3.3	1.7	13.3	35.0
MAX = 24			3.9	3.9	1.7	1.7	3.6		4.1	2.8	4.6	2.3	4.1	4.4	6.2
"	8	17	1	1	2	1	3	1	3	4	1	3	3	2	9
	NSW		5.9	5.9	1.8	5.9	17.6	5.9	17.6	23.5	5.9	17.6	17.6	11.8	52.9
			5.7	5.7	7.8	5.7	9.2	5.7	9.2	10.3	5.7	9.2	9.2	7.8	12.1
"	8	77	7	7	3	2	8	1	10	7	10	5	10	10	30
	BOTH		9.1	9.1	3.9	2.6	10.4	1.3	13.0	9.1	13.0	6.5	13.0	13.0	39.0
			3.3	3.3	2.2	1.8	3.5	1.3	3.8	3.3	3.8	2.8	3.8	3.8	5.6
ME = 103	5	38	1	6		1	3		8	1	2	1	8	6	15
RN = 25+	SW		2.6	15.8		2.6	7.9		21.1	2.6	5.3	2.6	21.1	15.8	39.5
MAX = 410			2.6	5.9		2.6	4.4		6.6	2.6	3.6	2.6	6.6	5.9	7.9
"	5	20	1	2			1		2	1			2	2	4
	NSW		5.0	10.0			5.0		10.0	5.0			10.0	10.0	20.0
			4.9	6.7			4.9		6.7	4.9			6.7	6.7	8.9
"	5	58	2	8		1	4		10	2	2	1	10	8	19
	BOTH		3.4	13.8		1.7	6.9		17.2	3.4	3.4	1.7	17.2	13.8	32.8
			2.4	4.5		1.7	3.3		5.0	2.4	2.4	1.7	5.0	4.5	6.2
ME = 19	13	98	7	12	1	2	8		15	4	11	3	15	14	36
RN = 0+	SW		7.1	12.2	1.0	2.0	8.2		15.3	4.1	11.2	3.1	15.3	14.3	36.7
MAX = 410			2.6	3.3	1.0	1.4	2.8		3.6	2.0	3.2	1.7	3.6	3.5	4.9
"	13	37	2	3	2	1	4	1	5	5	1	3	5	4	13
	NSW		5.4	8.1	5.4	2.7	10.8	2.7	13.5	13.5	2.7	8.1	13.5	10.8	35.1
			3.7	4.5	3.7	2.7	5.1	2.7	5.6	5.6	2.7	4.5	5.6	5.1	7.8
"	13	135	9	15	3	3	12	1	20	9	12	6	20	18	49
	BOTH		6.7	11.1	2.2	2.2	8.9	.7	14.8	6.7	8.9	4.4	14.8	13.3	36.3
			2.1	2.7	1.3	1.3	2.4	.7	3.1	2.1	2.4	1.8	3.1	2.9	4.1

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(e)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: enterococci (CFU/100 ml)(log mean(*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 7	20	550	25	33	18	8	30	8	24	24	17	9	42	53	100
RN = 0-24	SW		4.5	6.0	3.3	1.5	5.5	1.5	4.4	4.4	3.1	1.6	7.6	9.6	18.2
MAX = 24			.9	1.0	.8	.5	1.0	.5	.9	.9	.7	.5	1.1	1.3	1.6
"	20	294	8	10	6	3	12	3	12	8	5	3	15	15	36
	NSW		2.7	3.4	2.0	1.0	4.1	1.0	4.1	2.7	1.7	1.0	5.1	5.1	12.2
			.9	1.1	.8	.6	1.2	.6	1.2	.9	.8	.6	1.3	1.3	1.9
"	20	844	33	43	24	11	42	11	36	32	22	12	57	68	136
	BOTH		3.9	5.1	2.8	1.3	5.0	1.3	4.3	3.8	2.6	1.4	6.8	8.1	16.1
			.7	.8	.6	.4	.7	.4	.7	.7	.5	.4	.9	.9	1.3
ME = 49	22	781	23	49	16	13	40	15	59	25	27	16	81	61	160
RN = 25+	SW		2.9	6.3	2.0	1.7	5.1	1.9	7.6	3.2	3.5	2.0	10.4	7.8	20.5
MAX = 410			.6	.9	.5	.5	.8	.5	.9	.6	.7	.5	1.1	1.0	1.4
"	22	411	11	16	5	6	21	6	20	11	12	1	33	24	64
	NSW		2.7	3.9	1.2	1.5	5.1	1.5	4.9	2.7	2.9	.2	8.0	5.8	15.6
			.8	1.0	.5	.6	1.1	.6	1.1	.8	.8	.2	1.3	1.2	1.8
"	22	1192	34	65	21	19	61	21	79	36	39	17	114	85	224
	BOTH		2.9	5.5	1.8	1.6	5.1	1.8	6.6	3.0	3.3	1.4	9.6	7.1	18.8
			.5	.7	.4	.4	.6	.4	.7	.5	.5	.3	.9	.7	1.1
ME = 29	42	1331	48	82	34	21	70	23	83	49	44	25	123	114	260
RN = 0+	SW		3.6	6.2	2.6	1.6	5.3	1.7	6.2	3.7	3.3	1.9	9.2	8.6	19.5
MAX = 410			.5	.7	.4	.3	.6	.4	.7	.5	.5	.4	.8	.8	1.1
"	42	705	19	26	11	9	33	9	32	19	17	4	48	39	100
	NSW		2.7	3.7	1.6	1.3	4.7	1.3	4.5	2.7	2.4	.6	6.8	5.5	14.2
			.6	.7	.5	.4	.8	.4	.8	.6	.6	.3	.9	.9	1.3
"	42	2036	67	108	45	30	103	32	115	68	61	29	171	153	360
	BOTH		3.3	5.3	2.2	1.5	5.1	1.6	5.6	3.3	3.0	1.4	8.4	7.5	17.7
			.4	.5	.3	.3	.5	.3	.5	.4	.4	.3	.6	.6	.8

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order; number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(f)

Table MSPA No.15

Epidemiological study of Mediterranean Sea Pollution

Association between microbial quality of seawater and morbidity among bathers:

distribution of symptoms for all bathers by the concentration of bacterial indicators (median (ME); range (RN); maximum (MAX) in seawater, and by: beaches, swimmers (SW), non-swimmers (NSW) and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: enterococci (CFU/100 ml)(log mean(*))

Sex: Both

Beach: Gordon

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	POPULATION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 7	3	48	3	1	3	2	1	1	1	3	1	1	3	5	8
RN = 0-24	SW		6.3	2.1	6.3	4.2	2.1	2.1	2.1	6.3	2.1	2.1	6.3	10.4	16.7
MAX = 15			3.5	2.1	3.5	2.9	2.1	2.1	2.1	3.5	2.1	2.1	3.5	4.4	5.4
"	3	26							1				1		1
	NSW								3.8				3.8		3.8
									3.8				3.8		3.8
"	3	74	3	1	3	2	1	1	2	3	1	1	4	5	9
	BOTH		4.1	1.4	4.1	2.7	1.4	1.4	2.7	4.1	1.4	1.4	5.4	6.8	12.2
			2.3	1.3	2.3	1.9	1.3	1.3	1.9	2.3	1.3	1.3	2.6	2.9	3.8
ME = 40	13	637	20	38	14	12	32	15	45	22	19	11	64	48	123
RN = 25+	SW		3.1	6.0	2.2	1.9	5.0	2.4	7.1	3.5	3.0	1.7	10.0	7.5	19.3
MAX = 230			.7	.9	.6	.5	.9	.6	1.0	.7	.7	.5	1.2	1.0	1.6
"	13	267	6	12	2	4	10	5	10	4	10	1	17	14	41
	NSW		2.2	4.5	.7	1.5	3.7	1.9	3.7	1.5	3.7	.4	6.4	5.2	15.4
			.9	1.3	.5	.7	1.2	.8	1.2	.7	1.2	.4	1.5	1.4	2.2
"	13	904	26	50	16	16	42	20	55	26	29	12	81	62	164
	BOTH		2.9	5.5	1.8	1.8	4.6	2.2	6.1	2.9	3.2	1.3	9.0	6.9	18.1
			.6	.8	.4	.4	.7	.5	.8	.6	.6	.4	.9	.8	1.3
ME = 44	16	685	23	39	17	14	33	16	46	25	20	12	67	53	131
RN = 0+	SW		3.4	5.7	2.5	2.0	4.8	2.3	6.7	3.6	2.9	1.8	9.8	7.7	19.1
MAX = 230			.7	.9	.6	.5	.8	.6	1.0	.7	.6	.5	1.1	1.0	1.5
"	16	293	6	12	2	4	10	5	11	4	10	1	18	14	42
	NSW		2.0	4.1	.7	1.4	3.4	1.7	3.8	1.4	3.4	.3	6.1	4.8	14.3
			.8	1.2	.5	.7	1.1	.8	1.1	.7	1.1	.3	1.4	1.2	2.0
"	16	978	29	51	19	18	43	21	57	29	30	13	85	67	173
	BOTH		3.0	5.2	1.9	1.8	4.4	2.1	5.8	3.0	3.1	1.3	8.7	6.9	17.7
			.5	.7	.4	.4	.7	.5	.7	.5	.6	.4	.9	.8	1.2

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(g)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers:
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

Beach: Both Sheratons

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 12	8	198	10	14	5	4	14	3	14	9	10	3	19	18	43
RN = 0-24	SW		5.1	7.1	2.5	2.0	7.1	1.5	7.1	4.5	5.1	1.5	9.6	9.1	21.7
MAX = 24			1.6	1.8	1.1	1.0	1.8	.9	1.8	1.5	1.6	.9	2.1	2.0	2.9
"	8	80	2	2	2	2	9	3	7	4	1	3	9	4	16
	NSW		2.5	2.5	2.5	2.5	11.3	3.8	8.8	5.0	1.3	3.8	11.3	5.0	20.0
			1.7	1.7	1.7	1.7	3.5	2.1	3.2	2.4	1.2	2.1	3.5	2.4	4.5
"	8	278	12	16	7	6	23	6	21	13	11	6	28	22	59
	BOTH		4.3	5.8	2.5	2.2	8.3	2.2	7.6	4.7	4.0	2.2	10.1	7.9	21.2
			1.2	1.4	.9	.9	1.7	.9	1.6	1.3	1.2	.9	1.8	1.6	2.5
ME = 103	5	100	2	10	1	1	7		12	2	4	3	14	11	28
RN = 25+	SW		2.0	10.0	1.0	1.0	7.0		12.0	2.0	4.0	3.0	14.0	11.0	28.0
MAX = 410			1.4	3.0	1.0	1.0	2.6		3.2	1.4	2.0	1.7	3.5	3.1	4.5
"	5	75	2	4		2	4	1	3	2			8	4	11
	NSW		2.7	5.3		2.7	5.3	1.3	4.0	2.7			10.7	5.3	14.7
			1.9	2.6		1.9	2.6	1.3	2.3	1.9			3.6	2.6	4.1
"	5	175	4	14	1	3	11	1	15	4	4	3	22	15	39
	BOTH		2.3	8.0	.6	1.7	6.3	.6	8.6	2.3	2.3	1.7	12.6	8.6	2.3
			1.1	2.1	.6	1.0	1.8	.6	2.1	1.1	1.1	1.0	2.5	2.1	3.1
ME = 19	13	298	12	24	6	5	21	3	26	11	14	6	33	29	71
RN = 0+	SW		4.0	8.1	2.0	1.7	7.0	1.0	8.7	3.7	4.7	2.0	11.1	9.7	23.8
MAX = 410			1.1	1.6	.8	.7	1.5	.6	1.6	1.1	1.2	.8	1.8	1.7	2.5
"	13	155	4	6	2	4	13	4	10	6	1	3	17	8	27
	NSW		2.6	3.9	1.3	2.6	8.4	2.6	6.5	3.9	.6	1.9	11.0	5.2	17.4
			1.3	1.5	.9	1.3	2.2	1.3	2.0	1.5	.6	1.1	2.5	1.8	3.0
"	13	453	16	30	8	9	34	7	36	17	15	9	50	37	98
	BOTH		3.5	6.6	1.8	2.0	7.5	1.5	7.9	3.8	3.3	2.0	11.0	8.2	21.6
			.9	1.2	.6	.7	1.2	.6	1.3	.9	.8	.7	1.5	1.3	1.9

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(h)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

Beach: LeZion

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 6	9	304	12	18	10	2	15	4	9	12	6	5	20	30	49
RN = 0-24	SW		3.9	5.9	3.3	.7	4.9	1.3	3.0	3.9	2.0	1.6	6.6	9.9	16.1
MAX = 21			1.1	1.4	1.0	.5	1.2	.7	1.0	1.1	.8	.7	1.4	1.7	2.1
"	9	188	6	8	4	1	3		4	4	4		5	11	19
	NSW		3.2	4.3	2.1	.5	1.6		2.1	2.1	2.1		2.7	5.9	10.1
			1.3	1.5	1.1	.5	.9		1.1	1.1	1.1		1.2	1.7	2.2
"	9	492	18	26	14	3	18	4	13	16	10	5	25	41	68
	BOTH		3.7	5.3	2.8	.6	3.7	.8	2.6	3.3	2.0	1.0	5.1	8.3	13.8
			.8	1.0	.7	.4	.8	.4	.7	.8	.6	.5	1.0	1.2	1.6
ME = 37	4	44	1	1	1		1		2	1	4	2	3	2	9
RN = 25+	SW		2.3	2.3	2.3		2.3		4.5	2.3	9.1	4.5	6.8	4.5	20.5
MAX = 82			2.2	2.2	2.2		2.2		3.1	2.2	4.3	3.1	3.8	3.1	6.1
"	4	69	3		3		7		7	5	2		8	6	12
	NSW		4.3		4.3		10.1		10.1	7.2	2.9		11.6	8.7	17.4
			2.5		2.5		3.6		3.6	3.1	2.0		3.9	3.4	4.6
"	4	113	4	1	4		8		9	6	6	2	11	8	21
	BOTH		3.5	.9	3.5		7.1		8.0	5.3	5.3	1.8	9.7	7.1	18.6
			1.7	.9	1.7		2.4		2.5	2.1	2.1	1.2	2.8	2.4	3.7
ME = 13	13	348	13	19	11	2	16	4	11	13	10	7	23	32	58
RN = 0+	SW		3.7	5.5	3.2	.6	4.6	1.1	3.2	3.7	2.9	2.0	6.6	9.2	16.7
MAX = 82			1.0	1.2	.9	.4	1.1	.6	.9	1.0	.9	.8	1.3	1.5	2.0
"	13	257	9	8	7	1	10		11	9	6		13	17	31
	NSW		3.5	3.1	2.7	.4	3.9		4.3	3.5	2.3		5.1	6.6	12.1
			1.1	1.1	1.0	.4	1.2		1.3	1.1	.9		1.4	1.6	2.0
"	13	605	22	27	18	3	26	4	22	22	16	7	36	49	89
	BOTH		3.6	4.5	3.0	.5	4.3	.7	3.6	3.6	2.6	1.2	6.0	8.1	14.7
			.8	.8	.7	.3	.8	.3	.8	.8	.7	.4	1.0	1.1	1.4

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache

- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(i)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: faecal coliforms (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO. OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 9	16	418	18	22	13	6	26	6	22	14	13	5	34	37	74
RN = 0-50	SW		4.3	5.3	3.1	1.4	6.2	1.4	5.3	3.3	3.1	1.2	8.1	8.9	17.7
MAX = 47			1.0	1.1	.8	.6	1.2	.6	1.1	.9	.8	.5	1.3	1.4	1.9
"	16	210	3	7	4	2	13	3	9	5	5	3	14	8	27
	NSW		1.4	3.3	1.9	1.0	6.2	1.4	4.3	2.4	2.4	1.4	6.7	3.8	12.9
			.8	1.2	.9	.7	1.7	.8	1.4	1.1	1.1	.8	1.7	1.3	2.3
"	16	628	21	29	17	8	39	9	31	19	18	8	48	45	101
	BOTH		3.3	4.6	2.7	1.3	6.2	1.4	4.9	3.0	2.9	1.3	7.6	7.2	16.1
			.7	.8	.6	.4	1.0	.5	.9	.7	.7	.4	1.1	1.0	1.5
ME = 138	21	866	29	55	20	13	41	16	57	33	30	20	82	72	177
RN = 51+	SW		3.3	6.4	2.3	1.5	4.7	1.8	6.6	3.8	3.5	2.3	9.5	8.3	20.4
MAX = 650			.6	.8	.5	.4	.7	.5	.8	.7	.6	.5	1.0	.9	1.4
"	21	427	15	16	7	5	18	4	20	13	12	1	29	28	65
	NSW		3.5	3.7	1.6	1.2	4.2	.9	4.7	3.0	2.8	.2	6.8	6.6	15.2
			.9	.9	.6	.5	1.0	.5	1.0	.8	.8	.2	1.2	1.2	1.7
"	21	1293	44	71	27	18	59	20	77	46	42	21	111	100	242
	BOTH		3.4	5.5	2.1	1.4	4.6	1.5	6.0	3.6	3.2	1.6	8.6	7.7	18.7
			.5	.6	.4	.3	.6	.3	.7	.5	.5	.4	.8	.7	1.1
ME = 79	37	1284	47	77	33	19	67	22	79	47	43	25	116	109	251
RN = 0+	SW		3.7	6.0	2.6	1.5	5.2	1.7	6.2	3.7	3.3	1.9	9.0	8.5	19.5
MAX = 650			.5	.7	.4	.3	.6	.4	.7	.5	.5	.4	.8	.8	1.1
"	37	637	18	23	11	7	31	7	29	18	17	4	43	36	92
	NSW		2.8	3.6	1.7	1.1	4.9	1.1	4.6	2.8	2.7	.6	6.8	5.7	14.4
			.7	.7	.5	.4	.9	.4	.8	.7	.6	.3	1.0	.9	1.4
"	37	1921	65	100	44	26	98	29	108	65	60	29	159	145	343
	BOTH		3.4	5.2	2.3	1.4	5.1	1.5	5.6	3.4	3.1	1.5	8.3	7.5	17.9
			.4	.5	.3	.3	.5	.3	.5	.4	.4	.3	.6	.6	.9

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(j)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: faecal coliforms (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	POPULATION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUD.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 9	16	106	11	12	3	1	10		11	4	12	2	13	17	35
RN = 0-50	SW		10.4	11.3	2.8	.9	9.4		10.4	3.8	11.3	1.9	12.3	16.0	33.0
MAX = 47			3.0	3.1	1.6	.9	2.8		3.0	1.9	3.1	1.3	3.2	3.6	4.6
"	16	51	1	3	2	1	6	1	5	5	2	3	7	4	15
	NSW		2.0	5.9	3.9	2.0	11.8	2.0	9.8	9.8	3.9	5.9	13.7	7.8	29.4
			1.9	3.3	2.7	1.9	4.5	1.9	4.2	4.2	2.7	3.3	4.8	3.8	6.4
"	16	157	12	15	5	2	16	1	16	9	14	5	20	21	50
	BOTH		7.6	9.6	3.2	1.3	10.2	.6	10.2	5.7	8.9	3.2	12.7	13.4	31.8
			2.1	2.3	1.4	.9	2.4	.6	2.4	1.9	2.3	1.4	2.7	2.7	3.7
ME = 138	21	184	16	32	4	8	13	1	26	16	11	8	35	37	77
RN = 51+	SW		8.7	17.4	2.2	4.3	7.1	.5	14.1	8.7	6.0	4.3	19.0	20.1	41.8
MAX = 650			2.1	2.8	1.1	1.5	1.9	.5	2.6	2.1	1.7	1.5	2.9	3.0	3.6
"	21	108	9	11	3	2	8		11	9	6	1	13	16	33
	NSW		8.3	10.2	2.8	1.9	7.4		10.2	8.3	5.6	.9	21.0	14.8	30.6
			2.7	2.9	1.6	1.3	2.5		2.9	2.7	2.2	.9	3.1	3.4	4.4
"	21	292	25	43	7	10	21	1	37	25	17	9	48	53	110
	BOTH		8.6	14.7	2.4	3.4	7.2	.3	12.7	8.6	5.8	3.1	16.4	18.2	37.7
			1.6	2.1	.9	1.1	1.5	.3	1.9	1.6	1.4	1.0	2.2	2.3	2.8
ME = 79	37	290	27	44	7	9	23	1	37	20	23	10	48	54	112
RN = 0+	SW		9.3	15.2	2.4	3.1	7.9	.3	12.8	6.9	7.9	3.4	16.6	18.6	38.6
MAX = 650			1.7	2.1	.9	1.0	1.6	.3	2.0	1.5	1.6	1.1	2.2	2.3	2.9
"	37	159	10	14	5	3	14	1	16	14	8	4	20	20	48
	NSW		6.3	8.8	3.1	1.9	8.8	.6	10.1	8.8	5.0	2.5	12.6	12.6	30.2
			1.9	2.2	1.4	1.1	2.2	.6	2.4	2.2	1.7	1.2	2.6	2.6	3.6
"	37	449	37	58	12	12	37	2	53	34	31	14	68	74	160
	BOTH		8.2	12.9	2.7	2.7	8.2	.4	11.8	7.6	6.9	3.1	15.1	16.5	35.6
			1.3	1.6	.8	.8	1.3	.3	1.5	1.2	1.2	.8	1.7	1.8	2.3

*] Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUD: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(k)

Table MSPA

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers:
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: *E. coli* (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 BAR.	11 ENT.	12 RES.	13 SICK
ME = 5	24	149	15	19	4	4	14		14	10	16	5	20	26	53
RN = 0-24	SW		10.1	12.8	2.7	2.7	9.4		9.4	6.7	10.7	3.4	13.4	17.4	35.6
MAX = 22			2.5	2.7	1.3	1.3	2.4		2.4	2.0	2.5	1.5	2.8	3.1	3.9
"	24	81	5	10	3	1	6	1	6	7	5	3	8	13	28
	NSW		6.2	12.3	3.7	1.2	7.4	1.2	7.4	8.6	6.2	3.7	9.9	16.0	34.6
			2.7	3.7	2.1	1.2	2.9	1.2	2.9	3.1	2.7	2.1	3.3	4.1	5.3
"	24	230	20	29	7	5	20	1	20	17	21	8	28	39	81
	BOTH		8.7	12.6	3.0	2.2	8.7	.4	8.7	7.4	9.1	3.5	12.2	17.0	35.2
			1.9	2.2	1.1	1.0	1.9	.4	1.9	1.7	1.9	1.2	2.2	2.5	3.1
ME = 49	17	154	13	27	3	6	11	2	25	12	8	5	32	30	63
RN = 25+	SW		8.4	17.5	1.9	3.9	7.1	1.3	16.2	7.8	5.2	3.2	20.8	19.5	40.9
MAX = 268			2.2	3.1	1.1	1.6	2.1	.9	3.0	2.2	1.8	1.4	3.3	3.2	4.0
"	17	96	6	7	2	2	8		10	7	3	1	12	10	23
	NSW		6.3	7.3	2.1	2.1	8.3		10.4	7.3	3.1	1.0	12.5	10.4	24.0
			2.5	2.7	1.5	1.5	2.8		3.1	2.7	1.8	1.0	3.4	3.1	4.4
"	17	250	19	34	5	8	19	2	35	19	11	6	44	40	86
	BOTH		7.6	13.6	2.0	3.2	7.6	.8	14.0	7.6	4.4	2.4	17.6	16.0	34.4
			1.7	2.2	.9	1.1	1.7	.6	2.2	1.7	1.3	1.0	2.4	2.3	3.0
ME = 14	41	303	28	46	7	10	25	2	39	22	24	10	52	56	116
RN = 0+	SW		9.2	15.2	2.3	3.3	8.3	.7	12.9	7.3	7.9	3.3	17.2	18.5	38.3
MAX = 268			1.7	2.1	.9	1.0	1.6	.5	1.9	1.5	1.6	1.0	2.2	2.2	2.8
"	41	177	11	17	5	3	14	1	16	14	8	4	20	23	51
	NSW		6.2	9.6	2.8	1.7	7.9	.6	9.0	7.9	4.5	2.3	11.3	13.0	28.8
			1.8	2.2	1.2	1.0	2.0	.6	2.2	2.0	1.6	1.1	2.4	2.5	3.4
"	41	480	39	63	12	13	39	3	55	36	32	14	72	79	167
	BOTH		8.1	13.1	2.5	2.7	8.1	.6	11.5	7.5	6.7	2.9	15.0	16.5	34.8
			1.2	1.5	.7	.7	1.2	.4	1.5	1.2	1.1	.8	1.6	1.7	2.2

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) BAR: Barache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(1)

Table MSPA

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 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: *E. coli* (CFU/100 ml)(log mean(*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
			COU.	COLD	THR.	VOM.	AB-P	NAU.	DIA.	FUO.	SKT.	EAR.	ENT.	RES.	SICK
ME = 5	24	662	28	37	22	11	37	13	33	28	20	8	55	60	119
RN = 0-24	SW		4.2	5.6	3.3	1.7	5.6	2.0	5.0	4.2	3.0	1.2	8.3	9.1	18.0
MAX = 22			.8	.9	.7	.5	.9	.5	.8	.8	.7	.4	1.1	1.1	1.5
"	24	317	7	14	6	2	13	3	13	7	11	3	18	18	47
	NSW		2.2	4.4	1.9	.6	4.1	.9	4.1	2.2	3.5	.9	5.7	5.7	14.8
			.8	1.2	.8	.4	1.1	.5	1.1	.8	1.0	.5	1.3	1.3	2.0
"	24	979	35	51	28	13	50	16	46	35	31	11	73	78	166
	BOTH		3.6	5.2	2.9	1.3	5.1	1.6	4.7	3.6	3.2	1.1	7.5	8.0	17.0
			.6	.7	.5	.4	.7	.4	.7	.6	.6	.3	.8	.9	1.2
ME = 49	17	669	20	45	12	10	33	10	50	21	24	17	68	54	141
RN = 25+	SW		3.0	6.7	1.8	1.5	4.9	1.5	7.5	3.1	3.6	2.5	10.2	8.1	21.1
MAX = 268			.7	1.0	.5	.5	.8	.5	1.0	.7	.7	.6	1.2	1.1	1.6
"	17	388	12	12	5	7	20	6	19	12	6	1	30	21	53
	NSW		3.1	3.1	1.3	1.8	5.2	1.5	4.9	3.1	1.5	.3	7.7	5.4	13.7
			.9	.9	.6	.7	1.1	.6	1.1	.9	.6	.3	1.4	1.1	1.7
"	17	1057	32	57	17	17	53	16	69	33	30	18	98	75	194
	BOTH		3.0	5.4	1.6	1.6	5.0	1.5	6.5	3.1	2.8	1.7	9.3	7.1	18.4
			.5	.7	.4	.4	.7	.4	.8	.5	.5	.4	.9	.8	1.2
ME = 14	41	1331	48	82	34	21	70	23	83	49	44	25	123	114	260
RN = 0+	SW		3.6	6.2	2.6	1.6	5.3	1.7	6.2	3.7	3.3	1.9	9.2	8.6	19.5
MAX = 268			.5	.7	.4	.3	.6	.4	.7	.5	.5	.4	.8	.8	1.1
"	41	705	19	26	11	9	33	9	32	19	17	4	48	39	100
	NSW		2.7	3.7	1.6	1.3	4.7	1.3	4.5	2.7	2.4	.6	6.8	5.5	14.2
			.6	.7	.5	.4	.8	.4	.8	.6	.6	.3	.9	.9	1.3
"	41	2036	67	108	45	30	103	32	115	68	61	29	171	153	360
	BOTH		3.3	5.3	2.2	1.5	5.1	1.6	5.6	3.3	3.0	1.4	8.4	7.5	17.7
			.4	.5	.3	.3	.5	.3	.5	.4	.4	.3	.6	.6	.8

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(m)

Table MSPA No.1

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1984

Age Group (yrs): 0-4

Bacterial indicator: faecal coliforms-Abukabir (CFU/100ml)(log mean(*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 21	4	39	1	1	2		3			2			3	3	6
RN = 0-50	SW		2.6	2.6	5.1		7.7			5.1			7.7	7.7	15.4
MAX = 48			2.5	2.5	3.5		4.3			3.5			4.3	4.3	5.8
"	4	24	2	1	1	1							1	4	4
	NSW		8.3	4.2	4.2	4.2							4.2	16.7	16.7
			5.6	4.1	4.1	4.1							4.1	7.6	7.6
"	4	63	3	2	3	1	3			2			4	7	10
	BOTH		4.8	3.2	4.8	1.6	4.8			3.2			6.3	11.1	15.9
			2.7	2.2	2.7	1.6	2.7			2.2			3.1	4.0	4.6
ME = 336	4	49		2		1	1	1					2	2	3
RN = 51+	SW			4.1		2.0	2.0	2.0					4.1	4.1	6.1
MAX = 692				2.8		2.0	2.0	2.0					2.8	2.8	3.4
"	4	28	1		2				1				1	2	3
	NSW		3.6		7.1				3.6				3.6	7.1	10.7
			3.5		4.9				3.5				3.5	4.9	5.8
"	4	77	1	2	2	1	1	1	1				3	4	6
	BOTH		1.3	2.6	2.6	1.3	1.3	1.3	1.3				3.9	5.2	7.8
			1.3	1.8	1.8	1.3	1.3	1.3	1.3				2.2	2.5	3.1
ME = 56	8	88	1	3	2	1	4	1		2			5	5	9
RN = 0+	SW		1.1	3.4	2.3	1.1	4.5	1.1		2.3			5.7	5.7	10.2
MAX = 692			1.1	1.9	1.6	1.1	2.2	1.1		1.6			2.5	2.5	3.2
"	8	52	3	1	3	1			1				2	6	7
	NSW		5.8	1.9	5.8	1.9			1.9				3.8	11.5	13.5
			3.2	1.9	3.2	1.9			1.9				2.7	4.4	4.7
"	8	140	4	4	5	2	4	1	1	2			7	11	16
	BOTH		2.9	2.9	3.6	1.4	2.9	.7	.7	1.4			5.0	7.9	11.4
			1.4	1.4	1.6	1.0	1.4	.7	.7	1.0			1.8	2.3	2.7

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 16(n)

Table MSPA No.2

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers:
 morbidity symptoms for all bathers by the bacterial indicator densities (median (ME); range (RN); maximum (MAX) in seawater,
 by beaches, swimming status and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1984

Age Group (yrs): All ages

Bacterial indicator: faecal coliforms-Abukabir (CFU/100 ml)(log mean*)

Sex: Both

			SYMPTOMS												
BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 21	4	128	3	2	3		4			2			4	5	8
RN = 0-50	SW		2.3	1.6	2.3		3.1			1.6			3.1	3.9	6.3
MAX = 48			1.3	1.1	1.3		1.5			1.1			1.5	1.7	2.1
"	4	81	2	1	1	1							1	4	4
	NSW		2.5	1.2	1.2	1.2							1.2	4.9	4.9
			1.7	1.2	1.2	1.2							1.2	2.4	2.4
"	4	209	5	3	4	1	4			2			5	9	12
	BOTH		2.4	1.4	1.9	.5	1.9			1.0			2.4	4.3	5.7
			1.1	.8	.9	.5	.9			.7			1.1	1.4	1.6
ME = 336	4	153		4	1	2	2	1					3	4	5
RN = 51+	SW			2.6	.7	1.3	1.3	.7					2.0	2.6	3.3
MAX = 692				1.3	.7	.9	.9	.7					1.1	1.3	1.4
"	4	110	2	1	5		1	1	2				3	7	8
	NSW		1.8	.9	4.5		.9	.9	1.8				2.7	6.4	7.3
			1.3	.9	2.0		.9	.9	1.3				1.6	2.3	2.5
"	4	263	2	5	6	2	3	2	2				6	11	13
	BOTH		.8	1.9	2.3	.8	1.1	.8	.8				2.3	4.2	4.9
			.5	.8	.9	.5	.7	.5	.5				.9	1.2	1.3
ME = 56	8	281	3	6	4	2	6	1		2			7	9	13
RN = 0+	SW		1.1	2.1	1.4	.7	2.1	.4		.7			2.5	3.2	4.6
MAX = 692			.6	.9	.7	.5	.9	.4		.5			.9	1.1	1.3
"	8	191	4	2	6	1	1	1	2				4	11	12
	NSW		2.1	1.0	3.1	.5	.5	.5	1.0				2.1	5.8	6.3
			1.0	.7	1.3	.5	.5	.5	.7				1.0	1.7	1.8
"	8	472	7	8	10	3	7	2	2	2			11	20	25
	BOTH		1.5	1.7	2.1	.6	1.5	.4	.4	.4			2.3	4.2	5.3
			.6	.6	.7	.4	.6	.3	.3	.3			.7	.9	1.0

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 17(a)

Table MSPB No.11

Epidemiological study of Mediterranean Sea Pollution

Association between microbial quality of seawater and morbidity among bathers;

Distribution of symptoms for bathers who did not visit neither beach nor swimming pool at least one week prior to the day of beach interview by the concentration of bacterial indicators (median (ME); range (RN); maximum (MAX) in seawater and by: beaches, swimmers (SW), non-swimmers (NSW) and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	POPULATION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FEO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 7	20	90	7	7	1		4		6	5	11	3	6	11	27
RN = 0-24	SW		7.8	7.8	1.1		4.4		6.7	5.6	12.2	3.3	6.7	12.2	30.0
MAX = 24			2.8	2.8	1.1		2.2		2.6	2.4	3.5	1.9	2.6	3.5	4.8
"	20	50	3	3	2	2	6	1	5	6	1	3	6	5	14
	NSW		6.0	6.0	4.0	4.0	12.0	2.0	10.0	12.0	2.0	6.0	12.0	10.0	28.0
			3.4	3.4	2.8	2.8	4.6	2.0	4.2	4.6	2.0	3.4	4.6	4.2	6.3
"	20	140	10	10	3	2	10	1	11	11	12	6	12	16	41
	BOTH		7.1	7.1	2.1	1.4	7.1	.7	7.9	7.9	8.6	4.3	8.6	11.4	29.3
			2.2	2.2	1.2	1.0	2.2	.7	2.3	2.3	2.4	1.7	2.4	2.7	3.8
ME = 49	22	98	7	17	2	3	8	1	14	6	7	4	18	19	39
RN = 25+	SW		7.1	17.3	2.0	3.1	8.2	1.0	14.3	6.1	7.1	4.1	18.4	19.4	39.8
MAX = 410			2.6	3.8	1.4	1.7	2.8	1.0	3.5	2.4	2.6	2.0	3.9	4.0	4.9
"	22	69	7	10	1		4		7	6	5		7	12	22
	NSW		10.1	14.5	1.4		5.8		10.1	8.7	7.2		10.1	17.4	31.9
			3.6	4.2	1.4		2.8		3.6	3.4	3.1		3.6	4.6	5.6
"	22	167	14	27	3	3	12	1	21	12	12	4	25	31	61
	BOTH		8.4	16.2	1.8	1.8	7.2	.6	12.6	7.2	7.2	2.4	15.0	18.6	36.5
			2.1	2.8	1.0	1.0	2.0	.6	2.6	2.0	2.0	1.2	2.8	3.0	3.7
ME = 29	42	188	14	24	3	3	12	1	20	11	18	7	24	30	66
RN = 0+	SW		7.4	12.8	1.6	1.6	6.4	.5	10.6	5.9	9.6	3.7	12.8	16.0	35.1
MAX = 410			1.9	2.4	.9	.9	1.8	.5	2.2	1.7	2.1	1.4	2.4	2.7	3.5
"	42	119	10	13	3	2	10	1	12	12	6	3	13	17	36
	NSW		8.4	10.9	2.5	1.7	8.4	.8	10.1	10.1	5.0	2.5	10.9	14.3	30.3
			2.5	2.9	1.4	1.2	2.5	.8	2.8	2.8	2.0	1.4	2.9	3.2	4.2
"	42	307	24	37	6	5	22	2	32	23	24	10	37	47	102
	BOTH		7.8	12.1	2.0	1.6	7.2	.7	10.4	7.5	7.8	3.3	12.1	15.3	33.2
			1.5	1.9	.8	.7	1.5	.5	1.7	1.5	1.5	1.0	1.9	2.1	2.7

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FEO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 17(b)

Table MSEB No.15

Epidemiological study of Mediterranean Sea Pollution

Association between microbial quality of seawater and morbidity among bathers:

Distribution of symptoms for bathers who did not visit neither beach nor swimming pool at least one week prior to the day of beach interview by the concentration of bacterial indicators (median (ME); range (RN); maximum (MAX) in seawater and by: beaches, swimmers (SW), non-swimmers (NSW) and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 7	20	359	13	18	11	4	17	6	16	16	13	5	25	30	63
RN = 0-24	SW		3.6	5.0	3.1	1.1	4.7	1.7	4.5	4.5	3.6	1.4	7.0	8.4	17.5
MAX = 24			1.0	1.2	.9	.6	1.1	.7	1.1	1.1	1.0	.6	1.3	1.5	2.0
"	20	208	7	6	5	3	11	3	11	7	3	3	13	11	28
	NSW		3.4	2.9	2.4	1.4	5.3	1.4	5.3	3.4	1.4	1.4	6.3	5.3	13.5
			1.3	1.2	1.1	.8	1.6	.8	1.6	1.3	.8	.8	1.7	1.6	2.4
"	20	567	20	24	16	7	28	9	27	23	16	8	38	41	91
	BOTH		3.5	4.2	2.8	1.2	4.9	1.6	4.8	4.1	2.8	1.4	6.7	7.2	16.0
			.8	.8	.7	.5	.9	.5	.9	.8	.7	.5	1.1	1.1	1.5
ME = 49	22	391	9	27	8	6	20	7	29	13	14	9	39	33	82
RN = 25+	SW		2.3	6.9	2.0	1.5	5.1	1.8	7.4	3.3	3.6	2.3	10.0	8.4	21.0
MAX = 410			.8	1.3	.7	.6	1.1	.7	1.3	.9	.9	.8	1.5	1.4	2.1
"	22	253	8	12	2	5	15	6	15	9	8		23	15	43
	NSW		3.2	4.7	.8	2.0	5.9	2.4	5.9	3.6	3.2		9.1	5.9	17.0
			1.1	1.3	.6	.9	1.5	1.0	1.5	1.2	1.1		1.8	1.5	2.4
"	22	644	17	39	10	11	35	13	44	22	22	9	62	48	125
	BOTH		2.6	6.1	1.6	1.7	5.4	2.0	6.8	3.4	3.4	1.4	9.6	7.5	19.4
			.6	.9	.5	.5	.9	.6	1.0	.7	.7	.5	1.2	1.0	1.6
ME = 29	42	750	22	45	19	10	37	13	45	29	27	14	64	63	145
RN = 0+	SW		2.9	6.0	2.5	1.3	4.9	1.7	6.0	3.9	3.6	1.9	8.5	8.4	19.3
MAX = 410			.6	.9	.6	.4	.8	.5	.9	.7	.7	.5	1.0	1.0	1.4
"	42	461	15	18	7	8	26	9	26	16	11	3	36	26	71
	NSW		3.3	3.9	1.5	1.7	5.6	2.0	5.6	3.5	2.4	.7	7.8	5.6	15.4
			.8	.9	.6	.6	1.1	.6	1.1	.9	.7	.4	1.2	1.1	1.7
"	42	1211	37	63	26	18	63	22	71	45	38	17	100	89	216
	BOTH		3.1	5.2	2.1	1.5	5.2	1.8	5.9	3.7	3.1	1.4	8.3	7.3	17.8
			.5	.6	.4	.3	.6	.4	.7	.5	.5	.3	.8	.7	1.1

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 18(a)

Table MSPD No.7

Epidemiological study of Mediterranean Sea Pollution

Association between microbial quality of seawater and morbidity among bathers:

This distribution of enteric, respiratory and "sick" conditions among those bathers that did not have enteric, respiratory and "sick" conditions respectively one week prior to day of beach interview, by the concentration of bacterial indicators median (ME); range (RN); maximum (MAX) in seawater and by: beaches, swimmers (SW), non-swimmers (NSW) and age groups. Population (POP), No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: enterococci (CFU/100 ml){log mean (*)}

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	ENTERIC				RESPIRATORY				SICK			
		POP	CASES	RATE	S.E.	POP	CASES	RATE	S.E.	POP	CASES	RATE	S.E.
ME = 7	20	114	10	8.8	2.6	90	10	11.1	3.3	79	20	25.3	4.9
RN = 0-24	SW												
MAX = 24													
"	20	63	4	6.3	3.1	60	8	13.3	4.4	49	11	22.4	6.0
	NSW												
"	20	177	14	7.9	2.0	150	18	12.0	2.7	128	31	24.2	3.8
	BOTH												
ME = 49	22	149	28	18.8	3.2	134	17	12.7	2.9	109	34	31.2	4.4
RN = 25+	SW												
MAX = 410													
"	22	91	11	12.1	3.4	74	12	16.2	4.3	66	22	33.3	5.8
	NSW												
"	22	240	39	16.3	2.4	208	29	13.9	2.4	175	56	32.0	3.5
	BOTH												
ME = 29	42	263	38	14.4	2.2	224	27	12.1	2.2	188	54	28.7	3.3
RN = 0+	SW												
MAX = 410													
"	42	154	15	9.7	2.4	134	20	14.9	3.1	115	33	28.7	4.2
	NSW												
"	42	417	53	12.7	1.6	358	47	13.1	1.8	303	87	28.7	2.6
	BOTH												

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- | | | |
|----------------------|---------------------------------------|---------------------------|
| (1) COU: Heavy cough | (2) COLD: Cold | (3) THR: Throat infection |
| (4) VOM: Vomiting | (5) AB-P: Abdominal pain | (6) NAU: Nausea |
| (7) DIA: Diarrhoea | (8) FOU: Fever of undetermined origin | (9) SKI: Skin sores |
| (10) EAR: Earache | | |

ENTERIC: Includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea

RESPIRATORY: Includes persons having at least one of the following: Heavy cough, cold, throat infection

SICK: Person with at least one of the listed symptoms

APPENDIX 18(b)

Table MSFD No.9

Epidemiological study of Mediterranean Sea Pollution

Association between microbial quality of seawater and morbidity among bathers:

This distribution of enteric, respiratory and "sick" conditions among those bathers that did not have enteric, respiratory and "sick" conditions respectively one week prior to day of beach interview, by the concentration of bacterial indicators median (ME); range (RN); maximum (MAX) in seawater and by: beaches, swimmers (SW), non-swimmers (NSW) and age groups. Population (POP), No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO. OF DAYS IN FIELD	ENTERIC				RESPIRATORY				SICK			
		POP	CASES	RATE	S.E.	POP	CASES	RATE	S.E.	POP	CASES	RATE	S.E.
ME = 7	20	514	33	6.4	1.1	479	36	7.5	1.2	453	67	14.8	1.7
RN = 0-24	SW												
MAX = 24													
"	20	272	12	4.4	1.2	263	11	4.2	1.2	244	23	9.4	1.9
	NSW												
"	20	786	45	5.7	.8	742	47	6.3	.9	697	90	12.9	1.3
	BOTH												
ME = 49	22	727	63	8.7	1.0	698	36	5.2	.8	633	92	14.5	1.4
RN = 25+	SW												
MAX = 410													
"	22	384	28	7.3	1.3	353	14	4.0	1.0	331	42	12.7	1.8
	NSW												
"	22	1111	91	8.2	.8	1051	50	4.8	.7	964	134	13.9	1.1
	BOTH												
ME = 29	42	1241	96	7.7	.8	1177	72	6.1	.7	1086	159	14.6	1.1
RN = 0+	SW												
MAX = 410													
"	42	656	40	6.1	.9	616	25	4.1	.8	575	65	11.3	1.3
	NSW												
"	42	1897	136	7.2	.6	1793	97	5.4	.5	1661	224	13.5	.8
	BOTH												

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache

ENTERIC: Includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea

RESPIRATORY: Includes persons having at least one of the following: Heavy cough, cold, throat infection

SICK: Person with at least one of the listed symptoms

APPENDIX 19(a)

Table MSPE No.7

Epidemiological study of Mediterranean Sea Pollution

Association between microbial quality of seawater and morbidity among bathers:

Distribution of symptoms for bathers by the concentration of bacterial indicators (median (ME); range (RN); maximum (MAX) in seawater by: beaches, swimmers (SW), non-swimmers (NSW) and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	POPULATION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 13	34	99	13	18	3	1	8		8	8	13	4	11	22	36
RN = 0-24	SW		13.1	18.2	3.0	1.0	8.1		8.1	8.1	13.1	4.0	11.1	22.2	36.4
MAX = 24			3.4	3.9	1.7	1.0	2.7		2.7	2.7	3.4	2.0	3.2	4.2	4.8
"	34	67	3	6	2	1	6		5	7	2	2	7	8	19
	NSW		4.5	9.0	3.0	1.5	9.0		7.5	10.4	3.0	3.0	10.4	11.9	28.4
			2.5	3.5	2.1	1.5	3.5		3.2	3.7	2.1	2.1	3.7	4.0	5.5
"	34	166	16	24	5	2	14		13	15	15	6	18	30	55
	BOTH		9.6	14.5	3.0	1.2	8.4		7.8	9.0	9.0	3.6	10.8	18.1	33.1
			2.3	2.7	1.3	.8	2.2		2.1	2.2	2.2	1.4	2.4	3.0	3.7
ME = 60	40	187	15	27	4	8	15	2	30	14	10	6	39	33	76
RN = 25+	SW		8.0	14.4	2.1	4.3	8.0	1.1	16.0	7.5	5.3	3.2	20.9	17.6	40.6
MAX = 450			2.0	2.6	1.1	1.5	2.0	.8	2.7	1.9	1.6	1.3	3.0	2.8	3.6
"	40	101	7	10	3	2	8	1	11	7	6	2	13	14	31
	NSW		6.9	9.9	3.0	2.0	7.9	1.0	10.9	6.9	5.9	2.0	12.9	13.9	30.7
			2.5	3.0	1.7	1.4	2.7	1.0	3.1	2.5	2.4	1.4	3.3	3.4	4.6
"	40	288	22	37	7	10	23	3	41	21	16	8	52	47	107
	BOTH		7.6	12.8	2.4	3.5	8.0	1.0	14.2	7.3	5.6	2.8	18.1	16.3	37.2
			1.6	2.0	.9	1.1	1.6	.6	2.1	1.5	1.3	1.0	2.3	2.2	2.8
ME = 26	74	286	28	45	7	9	23	2	38	22	23	10	50	55	112
RN = 0+	SW		9.8	15.7	2.4	3.1	8.0	.7	13.3	7.7	8.0	3.5	17.5	19.2	39.2
MAX = 450			1.8	2.2	.9	1.0	1.6	.5	2.0	1.6	1.6	1.1	2.2	2.3	2.9
"	74	168	10	16	5	3	14	1	16	14	8	4	20	22	50
	NSW		6.0	9.5	3.0	1.8	8.3	.6	9.5	8.3	4.8	2.4	11.9	13.1	29.8
			1.8	2.3	1.3	1.0	2.1	.6	2.3	2.1	1.6	1.2	2.5	2.6	3.5
"	74	454	38	61	12	12	37	3	54	36	31	14	70	77	162
	BOTH		8.4	13.4	2.6	2.6	8.1	.7	11.9	7.9	6.8	3.1	15.4	17.0	35.7
			1.3	1.6	.8	.8	1.3	.4	1.5	1.3	1.2	.8	1.7	1.8	2.2

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 19(b)

Table MSPE No.9

Epidemiological study of Mediterranean Sea Pollution

Association between microbial quality of seawater and morbidity among bathers;

Distribution of symptoms for bathers by the concentration of bacterial indicators (median (ME); range (RN); maximum (MAX) in seawater by: beaches, swimmers (SW), non-swimmers (NSW) and age groups (No. of cases; rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

Beach: All beaches

SYMPTOMS

BACTERIAL CONCENTRATION	NO. OF DAYS IN FIELD	POPULATION NO.	1 COU.	2 COLD	3 THR.	4 VOM.	5 AB-P	6 NAU.	7 DIA.	8 FUO.	9 SKI.	10 EAR.	11 ENT.	12 RES.	13 SICK
ME = 13	34	447	21	31	13	5	23	5	18	17	15	9	31	46	82
RN = 0-24	SW		4.7	6.9	2.9	1.1	5.1	1.1	4.0	3.8	3.4	2.0	6.9	10.3	18.3
MAX = 24			1.0	1.2	.8	.5	1.0	.5	.9	.9	.9	.7	1.2	1.4	1.8
"	34	246	7	10	6	2	11	3	11	8	3	2	14	15	32
	NSW		2.8	4.1	2.4	.8	4.5	1.2	4.5	3.3	1.2	.8	5.7	6.1	13.0
			1.1	1.3	1.0	.6	1.3	.7	1.3	1.1	.7	.6	1.5	1.5	2.1
"	34	693	28	41	19	7	34	8	29	25	18	11	45	61	114
	BOTH		4.0	5.9	2.7	1.0	4.9	1.2	4.2	3.6	2.6	1.6	6.5	8.8	16.5
			.7	.9	.6	.4	.8	.4	.8	.7	.6	.5	.9	1.1	1.4
ME = 60	40	807	26	50	18	12	41	17	62	30	28	15	84	64	166
RN = 25+	SW		3.2	6.2	2.2	1.5	5.1	2.1	7.7	3.7	3.5	1.9	10.4	7.9	20.6
MAX = 450			.6	.8	.5	.4	.8	.5	.9	.7	.6	.5	1.1	1.0	1.4
"	40	409	11	15	5	7	21	6	21	11	12	2	33	23	64
	NSW		2.7	3.7	1.2	1.7	5.1	1.5	5.1	2.7	2.9	.5	8.1	5.6	15.6
			.8	.9	.5	.6	1.1	.6	1.1	.8	.8	.3	1.3	1.1	1.8
"	40	1216	37	65	23	19	62	23	83	41	40	17	117	87	230
	BOTH		3.0	5.3	1.9	1.6	5.1	1.9	6.8	3.4	3.3	1.4	9.6	7.2	18.9
			.5	.6	.4	.4	.6	.4	.7	.5	.5	.3	.8	.7	1.1
ME = 26	74	1254	47	81	31	17	64	22	80	47	43	24	115	110	248
RN = 0+	SW		3.7	6.5	2.5	1.4	5.1	1.8	6.4	3.7	3.4	1.9	9.2	8.8	19.8
MAX = 450			.5	.7	.4	.3	.6	.4	.7	.5	.5	.4	.8	.8	1.1
"	74	655	18	25	11	9	32	9	32	19	15	4	47	38	96
	NSW		2.7	3.8	1.7	1.4	4.9	1.4	4.9	2.9	2.3	.6	7.2	5.8	14.7
			.6	.7	.5	.5	.8	.5	.8	.7	.6	.3	1.0	.9	1.4
"	74	1909	65	106	42	26	96	31	112	66	58	28	162	148	344
	BOTH		3.4	5.6	2.2	1.4	5.0	1.6	5.9	3.5	3.0	1.5	8.5	7.8	18.0
			.4	.5	.3	.3	.5	.3	.5	.4	.4	.3	.6	.6	.9

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) COU: Heavy cough
- (2) COLD: Cold
- (3) THR: Throat infection
- (4) VOM: Vomiting
- (5) AB-P: Abdominal pain
- (6) NAU: Nausea
- (7) DIA: Diarrhoea
- (8) FUO: Fever of undetermined origin
- (9) SKI: Skin sores
- (10) EAR: Earache
- (11) ENT: Enteric includes persons having at least one of the following: vomiting, abdominal pain, nausea, diarrhea
- (12) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (13) SICK: Person with at least one of the listed symptoms

APPENDIX 20(a)

Table MSPF

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
Highly credible morbidity symptoms for all bathers by the bacterial indicator densities
 (median (ME); range (RN); maximum (MAX) in seawater, by swimming status and age groups (No. of cases;
 rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): 0-4

Beach: All beaches

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO. OF DAYS IN FIELD	POPULA- TION NO.	1 FUO.	2 ENT.	3 EHC1	4 EHC2	5 EHC3	6 RES.	7 RHC1	8 RHC2	9 RHC3	10 SICK	11 SHC3
ME = 6	20	131	9	14	3	8	9	23	5	8	9	43	19
RN = 0-24	SW		6.9	10.7	2.3	6.1	6.9	17.6	3.8	6.1	6.9	32.8	14.5
MAX = 24			2.2	2.7	1.3	2.1	2.2	3.3	1.7	2.1	2.2	4.1	3.1
"	20	76	7	7	3	4	4	8	2	2	2	20	8
	NSW		9.2	9.2	3.9	5.3	5.3	10.5	2.6	2.6	2.6	26.3	3.5
			3.3	3.3	2.2	2.6	2.6	3.5	1.8	1.8	1.8	5.1	3.5
"	20	207	16	21	6	12	13	31	7	10	11	63	27
	BOTH		7.7	10.1	2.9	5.8	6.3	15.0	3.4	4.8	5.3	30.4	13.0
			1.9	2.1	1.2	1.6	1.7	2.5	1.3	1.5	1.6	3.2	2.3
ME = 63	22	172	13	38	8	13	15	33	6	14	15	73	28
RN = 25+	SW		7.6	22.1	4.7	7.6	8.7	19.2	3.5	8.1	8.7	42.4	16.3
MAX = 410			2.0	3.2	1.6	2.0	2.2	3.0	1.4	2.1	2.2	3.8	2.8
"	22	101	7	13	4	7	8	15	2	5	5	31	13
	NSW		6.9	12.9	4.0	6.9	7.9	14.9	2.0	5.0	5.0	30.7	12.9
			2.5	3.3	1.9	2.5	2.7	3.5	1.4	2.2	2.2	4.6	3.3
"	22	273	20	51	12	20	23	48	8	19	20	104	41
	BOTH		7.3	18.7	4.4	7.3	8.4	17.6	2.9	7.0	7.3	38.1	15.0
			1.6	2.4	1.2	1.6	1.7	2.3	1.0	1.5	1.6	2.9	2.2
ME = 20	42	303	22	52	11	21	24	56	11	22	24	116	47
RN = 0+	SW		7.3	17.2	3.6	6.9	7.9	18.5	3.6	7.3	7.9	38.3	15.5
MAX = 410			1.5	2.2	1.1	1.5	1.6	2.2	1.1	1.5	1.6	2.8	2.1
"	42	177	14	20	7	11	12	23	4	7	7	51	21
	NSW		7.9	11.3	4.0	6.2	6.8	13.0	2.3	4.0	4.0	28.8	11.9
			2.0	2.4	1.5	1.8	1.9	2.5	1.1	1.5	1.5	3.4	2.4
"	42	480	36	72	18	32	36	79	15	29	31	167	68
	BOTH		7.5	15.0	3.8	6.7	7.5	16.5	3.1	6.0	6.5	34.8	14.2
			1.2	1.6	.9	1.1	1.2	1.7	.8	1.1	1.1	2.2	1.6

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) FUO: Fever of undetermined origin
- (2) ENT: Enteric includes persons having at least one of the following symptoms: Vomiting, Abdominal pain, nausea, diarrhoea
- (3) EHC1: Only enteric with FUO
- (4) EHC2: Only enteric with absent from work and/or visit nurse of physician and/or perform laboratory test
- (5) EHC3: EHC1 and/or EHC2
- (6) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (7) RHC1: Only respiratory with FUO
- (8) RHC2: Only respiratory with absent from work and/or visit physician or nurse and/or perform laboratory test
- (9) RHC3: RHC1 and/or RHC2
- (10) SICK: Person with at least one of the listed symptoms: Heavy cough, cold, throat infection, vomiting, abdominal pain, nausea, diarrhoea, FUO, skin sores, earache
- (11) SHC3: Any of the symptoms with FUO (excluding FUO alone) and/or absent from work and/or visit physician or nurse and/or perform laboratory test

APPENDIX 20(b)

Table MSPF

Epidemiological study of Mediterranean Sea Pollution
 Association between microbial quality of seawater and morbidity among bathers;
Highly credible morbidity symptoms for all bathers by the bacterial indicator densities
 (median (ME); range (RN); maximum (MAX) in seawater, by swimming status and age groups (No. of cases;
 rates per 100 persons and standard errors).

Bathing Season: 1983

Age Group (yrs): All ages

Beach: All beaches

Bacterial indicator: enterococci (CFU/100 ml)(log mean (*))

Sex: Both

SYMPTOMS

BACTERIAL CONCENTRA- TION	NO.OF DAYS IN FIELD	POPULA- TION NO.	1 FUO.	2 ENT.	3 EHC1	4 EHC2	5 EHC3	6 RES.	7 RHC1	8 RHC2	9 RHC3	10 SICK	11 SHC3
ME = 6	20	550	24	42	10	21	22	53	16	17	20	100	40
RN = 0-24	SW		4.4	7.6	1.8	3.8	4.0	9.6	2.9	3.1	3.6	18.2	7.3
MAX = 24			.9	1.1	.6	.8	.8	1.3	.7	.7	.8	1.6	1.1
"	20	294	8	15	3	7	7	15	3	6	6	36	15
	NSW		2.7	5.1	1.0	2.4	2.4	5.1	1.0	2.0	2.0	12.2	5.1
			.9	1.3	.6	.9	.9	1.3	.6	.8	.8	1.9	1.3
"	20	844	32	57	13	28	29	68	19	23	26	136	55
	BOTH		3.8	6.8	1.5	3.3	3.4	8.1	2.3	2.7	3.1	16.1	6.5
			.7	.9	.4	.6	.6	.9	.5	.6	.6	1.3	.8
ME = 63	22	781	25	81	15	26	29	61	9	20	22	160	52
RN = 25+	SW		3.2	10.4	1.9	3.3	3.7	7.8	1.2	2.6	2.8	20.5	6.7
MAX = 410			.6	1.1	.5	.6	.7	1.0	.4	.6	.6	1.4	.9
"	22	411	11	33	6	14	15	24	4	8	8	64	22
	NSW		2.7	8.0	1.5	3.4	.36	5.8	1.0	1.9	1.9	15.6	5.4
			.8	1.3	.6	.9	.9	1.2	.5	.7	.7	1.8	1.1
"	22	1192	36	114	21	40	44	85	13	28	30	224	74
	BOTH		3.0	9.6	1.8	3.4	3.7	7.1	1.1	2.3	2.5	18.8	6.2
			.5	.9	.4	.5	.5	.7	.3	.4	.5	1.1	.7
ME = 20	42	1331	49	123	25	47	51	114	25	37	42	260	92
RN = 0+	SW		3.7	9.2	1.9	3.5	3.8	8.6	1.9	2.8	3.2	19.5	6.9
MAX = 410			.5	.8	.4	.5	.5	.8	.4	.5	.5	1.1	.7
"	42	705	19	48	9	21	22	39	7	14	14	100	37
	NSW		2.7	6.8	1.3	3.0	3.1	5.5	1.0	2.0	2.0	14.2	5.2
			.6	.9	.4	.6	.7	.9	.4	.5	.5	1.3	.8
"	42	2036	68	171	34	68	73	153	32	51	56	360	129
	BOTH		3.3	8.4	1.7	3.3	3.6	7.5	1.6	2.5	2.8	17.7	6.3
			.4	.6	.3	.4	.4	.6	.3	.3	.4	.8	.5

*) Log mean of samples drawn on the same day

NOTE: In the columns of the listed symptoms, by descending order: number of positive cases; rate per 100 persons and standard error

SYMPTOMS:

- (1) FUO: Fever of undetermined origin
- (2) ENT: Enteric includes persons having at least one of the following symptoms: Vomiting, Abdominal pain, nausea, diarrhoea
- (3) EHC1: Only enteric with FUO
- (4) EHC2: Only enteric with absent from work and/or visit nurse of physician and/or perform laboratory test
- (5) EHC3: EHC1 and/or EHC2
- (6) RES: Respiratory includes persons having at least one of the following: Heavy cough, cold, throat infection
- (7) RHC1: Only respiratory with FUO
- (8) RHC2: Only respiratory with absent from work and/or visit physician or nurse and/or perform laboratory test
- (9) RHC3: RHC1 and/or RHC2
- (10) SICK: Person with at least one of the listed symptoms: Heavy cough, cold, throat infection, vomiting, abdominal pain, nausea, diarrhoea, FUO, skin sores, earache
- (11) SHC3: Any of the symptoms with FUO (excluding FUO alone) and/or absent from work and/or visit physician or nurse and/or perform laboratory test

APPENDIX 21(a)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)		Population		Rates of enteric symptoms ¹ per 100 persons in age group 0-4					
		sw	nsw	swimmers (sw)			non-swimmers (nsw)		
				No.	rate	SE ³	No.	rate	SE
FC	low (9)	106	51	13	12.3	3.2	7	13.7	4.8
	high (138)	184	108	35	19.0	2.9	13	12.0	3.1
	all (79)	290	159	48	16.6	2.2	20	12.6	2.6
Ent	low (7)	131	76	14	10.7	2.7	7	9.2	3.3
	high (49)	172	101	38	22.1	3.2	13	12.9	3.3
	all (29)	303	177	52	17.2	2.2	20	11.3	2.4
EC	low (5)	149	81	20	13.4	2.8	8	9.9	3.3
	high (49)	154	96	32	20.8	3.3	12	12.5	3.4
	all (112)	303	177	52	17.2	2.2	20	11.3	2.4
Pse	low (3)	138	75	27	19.6	3.4	11	14.7	4.1
	high (14)	23	5	3	13.0	7.0	1	20.0	17.9
	all (5)	161	80	30	18.6	3.1	12	15.0	4.0
St	low (10)	91	48	12	13.2	3.5	8	16.7	5.4
	high (44)	99	36	20	20.2	3.0	20	11.1	4.0
	all (32)	190	84	32	16.8	2.7	12	14.3	3.8

1) Enteric symptoms: vomiting, abdominal pains, nausea and diarrhoea

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(b)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)		Population		Rates of enteric symptoms ¹ per 100 persons in age group 5-9					
		sw	nsw	swimmers (sw)			non-swimmers (nsw)		
				No.	rate	SE ³	No.	rate	SE
FC	low (9)	145	16	11	7.6	2.2	1	6.3	6.1
	high (138)	172	40	27	9.9	1.8	3	7.5	4.2
	all (79)	417	56	38	9.1	1.4	4	7.1	3.4
Ent	low (7)	189	23	15	7.9	2.0	-	-	-
	high (49)	238	43	24	10.1	2.0	5	11.6	4.9
	all (29)	427	66	39	9.1	1.4	5	7.6	3.3
EC	low (5)	221	24	20	9.0	1.9	1	4.2	4.1
	high (49)	206	42	19	9.2	2.0	4	9.5	4.5
	all (112)	427	66	39	9.1	1.4	5	7.6	3.3
Pse	low (3)	200	265	14	7.0	1.8	0	-	-
	high (14)	38	1	5	13.2	5.5	1	100.0	0.0
	all (5)	238	27	19	8.0	1.8	1	3.7	3.6
St	low (10)	120	22	8	6.7	2.3	1	4.5	4.4
	high (44)	154	9	15	9.7	2.4	1	11.1	10.5
	all (32)	174	31	23	8.4	1.7	2	6.5	4.4

1) Enteric symptoms: vomiting, abdominal pains, nausea and diarrhoea

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(c)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population		Rates of enteric symptoms ¹ per 100 persons in age group 18+					
	sw	nsw	swimmers (sw)			non-swimmers (nsw)		
			No.	rate	SE ³	No.	rate	SE
FC low (9) high (138) all (79)	122	141	6	4.9	2.0	6	4.3	1.7
	282	272	16	5.7	1.4	12	4.4	1.2
	404	413	22	5.4	1.1	18	4.4	1.0
Ent low (7) high (49) all (29)	166	193	8	4.8	1.7	8	4.1	1.4
	256	257	15	5.9	1.5	14	5.4	1.4
	422	450	23	5.5	1.1	22	4.9	1.0
EC low (5) high (49) all (112)	215	210	9	4.2	1.4	9	4.3	1.4
	207	240	14	6.8	1.7	13	5.4	1.5
	422	450	23	5.5	1.1	22	4.9	1.0
Pse low (3) high (14) all (5)	241	195	13	5.4	1.5	6	3.1	1.2
	40	25	2	5.0	3.4	1	4.0	3.9
	281	220	15	5.3	1.3	7	3.2	1.2
St low (10) high (44) all (32)	110	126	8	7.3	2.5	5	4.0	1.7
	184	118	8	4.3	1.5	3	2.5	1.4
	294	244	16	5.4	1.3	8	3.3	1.1

1) Enteric symptoms: vomiting, abdominal pains, nausea and diarrhoea

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(d)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population		Rates of enteric symptoms ¹ per 100 persons in all age groups						
	sw	nsw	swimmers (sw)			non-swimmers (nsw)			
			No.	rate	SE ³	No.	rate	SE	
FC ⁴	low (9)	418	866	34	8.1	1.3	14	6.7	1.7
	high (138)	210	427	82	9.5	1.0	29	6.8	1.2
	all (79)	1284	637	116	9.0	0.8	43	6.8	1.0
Ent ⁵	low (7)	550	294	42	7.6	1.1	15	5.1	1.3
	high (49)	781	411	81	10.4	1.1	33	8.0	1.3
	all (29)	1331	705	123	9.2	0.8	48	6.8	0.9
EC ⁶	low (5)	662	317	55	8.3	1.1	18	5.7	1.3
	high (49)	669	388	68	10.2	1.2	30	7.7	1.4
	all (112)	1331	705	123	9.2	0.8	48	6.8	0.9
Pse ⁷	low (3)	687	302	57	8.3	1.1	17	5.6	1.3
	high (14)	117	31	10	8.5	2.6	3	9.7	5.3
	all (5)	804	333	67	8.3	1.0	20	6.0	1.3
St ⁸	low (10)	365	201	30	8.2	1.4	15	7.5	1.9
	high (44)	526	165	44	8.4	1.2	8	4.8	1.7
	all (32)	891	366	74	8.3	0.9	23	6.3	1.3

- 1) Enteric symptoms: vomiting, abdominal pains, nausea and diarrhoea
 2) Colony forming units 3) Standard error 4) Faecal coliforms
 5) Enterococci 6) E. coli 7) Pseudomonas aeruginosa
 8) Staphylococcus aureus

APPENDIX 21(e)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population		Rates of respiratory symptoms ¹ per 100 persons in age group 0-4					
	sw	nsw	swimmers (sw)			non-swimmers (nsw)		
			No.	rate	SE ³	No.	rate	SE
FC low (9) high (138) all (79)	106	51	17	16.0	3.6	4	7.8	3.8
	184	108	37	20.1	3.0	16	14.8	3.4
	290	159	54	18.6	2.3	20	12.6	2.6
Ent low (7) high (49) all (29)	131	76	23	17.6	3.3	8	10.5	3.5
	172	101	33	19.2	3.0	15	14.9	3.5
	303	177	56	18.5	2.2	23	13.0	2.5
EC low (5) high (49) all (112)	149	81	26	17.4	3.1	13	16.0	4.1
	154	96	30	19.5	3.2	10	10.4	3.1
	303	177	56	18.5	2.2	23	13.0	2.5
Pse low (3) high (14) all (5)	138	75	29	21.0	3.5	10	13.3	3.9
	23	5	3	13.0	7.0	2	40.0	21.9
	161	8	32	19.9	3.1	12	15.0	4.0
St ⁹ low (10) high (44) all (32)	91	48	17	18.7	4.1	6	12.5	4.8
	99	36	18	18.2	3.9	6	16.7	6.2
	190	84	35	18.4	2.8	12	14.3	3.8

1) Respiratory symptoms: heavy cough, cold, throat infection

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(f)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population		Rates of respiratory symptoms ¹ per 100 persons in age group 5-9					
	sw	nsw	swimmers (sw)			non-swimmers (nsw)		
			No.	rate	SE ³	No.	rate	SE
FC low (9)	145	16	14	9.7	2.5	2	12.5	8.3
	272	40	25	9.2	1.8	2	5.0	3.4
	417	56	39	9.4	1.4	4	7.1	3.4
Ent low (7)	189	23	20	10.6	2.2	3	13.0	7.0
	238	43	21	8.8	1.8	1	2.3	2.3
	427	66	41	9.6	1.4	4	6.1	2.9
EC low (5)	221	24	24	10.9	2.1	2	8.3	5.6
	206	42	17	8.3	1.9	2	4.8	3.2
	427	66	41	9.6	1.4	4	6.1	2.9
Pse low (3)	200	26	17	8.5	2.0	3	11.5	6.3
	38	2	1	5.3	3.5	0	-	-
	238	27	32	19.9	3.1	12	15.0	4.0
St low (10)	120	22	13	10.8	2.8	3	13.6	7.3
	154	9	9	5.8	1.9	1	11.1	10.5
	274	31	22	8.0	1.6	4	12.9	6.0

1) Respiratory symptoms: heavy cough, cold, throat infection

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse - Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(g)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population	Rates of respiratory symptoms ¹ per 100 persons in age group 18+						
		Population		swimmers (sw)			non-swimmers (nsw)	
		sw	nsw	No.	rate	SE ³	No.	rate
FC low (9) high (138) all (79)	122	141	4	3.3	1.6	2	1.4	1.0
	282	272	8	2.8	1.0	10	3.7	1.1
	404	414	12	3.0	0.8	12	2.9	0.8
Ent low (7) high (49) all (29)	166	193	7	4.2	1.6	4	2.1	1.0
	256	257	5	2.3	0.9	8	3.1	1.1
	422	450	13	3.1	0.8	12	2.7	0.8
EC low (5) high (49) all (112)	215	210	8	3.7	1.3	3	1.4	0.8
	207	240	5	2.4	1.1	9	3.8	1.2
	422	450	13	3.1	0.8	12	2.7	0.8
Pse low (3) high (14) all (5)	241	195	6	2.5	1.0	6	3.1	1.2
	40	25	1	2.5	0.0	0	-	-
	281	220	7	2.5	0.9	6	2.7	1.1
St low (10) high (44) all (32)	110	126	4	3.6	1.8	5	4.0	1.7
	118	9	3	1.6	0.9	3	2.5	1.4
	294	244	7	2.4	0.9	8	3.3	1.1

1) Respiratory symptoms: heavy cough, cold, throat infection

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(h)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population	Rates of respiratory symptoms ¹ per 100 persons in all age groups							
		Population		swimmers (sw)			non-swimmers (nsw)		
		sw	nsw	No.	rate	SE ³	No.	rate	SE
FC low (9) high (138) all (79)	418	866	37	8.9	1.4	8	3.8	1.3	
	210	427	72	8.3	0.9	28	6.6	1.2	
	1284	637	109	8.5	0.8	36	5.7	0.9	
Ent low (7) high (49) all (29)	550	294	42	7.6	1.1	15	5.1	1.3	
	781	411	81	10.4	1.1	33	8.0	1.3	
	1331	705	123	9.2	0.8	48	6.8	0.9	
EC low (5) high (49) all (112)	662	317	60	9.1	1.1	18	5.7	1.3	
	669	388	54	8.1	1.1	21	5.4	1.1	
	1331	705	114	8.6	0.8	39	5.5	0.9	
Pse low (3) high (14) all (5)	687	302	55	8.0	1.0	19	6.3	1.4	
	117	31	6	5.1	2.0	2	6.5	4.4	
	804	333	61	7.6	0.9	21	6.3	1.3	
St low (10) high (44) all (32)	365	201	36	9.9	1.6	14	7.0	1.8	
	526	165	31	5.9	1.0	10	6.1	1.9	
	891	366	67	7.5	0.9	24	6.6	1.3	

1) Respiratory symptoms: heavy cough, cold, throat infection

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(i)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population		Rates of sickness symptoms ¹ per 100 persons in age group 0-4						
	sw	nsw	swimmers (sw)			non-swimmers (nsw)			
			No.	rate	SE ³	No.	rate	SE	
FC	low (9)	106	51	35	33.0	4.6	15	29.4	6.4
	high (138)	184	108	77	41.8	3.6	33	30.6	4.4
	all (79)	290	159	112	38.6	2.9	48	30.2	3.6
Ent	low (7)	131	76	43	32.8	4.1	20	26.3	5.1
	high (49)	172	101	73	42.4	3.8	31	30.7	4.6
	all (29)	303	177	116	38.3	2.8	51	28.8	3.4
EC	low (5)	149	81	53	35.6	3.9	28	34.6	5.3
	high (49)	154	96	63	40.9	4.0	23	24.0	4.4
	all (112)	303	177	116	38.3	2.8	51	28.8	3.4
Pse	low (3)	138	75	57	41.3	4.2	23	30.7	5.3
	high (14)	23	5	7	30.4	9.6	3	60.0	21.9
	all (5)	161	80	64	39.8	3.9	26	32.5	5.2
St	low (10)	91	48	31	34.1	5.0	13	27.1	6.4
	high (44)	99	36	40	40.4	4.9	13	36.1	8.0
	all (32)	190	84	71	37.4	3.5	26	31.0	5.0

1) Sickness symptoms: heavy cough, cold, throat infection, vomiting, abdominal pain, nausea, diarrhoea, fever of undetermined origin, skin and ear infections

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(j)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population		Rates of sickness symptoms ¹ per 100 persons in age group 5-9						
	sw	nsw	swimmers (sw)			non-swimmers (nsw)			
			No.	rate	SE ³	No.	rate	SE	
FC low (9)	145	16	23	15.9	3.0	3	18.8	9.8	
	high (138)	272	40	60	22.1	2.5	5	12.5	5.2
	all (79)	417	56	83	19.9	2.0	8	13.6	4.2
Ent low (7)	189	23	34	18.0	2.8	3	13.0	7.0	
	high (49)	238	43	51	21.4	2.7	6	14.0	5.3
	all (29)	427	66	85	19.9	1.9	9	13.6	4.2
EC low (5)	221	24	39	17.6	2.6	4	16.7	7.6	
	high (49)	206	42	46	22.3	2.9	5	11.9	5.0
	all (112)	427	66	85	19.9	1.9	9	13.6	4.2
Pse low (3)	200	26	38	19.0	2.8	4	15.4	7.1	
	high (14)	38	1	6	15.8	5.9	1	100.0	0.0
	all (5)	238	27	44	18.5	2.5	5	18.5	7.5
St ⁹ low (10)	120	22	22	18.3	3.5	3	13.6	7.3	
	high (44)	154	9	28	18.2	3.1	3	33.3	15.7
	all (32)	274	31	50	18.2	2.3	6	19.4	7.1

1) Sickness symptoms: heavy cough, cold, throat infection, vomiting, abdominal pain, nausea, diarrhoea, fever of undetermined origin, skin and ear infections

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(k)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)	Population	Rates of sickness symptoms ¹ per 100 persons in age group 18+							
		Population		swimmers (sw)			non-swimmers (nsw)		
		sw	nsw	No.	rate	SE ³	No.	rate	SE
FC low (9)	122	141	10	8.2	2.5	9	6.4	2.1	
	high (138)	282	272	31	11.0	1.9	26	9.6	1.8
	all (79)	404	413	41	10.1	1.5	35	8.5	1.4
Ent low (7)	166	193	14	8.4	2.2	13	6.7	1.8	
	high (49)	256	257	29	11.3	2.0	26	10.1	1.9
	all (29)	422	450	43	10.2	1.5	39	8.7	1.3
EC low (5)	215	210	18	8.4	1.9	15	7.1	1.8	
	high (49)	207	240	25	12.1	2.3	24	10.0	1.9
	all (112)	422	450	43	10.2	1.5	39	8.7	1.3
Pse low (3)	241	195	6	2.5	1.0	6	3.1	1.2	
	high (14)	40	25	1	2.5	2.5	0	-	-
	all (5)	281	220	7	2.5	0.9	6	2.7	1.1
St low (10)	110	126	12	10.9	3.0	10	7.9	2.4	
	high (44)	184	118	16	8.7	2.1	8	6.8	2.3
	all (32)	294	244	28	9.5	1.7	18	7.4	1.7

1) Sickness symptoms: heavy cough, cold, throat infection, vomiting, abdominal pain, nausea, diarrhoea, fever of undetermined origin, skin and ear infections

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(1)

Association between Microbial quality of seawater and morbidity among bathers: Comparison of different bacterial indicators

Bathing season 1983

Bacterial indicator (median CFU ² per 100 ml)		Population		Rates of respiratory symptoms ¹ per 100 persons in all age groups					
		sw	nsw	swimmers (sw)			non-swimmers (nsw)		
				No.	rate	SE ³	No.	rate	SE
FC	low (9)	418	866	74	17.7	1.9	27	12.9	2.3
	high (138)	210	427	177	20.4	1.4	65	15.2	1.7
	all (79)	1284	637	251	19.5	1.1	92	14.4	1.4
Ent	low (7)	550	294	100	18.2	1.6	36	12.2	1.9
	high (49)	781	411	160	20.3	1.4	64	15.6	1.8
	all (29)	1331	705	260	19.5	1.1	100	14.2	1.3
EC	low (5)	662	317	119	18.0	1.5	39	12.9	1.9
	high (49)	669	388	141	21.1	1.6	53	13.7	1.7
	all (112)	1331	705	260	19.5	1.1	100	14.2	1.3
Pse	low (3)	687	302	124	18.0	1.5	39	12.9	1.9
	high (14)	117	31	17	14.5	3.3	7	22.6	7.5
	all (5)	804	333	141	17.5	1.3	46	13.8	1.9
St	low (10)	365	201	69	18.9	2.0	27	13.4	2.4
	high (44)	526	165	87	16.5	1.6	24	14.5	2.7
	all (32)	891	366	156	17.5	1.3	51	13.9	1.8

1) Sickness symptoms: heavy cough, cold, throat infection, vomiting, abdominal pain, nausea, diarrhoea, fever of undetermined origin, skin and ear infections

2) Colony forming units 3) Standard error

FC - Faecal coliforms; Ent - Enterococci; EC - E. coli

Pse- Pseudomonas aeruginosa; St - Staphylococcus aureus

APPENDIX 21(m)

Association between Microbial quality of seawater (measured by log mean of Enterococci (Ent) levels) and morbidity among bathers (highly credible enteric symptoms, HCES**) by age groups.

Bathing season 1983

Age	Ent levels	Population		Rates of HCES per 100 persons					
				swimmers			non-swimmers		
				sw	nsw	No.	rate	SE ³	No.
0-4	low	131	76	9	6.9	2.2	4	5.3	2.6
	high	172	101	15	6.3	1.7	8	7.9	2.7
	all	303	177	24	7.9	1.6	12	6.8	1.9
5-9	low	189	23	8	4.2	1.5	0	-	-
	high	238	43	9	3.8	1.2	4	9.3	4.4
	all	427	66	17	4.0	0.9	4	6.1	2.9
10-17	low	64	2	3	4.7	2.6	0	-	-
	high	115	10	0	-	-	0	-	-
	all	179	12	3	1.7	1.0	0	-	-
18+	low	166	193	2	1.2	0.8	3	1.6	0.9
	high	256	257	5	2.0	0.9	3	1.2	0.7
	all	422	450	7	1.7	0.6	6	1.3	0.5
All ages	low	550	294	22	4.0	0.8	7	2.4	0.9
	high	781	411	29	3.7	0.7	15	3.6	0.9
	all	1331	705	51	3.8	0.5	22	3.1	0.7

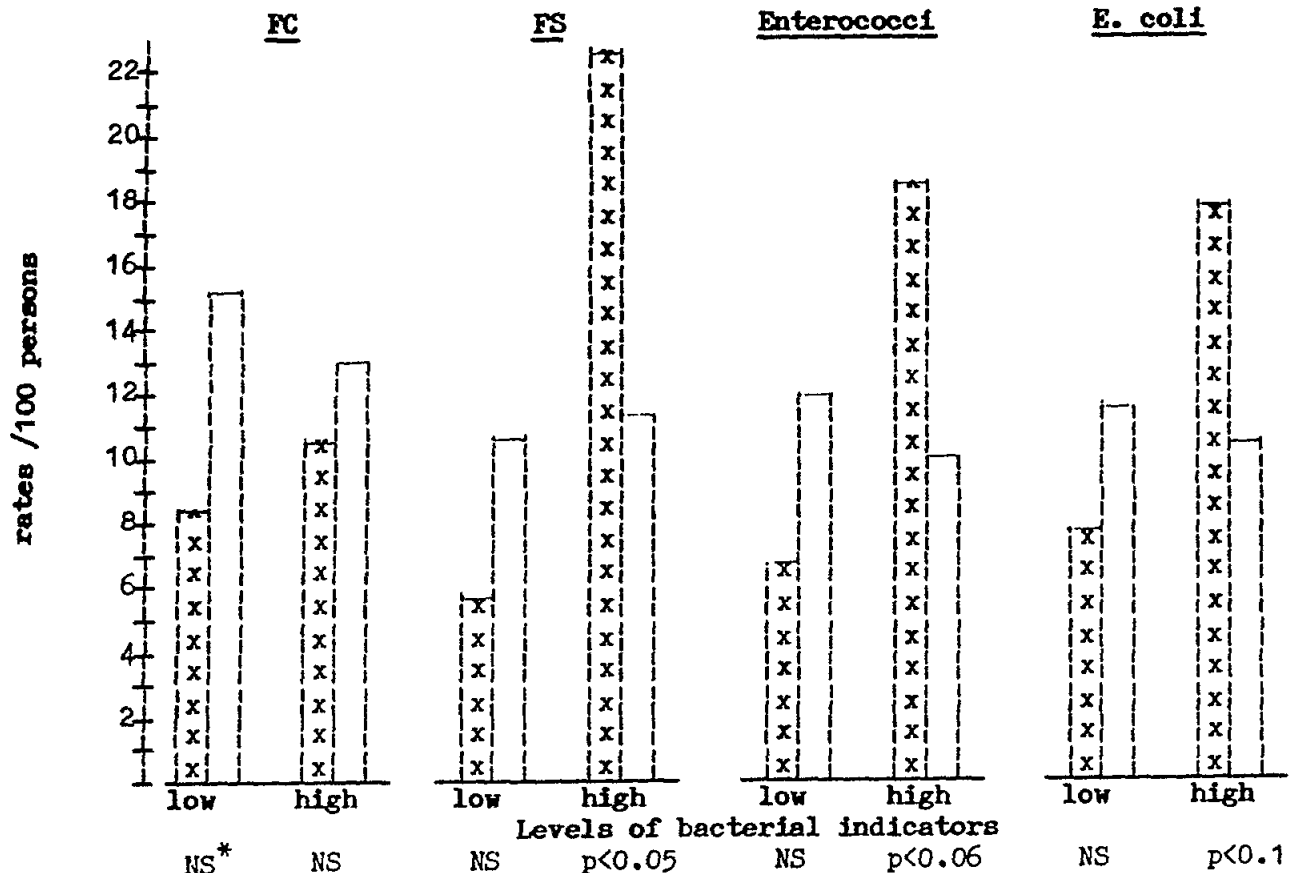
* Log means of Enterococci concentrations measured by CFU/100 ml - 6 for "low", - 63 for "high" and - 20 for all

** Highly Credible Enteric symptoms: vomiting, abdominal pain, nausea, diarrhoea with fever of unknown origin and/or absent from work and/or visit nurse or physician and/or performed the lab tests

1 - SE - standard error

APPENDIX 22

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group who did not visit any beach or swimming pool one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPB)



x swimmers (The number ranged from 72 to 108 in "low" and from 80 to 108 in "high")

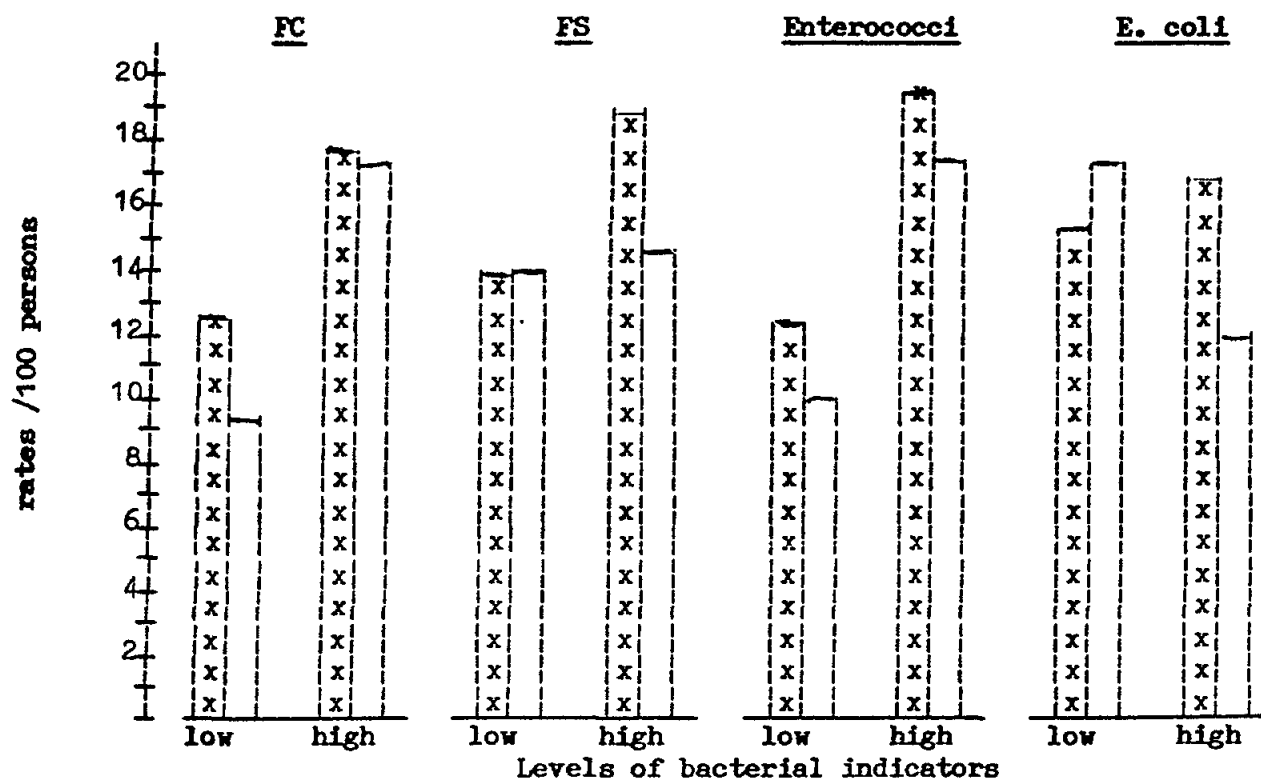
□ non-swimmers (The number ranged from 33 to 57 in "low" and from 62 to 75 in "high")

* Level of significance of differences between swimmers and non-swimmers (NS - not significant). Significant differences between swimmers in "high" vs "low" were found for FS ($p < 0.0006$), enterococci ($p < 0.007$) and E. coli ($p < 0.02$). No significant differences were found between non-swimmers in "high" vs "low".

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high" - 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high" - 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high" - 25 to 410 CFU/100 ml
E. coli: "low" - 0 to 24 CFU/100 ml
 "high" - 25 to 268 CFU/100 ml
 CFU - colony forming units

APPENDIX 23

Incidence of respiratory symptoms per 100 persons among bathers of 0-4 year old age group who did not visit any beach or swimming pool one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPB)



swimmers (The number ranged from 72 to 108 in "low" and from 80 to 108 in "high")

non-swimmers (The number ranged from 33 to 57 in "low" and from 62 to 75 in "high")

* No significant differences between swimmers and non-swimmers were found. No significant differences between swimmers in "high" vs "low" were found (enterococci, $p < 0.09$). No significant differences were found between non-swimmers in "high" vs "low".

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
"high"- 51 to 650 CFU/100 ml

FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
"high"- 51 to 395 CFU/100 ml

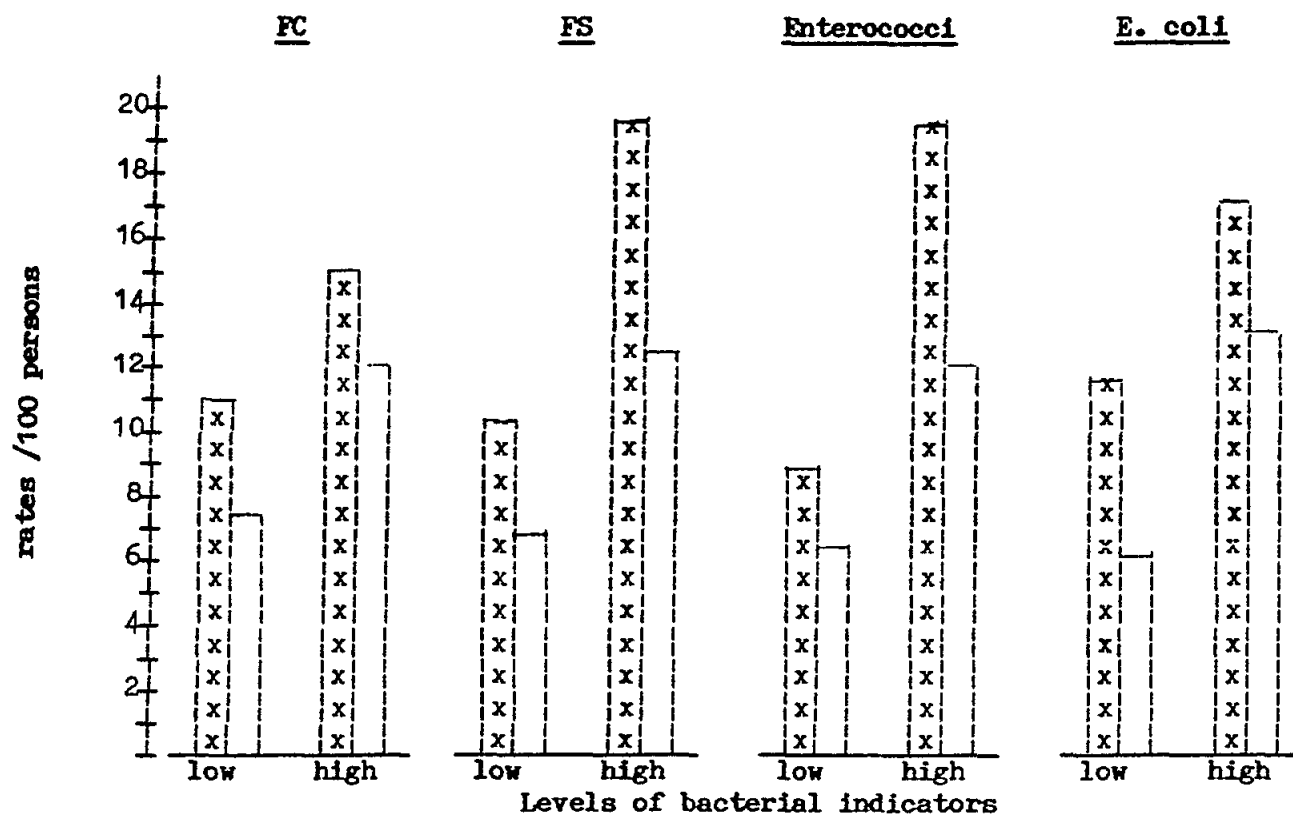
Enterococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 410 CFU/100 ml

E. coli: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 268 CFU/100 ml

CFU - colony forming units

APPENDIX 24

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group who did not have enteric symptoms one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPD)



swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

* Significant differences between swimmers and non-swimmers were found only for enterococci "high" ($p < 0.08$). Significant differences between swimmers in "high" vs "low" were found for FS ($p < 0.02$) and enterococci ($p < 0.01$). No significant differences were found between non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml

"high"- 51 to 650 CFU/100 ml

FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml

"high"- 51 to 395 CFU/100 ml

Enterococci: "low" - 0 to 24 CFU/100 ml

"high"- 25 to 410 CFU/100 ml

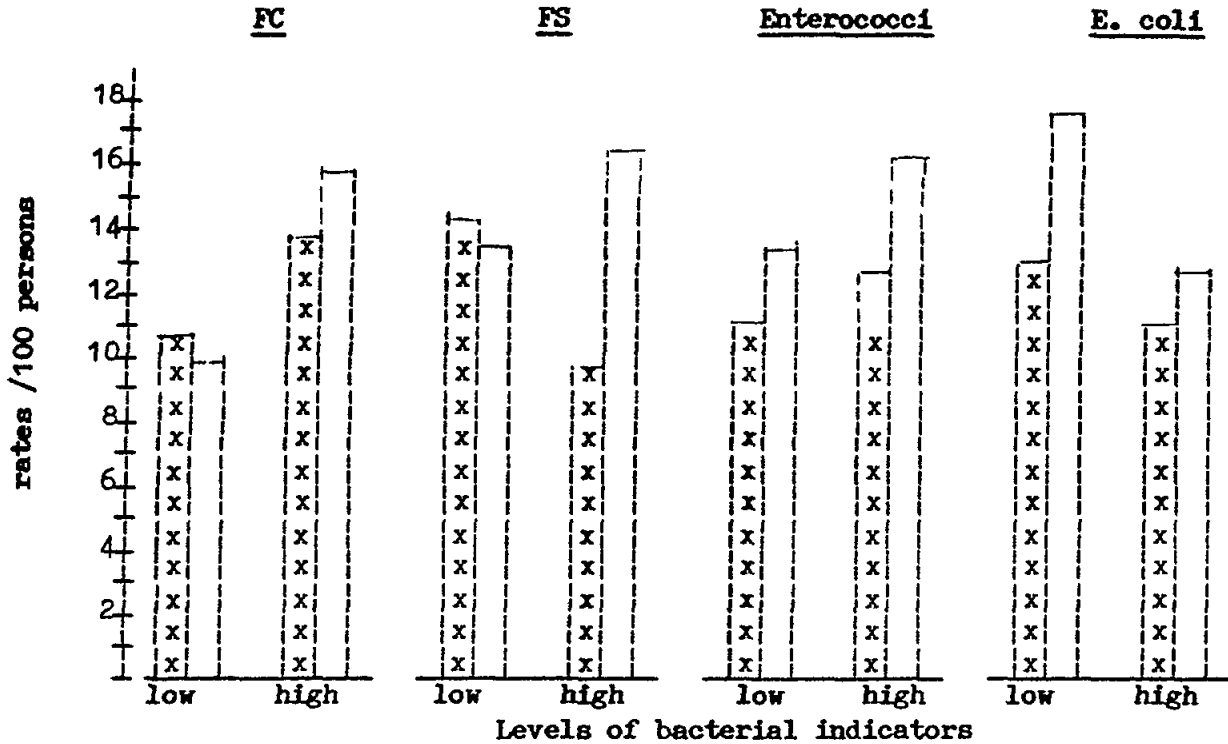
E. coli: "low" - 0 to 24 CFU/100 ml

"high"- 25 to 268 CFU/100 ml

CFU - colony forming units

APPENDIX 25

Incidence of respiratory symptoms per 100 persons among bathers of 0-4 year old age group who did not have respiratory symptoms one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPD)



swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

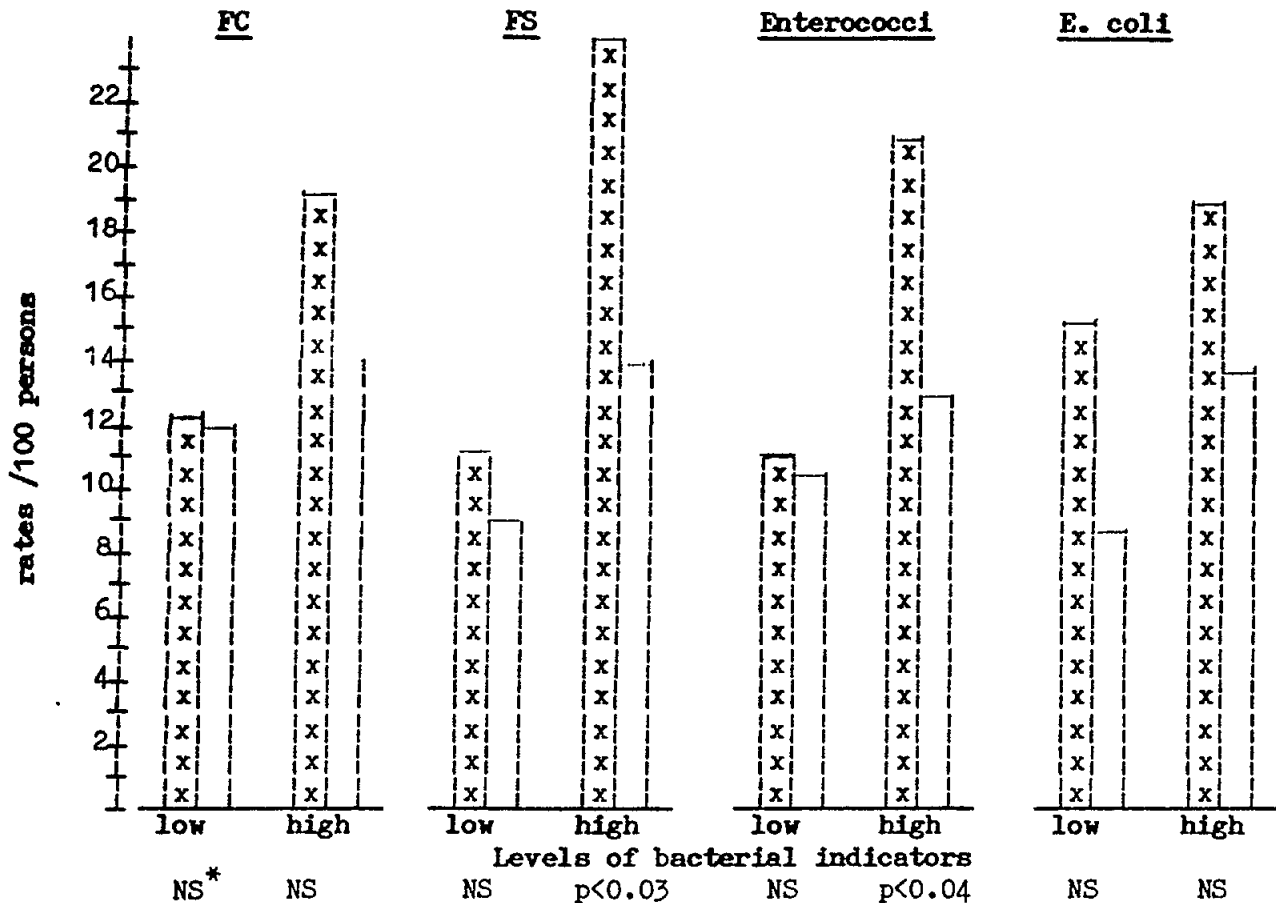
* No significant differences were found between swimmers and non-swimmers. Also no significant differences were found between swimmers or non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
 E. coli: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 268 CFU/100 ml

CFU - colony forming units

APPENDIX 26

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)



swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

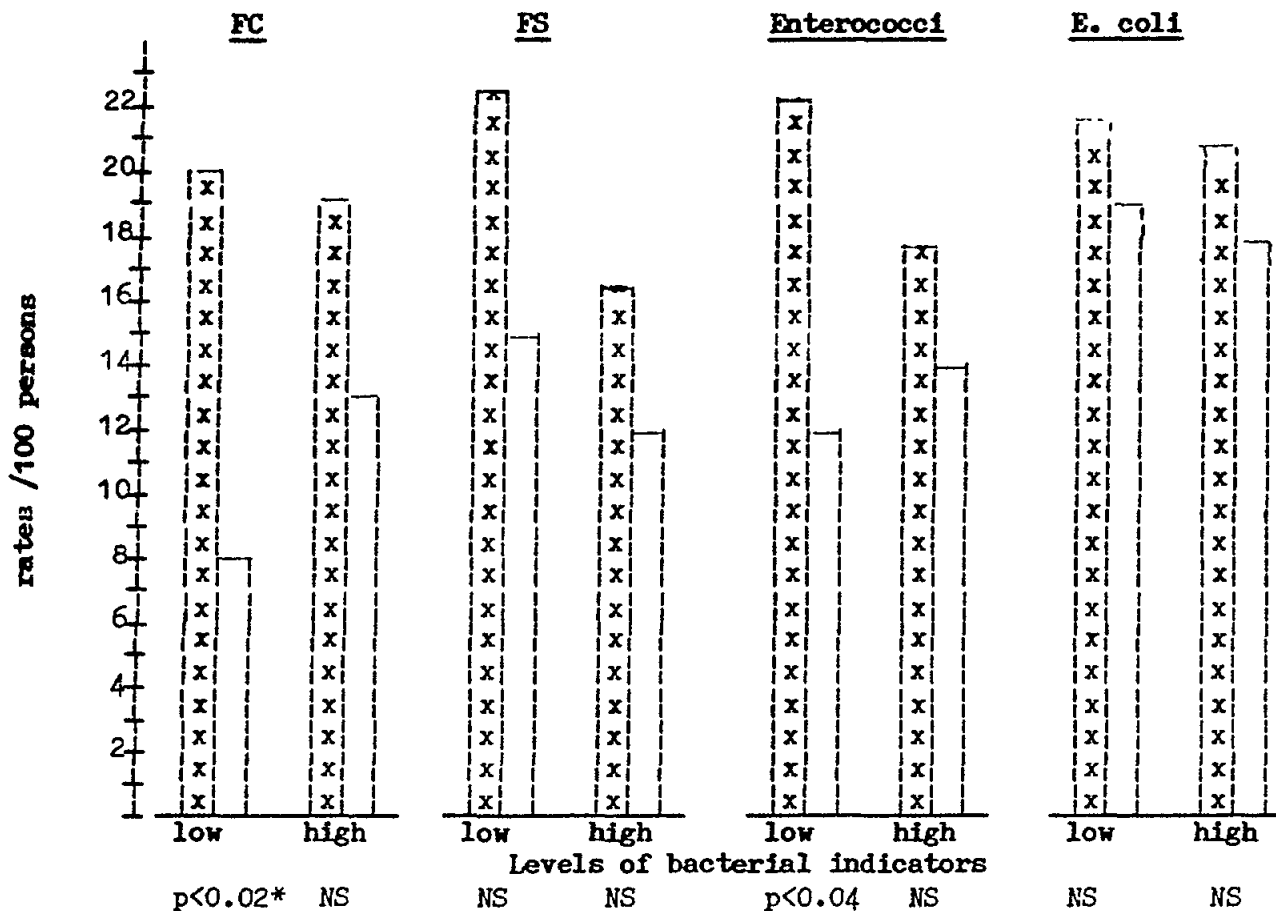
non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

* Level of significance of differences between swimmers and non-swimmers (NS - not significant). Significant differences between swimmers in "high" vs "low" were found for FS ($p < 0.002$) and enterococci ($p < 0.01$). No significant differences were found between swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
E. coli: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 268 CFU/100 ml
 CFU - colony forming units

APPENDIX 27

Incidence of respiratory symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)



⊗ swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

□ non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

* Level of significance of differences between swimmers and non-swimmers (NS - not significant). No significant differences between swimmers in "high" vs "low" were found. Also no significant differences were found between non-swimmers in "high" vs "low" (for FC, p<0.1).

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml

"high"- 51 to 650 CFU/100 ml

FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml

"high"- 51 to 395 CFU/100 ml

Enterococci: "low" - 0 to 24 CFU/100 ml

"high"- 25 to 410 CFU/100 ml

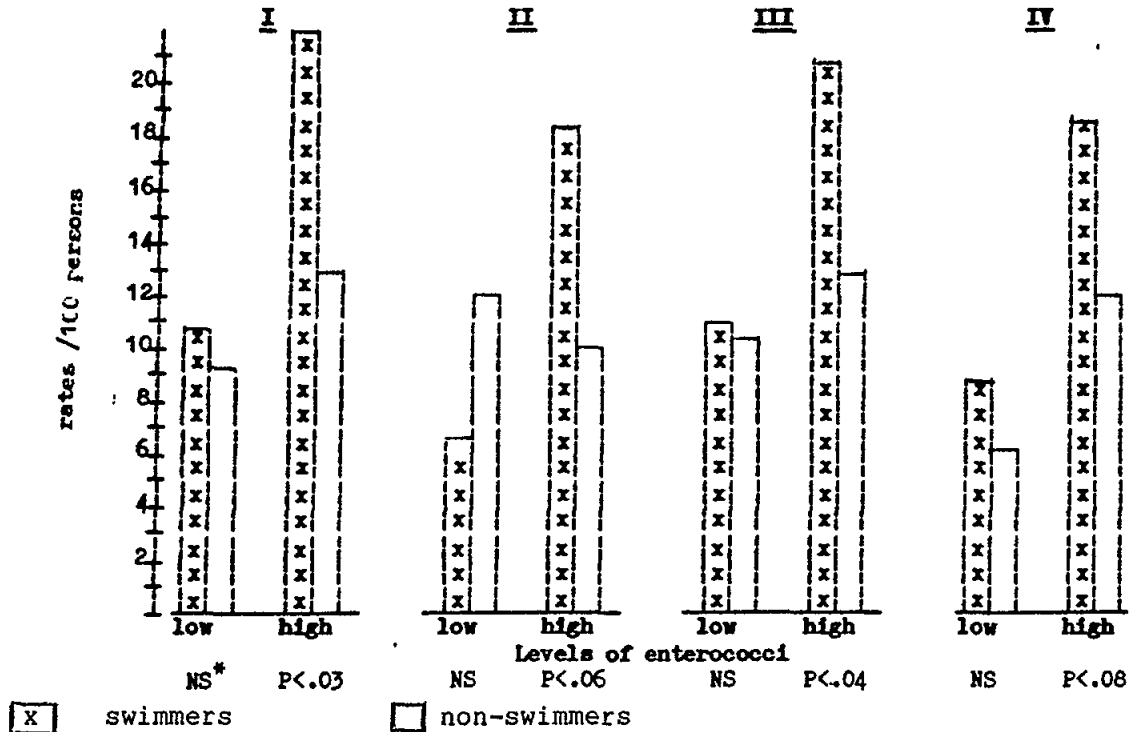
E. coli: "low" - 0 to 24 CFU/100 ml

"high"- 25 to 268 CFU/100 ml

CFU - colony forming units

APPENDIX 28

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of enterococci in seawater



* Level of significance of differences between swimmers and non-swimmers (NS - not significant). Significant differences were found between swimmers in "high" vs "low" for I ($p < 0.004$), II ($p < 0.007$), IV ($p < 0.01$). No significant differences were found between non-swimmers in "high" vs "low"

Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml

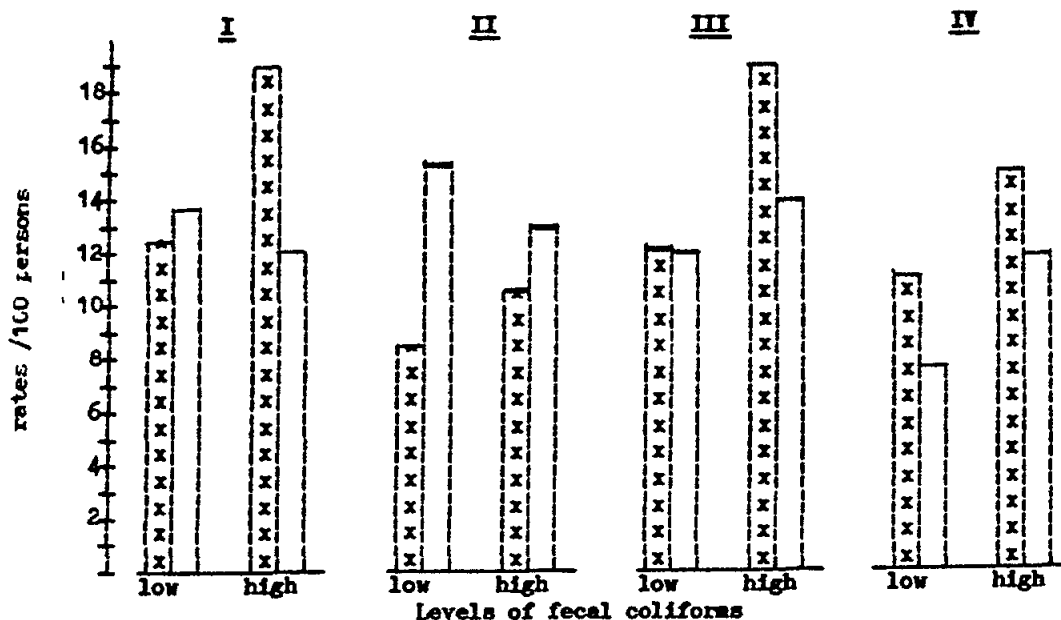
CFU - colony forming units

- I - all bathers
- II - bathers who did not visit any beach or swimming pool one week prior to beach interview
- III - all bathers (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)
- IV - bathers who did not have any enteric symptom one week prior to beach interview

	No. of swimmers		No. of non-swimmers	
	"low"	"high"	"low"	"high"
I	131	172	76	101
II	90	98	50	69
III	99	187	67	101
IV	114	149	63	91

APPENDIX 29

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of faecal coliforms in seawater



swimmers non-swimmers

* No significant differences were found between swimmers and non-swimmers (for "high" I, $p < 0.08$). No significant differences were found between swimmers or between non-swimmers in "high" vs "low" levels of faecal coliforms

Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml

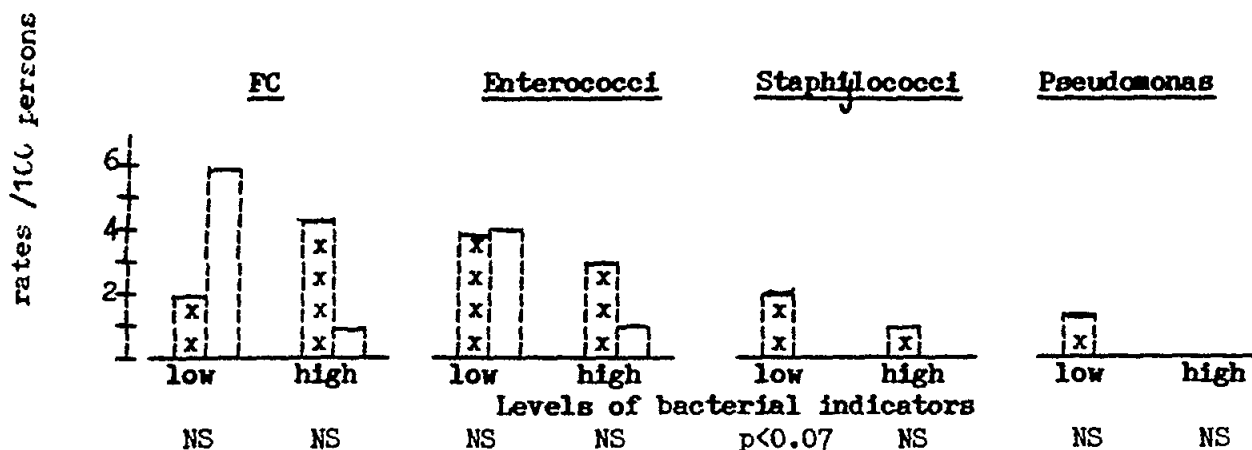
CFU - colony forming units

- I - all bathers
- II - bathers who did not visit any beach or swimming pool one week prior to beach interview
- III - all bathers (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)
- IV - bathers who did not have any enteric symptom one week prior to beach interview

	No. of swimmers		No. of non-swimmers	
	"low"	"high"	"low"	"high"
I	106	184	51	108
II	72	108	33	75
III	90	183	50	100
IV	91	159	40	99

APPENDIX 30

Incidence of ear symptoms per 100 persons among all bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater
(Master Table MSPA)



swimmers (The number ranged from 44 to 131 in "low" and from 89 (Pseudomonas) to 184 in "high")

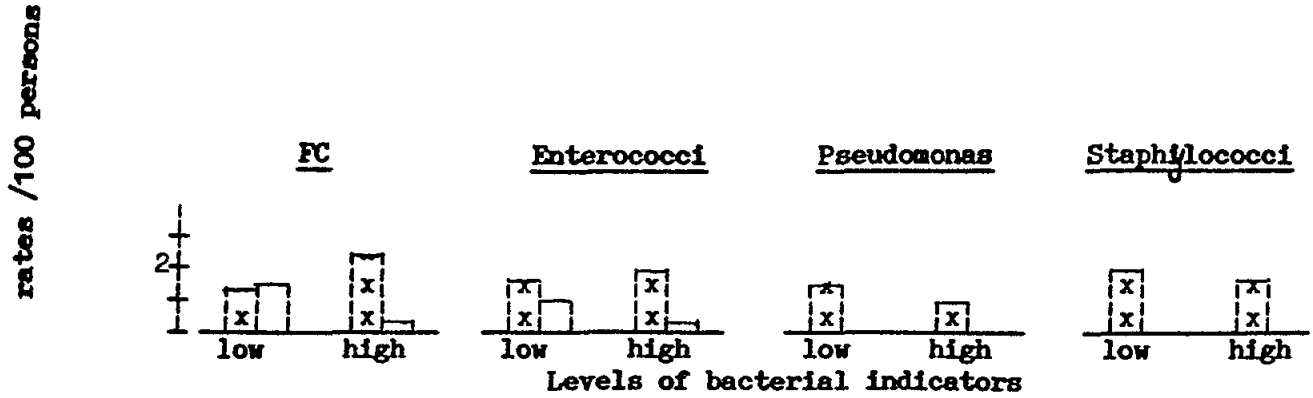
non-swimmers (The number ranged from 5 to 87 in "low" and from 2 (Pseudomonas) to 108 in "high")

* Level of significance of difference between swimmers and non-swimmers (NS - not significant). No significant differences were found between swimmers in "high" vs "low". No significant differences were also found between non-swimmers in "high" vs "low" (p<0.07 for FC)

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
 Staphylococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 70 CFU/100 ml
 Pseudomonas: "low" - 0 to 9 CFU/100 ml
 "high"- 10 to 45 CFU/100 ml
 CFU - colony forming units

APPENDIX 31

Incidence of ear symptoms per 100 persons among all bathers of all ages according to "low" and "high" levels of different bacterial indicators in seawater
(Master Table MSPA)



swimmers (The number ranged from 365 to 687 in "low" and from 117 (Pseudomonas) to 866 in "high")

non-swimmers (The number ranged from 201 to 302 in "low" and from 31 (Pseudomonas) to 427 in "high")

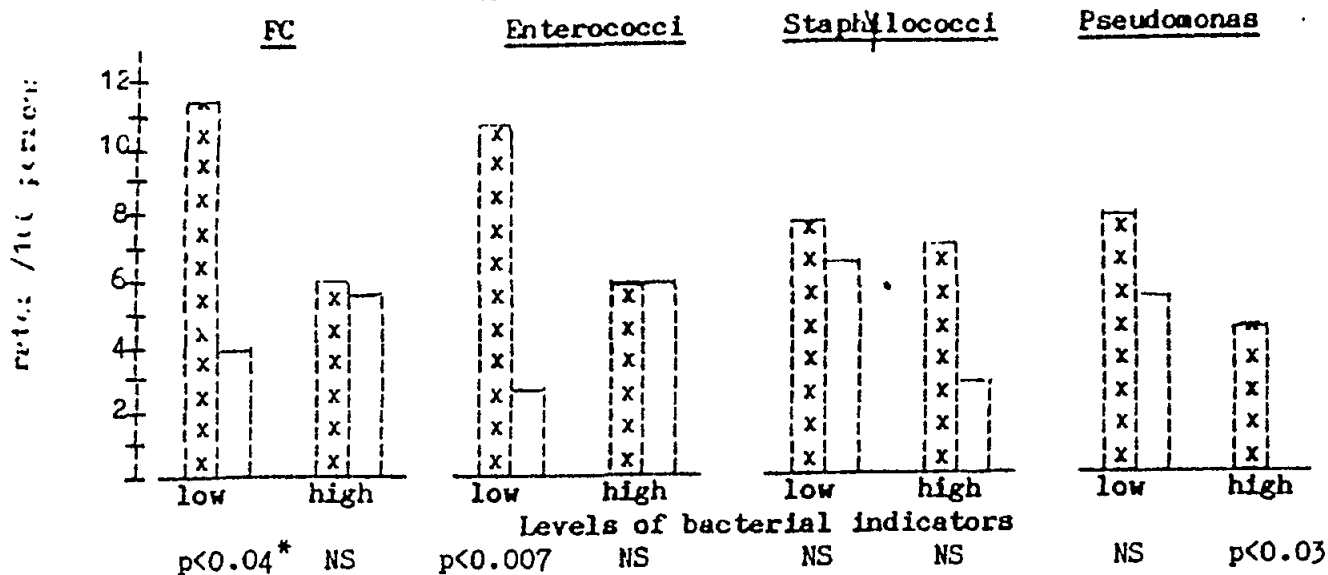
* No significant differences were found between swimmers and non-swimmers.
No significant differences were found between swimmers or non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
"high"- 51 to 650 CFU/100 ml
Enterococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 410 CFU/100 ml
Staphylococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 70 CFU/100 ml
Pseudomonas: "low" - 0 to 9 CFU/100 ml
"high"- 10 to 45 CFU/100 ml

CFU - colony forming units

APPENDIX 32

Incidence of skin symptoms per 100 persons among all bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater



swimmers (The number ranged from 44 to 131 in "low" and from 89 (Pseudomonas) to 89 in "high")

non-swimmers (The number ranged from 5 to 87 in "low" and from 2 (Pseudomonas) to 108 in "high")

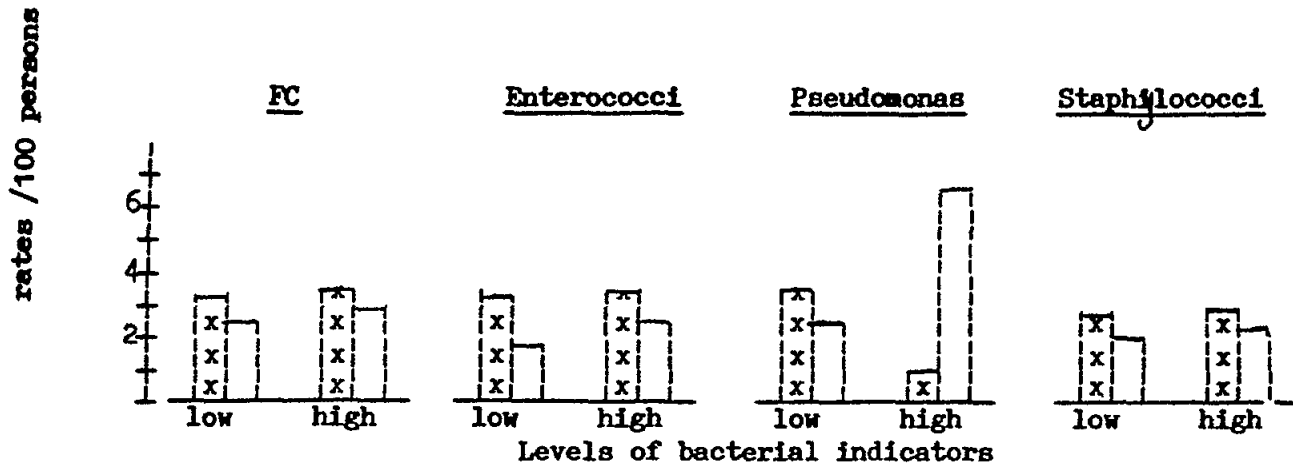
* Level of significance of difference between swimmers and non-swimmers (NS - not significant). No significant differences were found between swimmers in "high" vs "low" (p<0.07 for FC and enterococci). No significant differences were also found between non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
 Staphylococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 70 CFU/100 ml
 Pseudomonas: "low" - 0 to 9 CFU/100 ml
 "high"- 10 to 45 CFU/100 ml

CFU - colony forming units

APPENDIX 33

Incidence of skin symptoms per 100 persons among all bathers of all ages according to "low" and "high" levels of different bacterial indicators in seawater
(Master Table MSPA)



swimmers (The number ranged from 365 to 687 in "low" and from 117 (Pseudomonas) to 866 in "high")

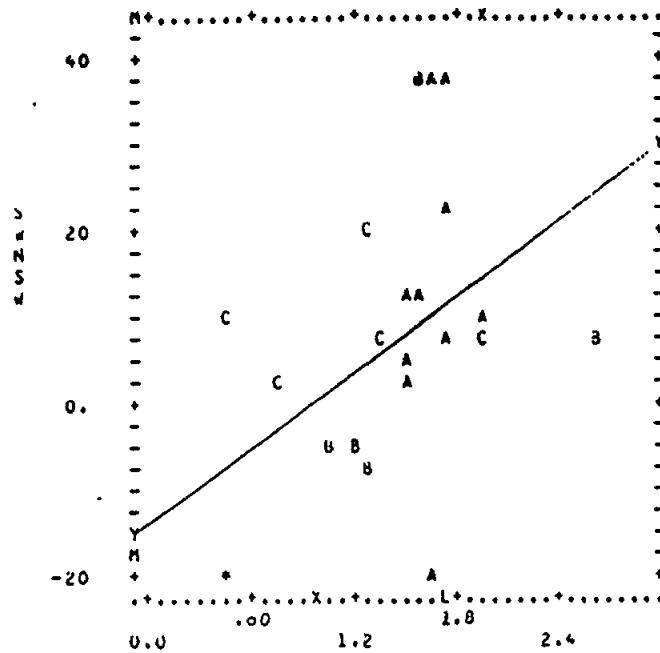
non-swimmers (The number ranged from 201 to 302 in "low" and from 31 (Pseudomonas) to 427 in "high")

* No significant differences were found between swimmers and non-swimmers. No significant differences were found between swimmers or non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" ~ 0 to 50 CFU/100 ml
 "high"~ 51 to 650 CFU/100 ml
 Enterococci: "low" ~ 0 to 24 CFU/100 ml
 "high"~ 25 to 410 CFU/100 ml
 Staphylococci: "low" ~ 0 to 24 CFU/100 ml
 "high"~ 25 to 70 CFU/100 ml
 Pseudomonas: "low" ~ 0 to 9 CFU/100 ml
 "high"~ 10 to 45 CFU/100 ml
 CFU - colony forming units

APPENDIX 34(a)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of enterococci (entero) densities for three beaches for the 0-4 year old age group

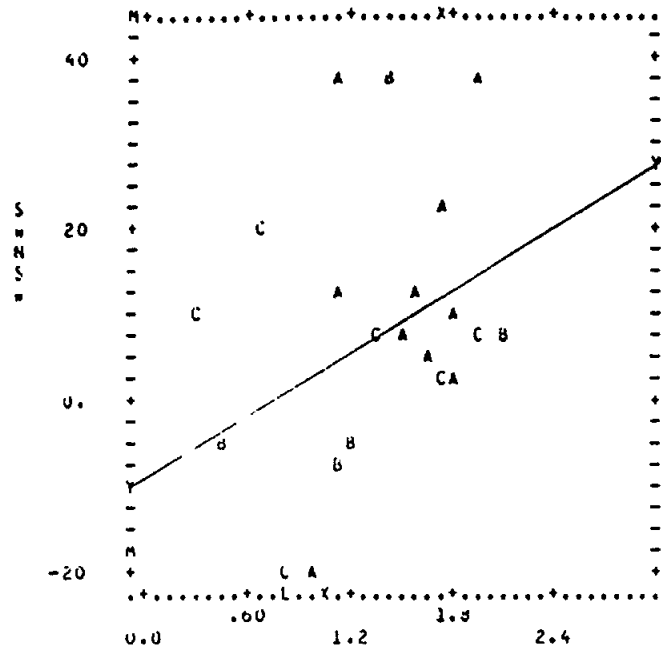


N = 22
 R = .4474
 P(R) .0272
 MEAN ST. DEV. REGRESSION LINE RES. MS.
 Y 7.4345 17.014 Y = 14.022 * X - 13.101 242.97

XVAR = ENTERO VS. YVAR = SWNS GROUP=GORDON, SYMBOL=A
 XVAR = ENTERO VS. YVAR = SWNS GROUP=SHERATON, SYMBOL=B
 XVAR = ENTERO VS. YVAR = SWNS GROUP=KISHON, SYMBOL=C

APPENDIX 34(b)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of E. coli densities for three beaches for the 0-4 year old age group

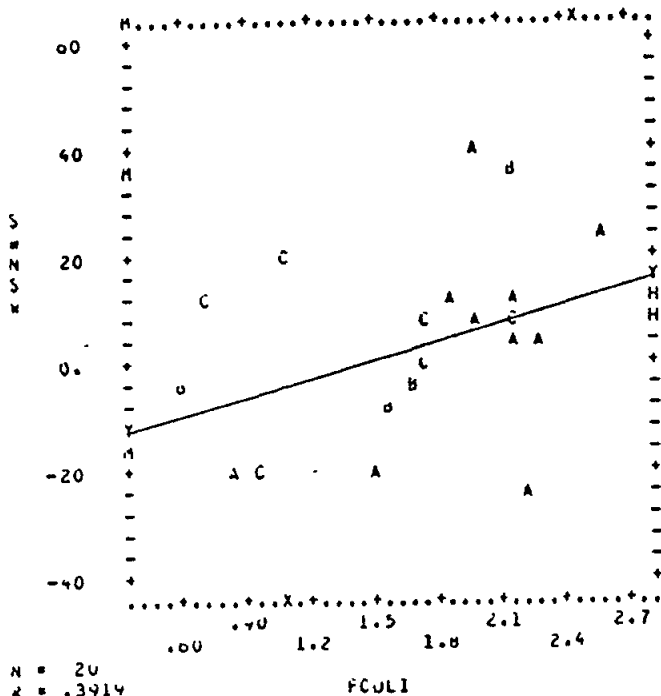


N = 22
 R = .3380
 P(R) .1004
 MEAN ST.DEV. REGRESSION LINE RES.MS.
 Y 7.4345 17.014 Y= 11.040+2-0.0708 269.21

XVAR = ECOLI VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
 XVAR = ECOLI VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
 XVAR = ECOLI VS. YVAR = SWNSW GROUP=RISHUN , SYMBOL=C

APPENDIX 34(c)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of faecal coliform (fcoli) densities for three beaches for the 0-4 year old age group

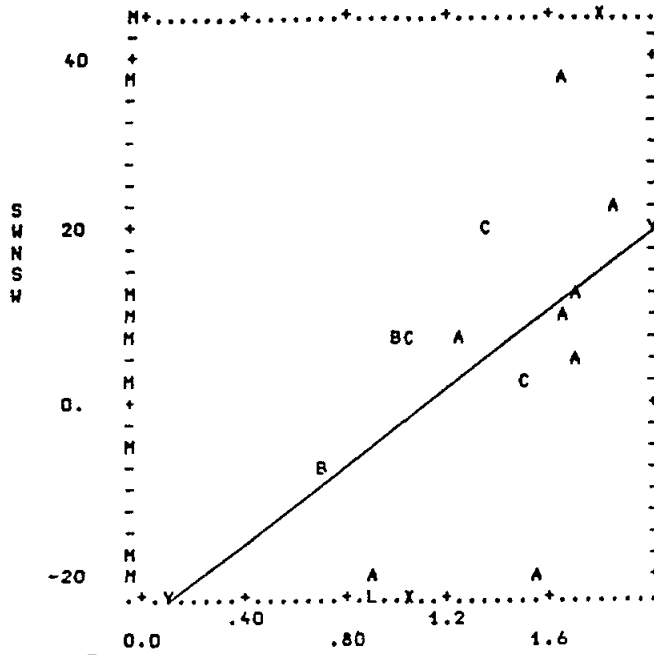


N = 20
 r = .3914
 P(P) = .0711
 MEAN ST. DEV. REGRESSION LINE RES. MS.
 Y 4.2010 17.461 Y = 12.168*X - 16.367 285.65

XVAR =	FCOLI	VS.	YVAR =	SWNSW	GROUP=GORDUN , SYMBOL=A
XVAR =	FCOLI	VS.	YVAR =	SWNSW	GROUP=SHERATON, SYMBOL=B
XVAR =	FCOLI	VS.	YVAR =	SWNSW	GROUP=RISHUN , SYMBOL=C

APPENDIX 34(d)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of Staphylococcus aureus densities for three beaches for the 0-4 year old age group

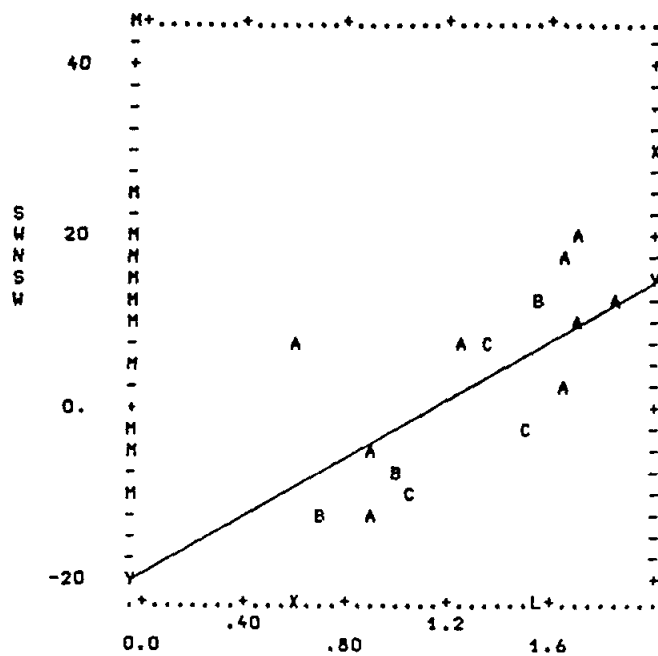


MEAN	ST.DEV.	REGRESSION LINE	RES.MS.	
Y	6.7462	16.326	Y = 22.950 * X - 24.692	216.50

XVAR =	STAPHIL	VS.	YVAR =	SWNSW	GROUP=GORDON ,	SYMBOL=A
XVAR =	STAPHIL	VS.	YVAR =	SWNSW	GROUP=SHERATON,	SYMBOL=B
XVAR =	STAPHIL	VS.	YVAR =	SWNSW	GROUP=RISHON ,	SYMBOL=C

APPENDIX 34(e)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of Staphylococcus aureus densities for three beaches for the 0-9 year old age group

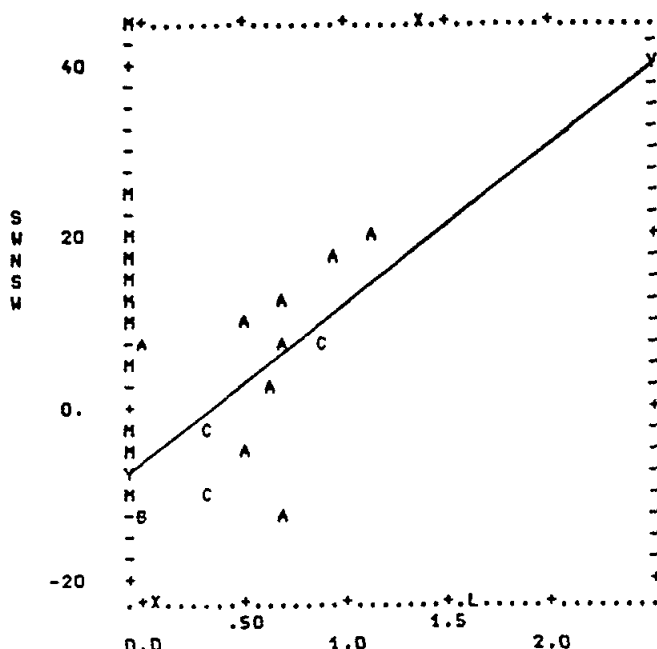


N = 15
R = .6849
P(R) .0017
MEAN ST.DEV. REGRESSION LINE RES.MS.
Y 3.2260 10.629 Y= 18.080*X-20.083 64.588

XVAR = STAPHIL VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
XVAR = STAPHIL VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
XVAR = STAPHIL VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

APPENDIX 34(f)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of Pseudomonas aeruginosa (pseudom) densities for three beaches for the 0-9 year old age group

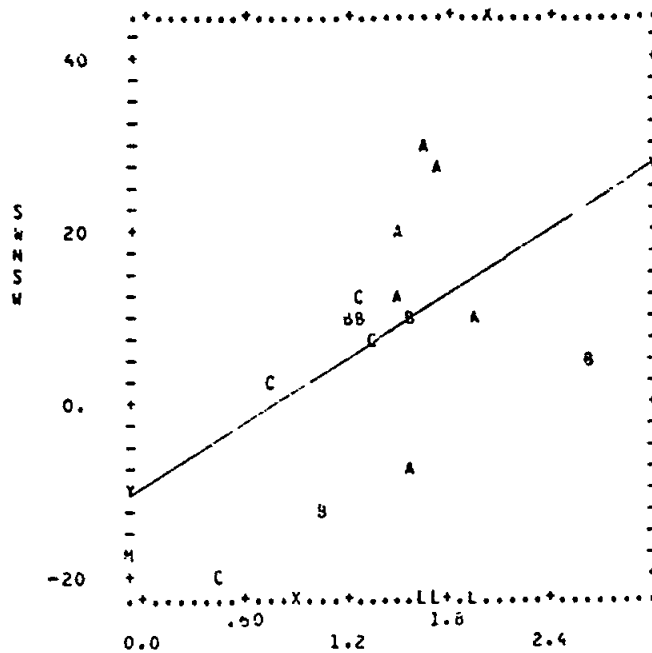


N = 13
R = .6138
P(R) .0133
MEAN ST.DEV. REGRESSION LINE RES.MS.
Y 3.1808 10.759 Y= 19.234*X-7.4728 78.702

XVAR = PSE000M VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
XVAR = PSE000M VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
XVAR = PSE000M VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

APPENDIX 34(g)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of enterococci (entero) densities for three beaches for the 0-4 year old age group

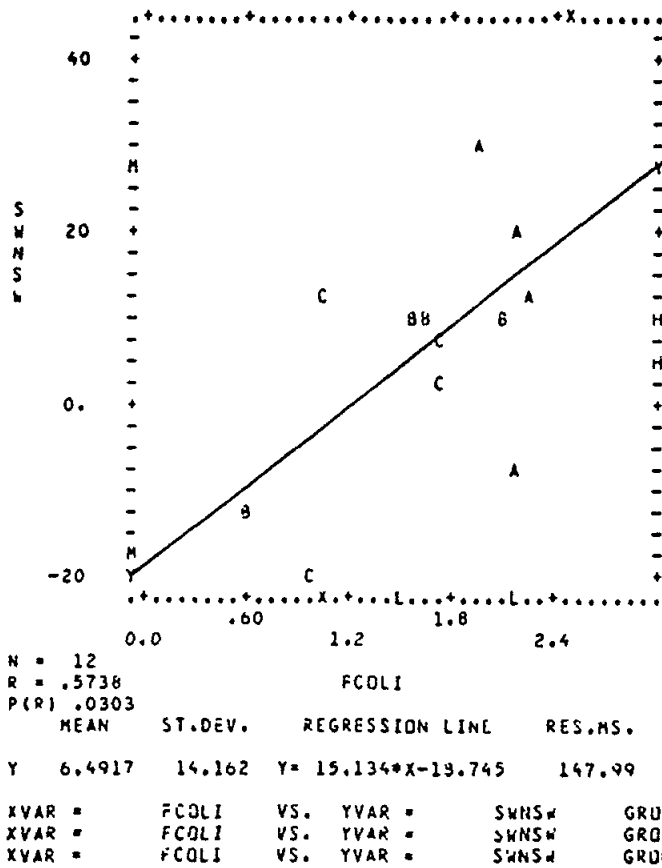


N = 15
R = .4492
P(R) .0703
MEAN ST.DEV. REGRESSION LINE RES.MS.
Y 7.8740 13.688 Y = 12.414 * X - 9.8557 161.05

XVAR = ENTERO VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
XVAR = ENTERO VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
XVAR = ENTERO VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

APPENDIX 34(h)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of faecal coliform (fcoli) densities for three beaches for the 0-4 year old age group



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- No. 8 PNUE: Etudes biogéochimiques de certains polluants au large de la Méditerranée (MED POL VIII). Addendum, Croisière Océanographique de la Grèce 1980. MAP Technical Reports Series No. 8, Addendum. UNEP, Athens 1986.
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PROGRAMME DES NATIONS UNIES POUR L' ENVIRONNEMENT
UNITED NATIONS ENVIRONMENT PROGRAMME

Unité de coordination
du Plan d' action pour la Méditerranée



Co-ordinating Unit
for the Mediterranean Action Plan

Memorandum Intérieur

Interoffice Memorandum

A-To: C. Marx, Adm. Officer, UNEP, Athens

Date: 26.01.88

De-From: L. Jeftic, Senior Marine Scientist, UNEP,
Athens

Ref: LJ/mf

A handwritten signature in dark ink, appearing to be 'L. J.' followed by a flourish.

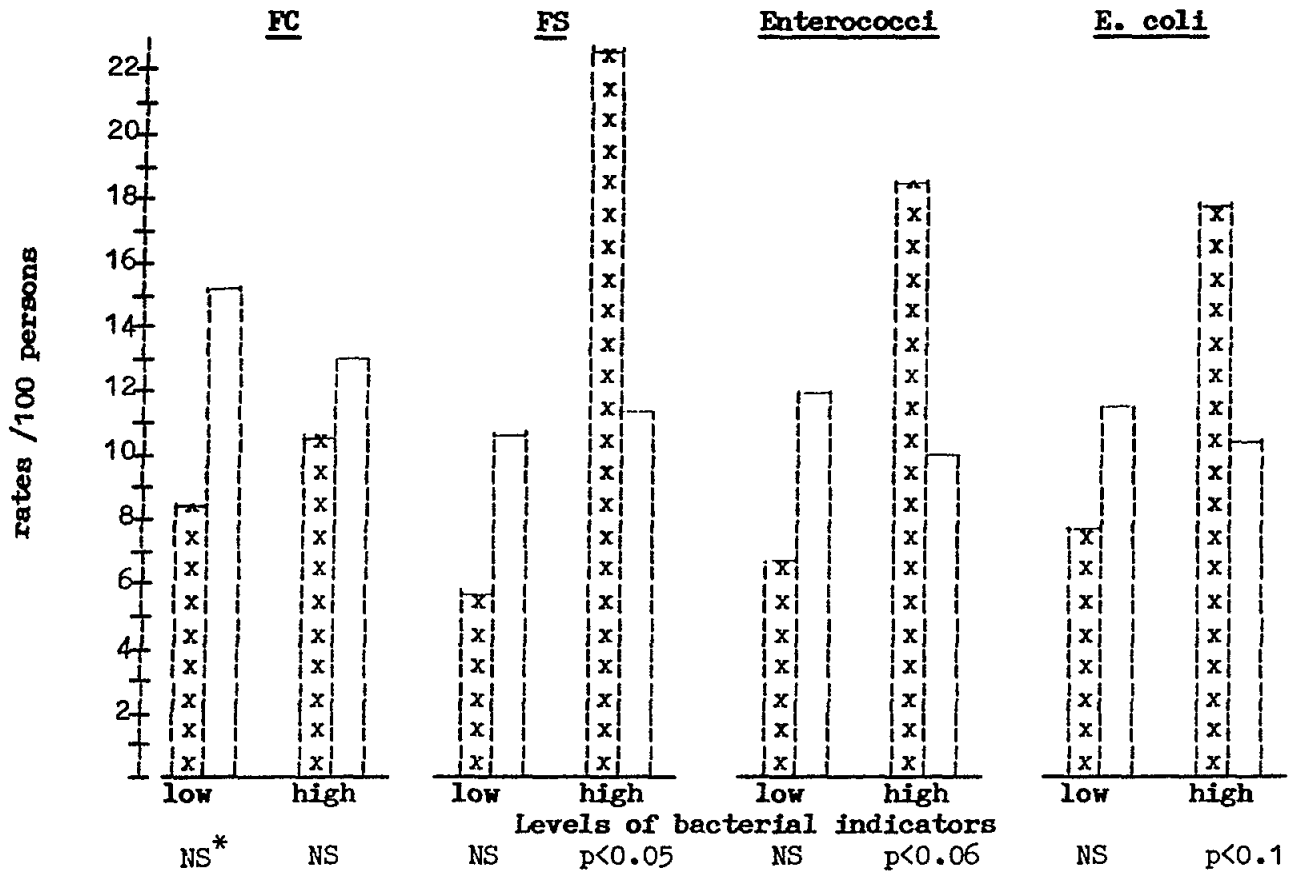
Objet-Subject: Reproduction of MAP Tech. Rep. No 20

ATHENS

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APPENDIX 22

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group who did not visit any beach or swimming pool one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPB)



x swimmers (The number ranged from 72 to 108 in "low" and from 80 to 108 in "high")

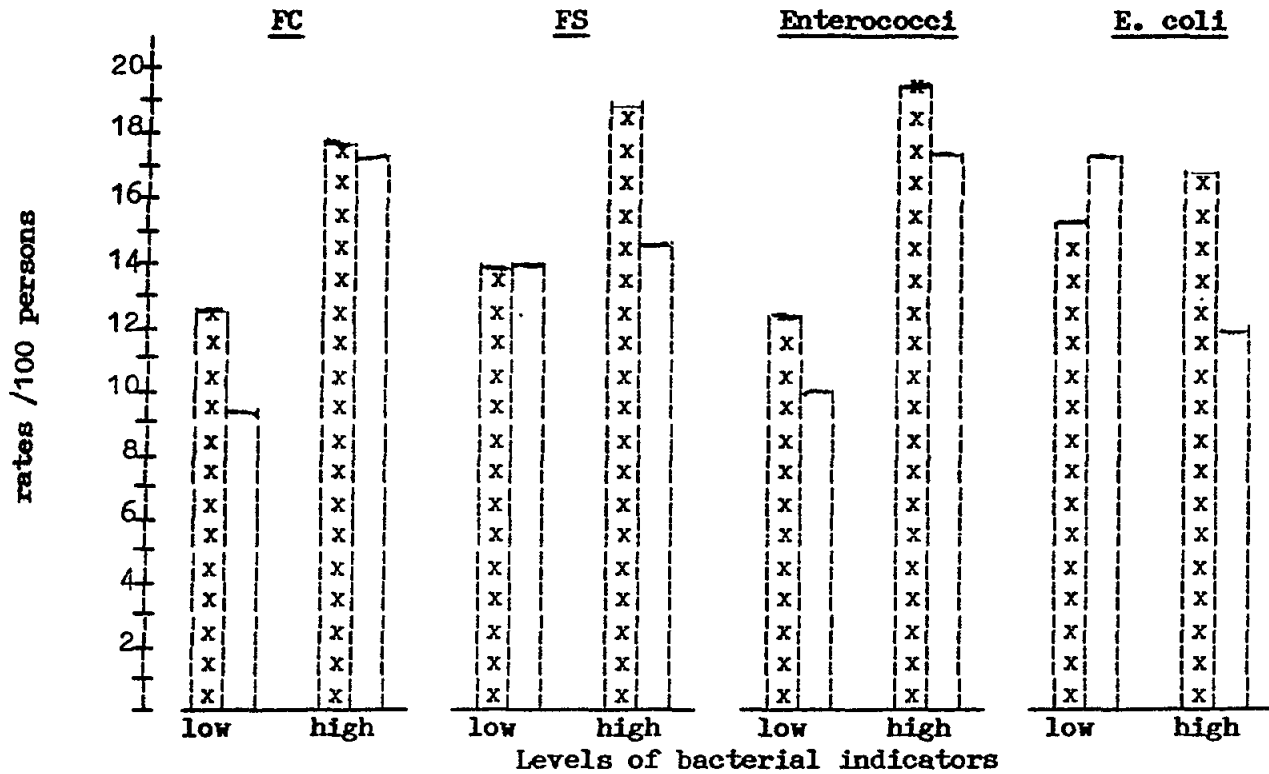
□ non-swimmers (The number ranged from 33 to 57 in "low" and from 62 to 75 in "high")

* Level of significance of differences between swimmers and non-swimmers (NS - not significant). Significant differences between swimmers in "high" vs "low" were found for FS ($p < 0.0006$), enterococci ($p < 0.007$) and E. coli ($p < 0.02$). No significant differences were found between non-swimmers in "high" vs "low".

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
E. coli: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 268 CFU/100 ml
 CFU - colony forming units

APPENDIX 23

Incidence of respiratory symptoms per 100 persons among bathers of 0-4 year old age group who did not visit any beach or swimming pool one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPB)



swimmers (The number ranged from 72 to 108 in "low" and from 80 to 108 in "high")

non-swimmers (The number ranged from 33 to 57 in "low" and from 62 to 75 in "high")

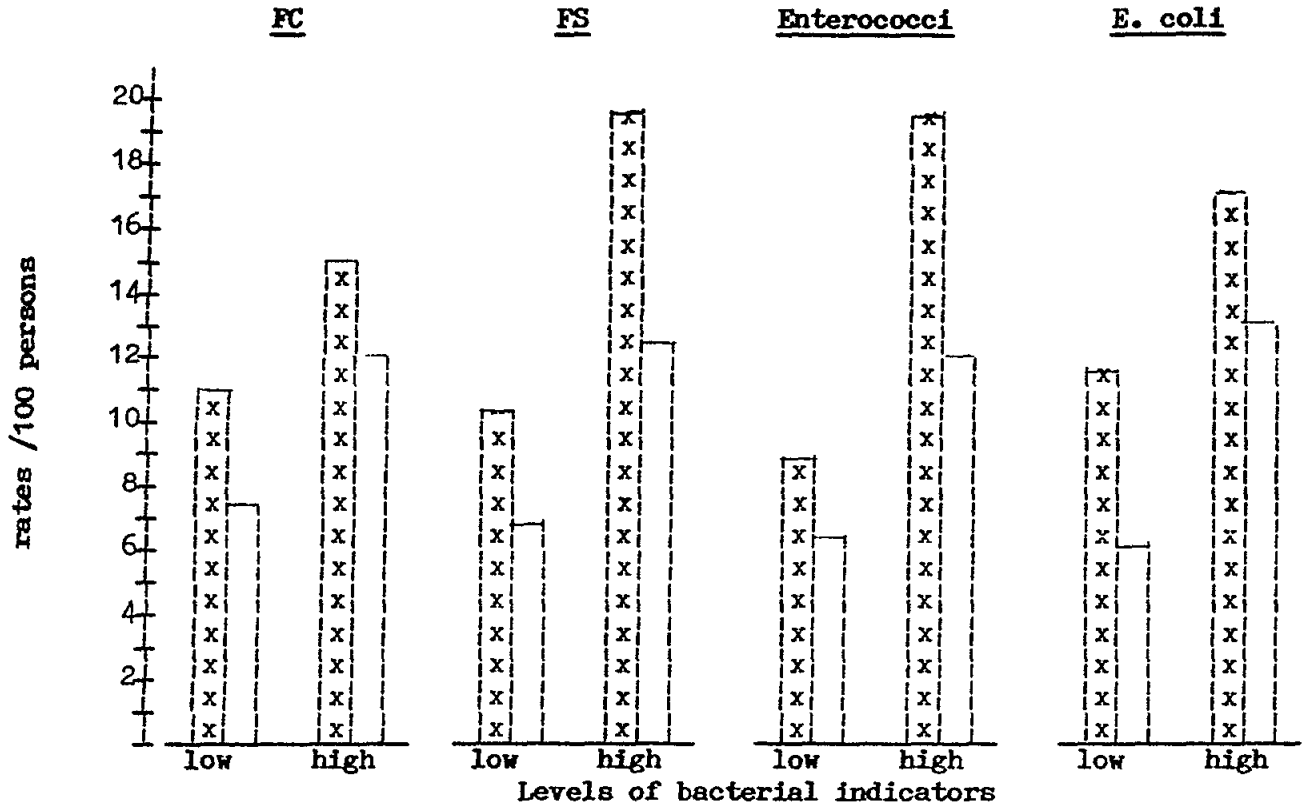
* No significant differences between swimmers and non-swimmers were found. No significant differences between swimmers in "high" vs "low" were found (enterococci, $p < 0.09$). No significant differences were found between non-swimmers in "high" vs "low".

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high" - 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high" - 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high" - 25 to 410 CFU/100 ml
E. coli: "low" - 0 to 24 CFU/100 ml
 "high" - 25 to 268 CFU/100 ml

CFU - colony forming units

APPENDIX 24

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group who did not have enteric symptoms one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPD)



swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

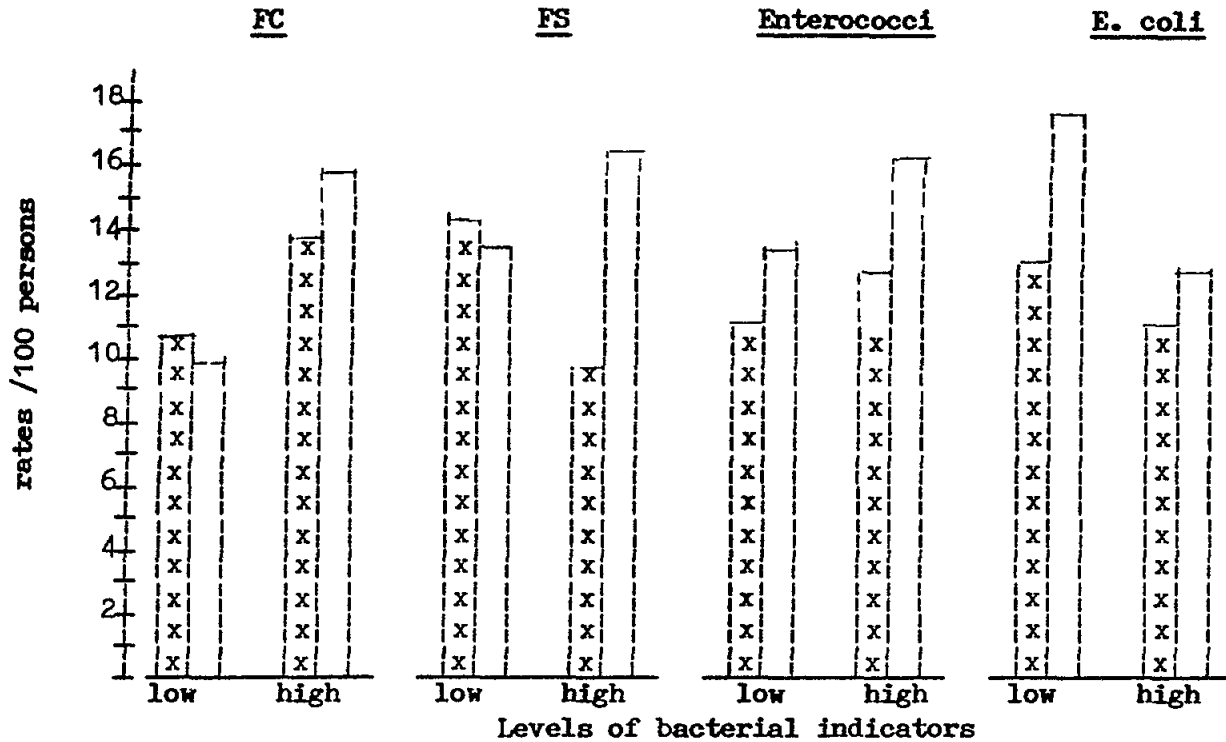
non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

* Significant differences between swimmers and non-swimmers were found only for enterococci "high" ($p < 0.08$). Significant differences between swimmers in "high" vs "low" were found for FS ($p < 0.02$) and enterococci ($p < 0.01$). No significant differences were found between non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
E. coli: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 268 CFU/100 ml
 CFU - colony forming units

APPENDIX 25

Incidence of respiratory symptoms per 100 persons among bathers of 0-4 year old age group who did not have respiratory symptoms one week prior to beach interview according to "low" and "high" levels of different bacterial indicators in seawater (Master Table MSPD)



swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

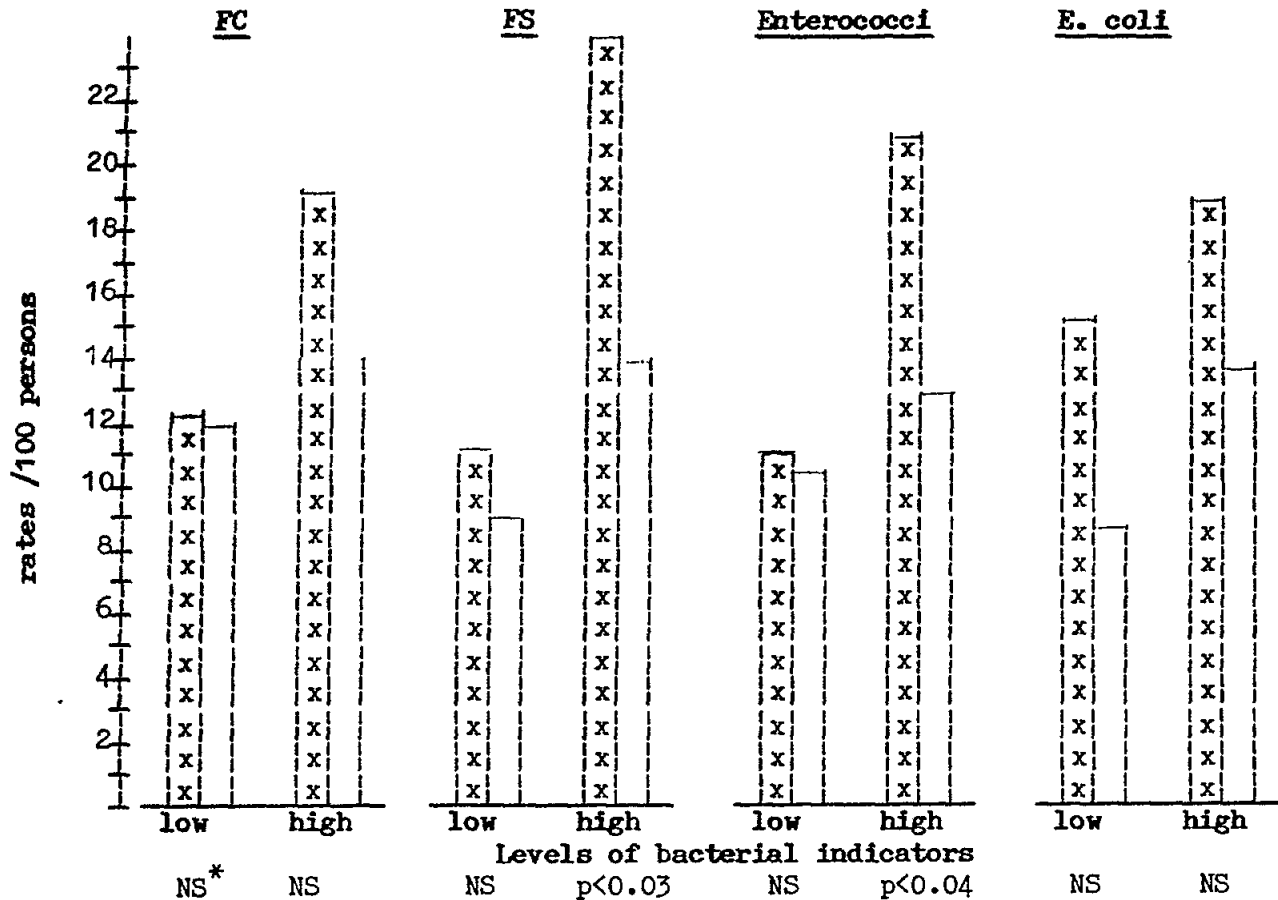
non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

* No significant differences were found between swimmers and non-swimmers. Also no significant differences were found between swimmers or non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high" - 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high" - 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high" - 25 to 410 CFU/100 ml
E. coli: "low" - 0 to 24 CFU/100 ml
 "high" - 25 to 268 CFU/100 ml
 CFU - colony forming units

APPENDIX 26

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)



⊠ swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

□ non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

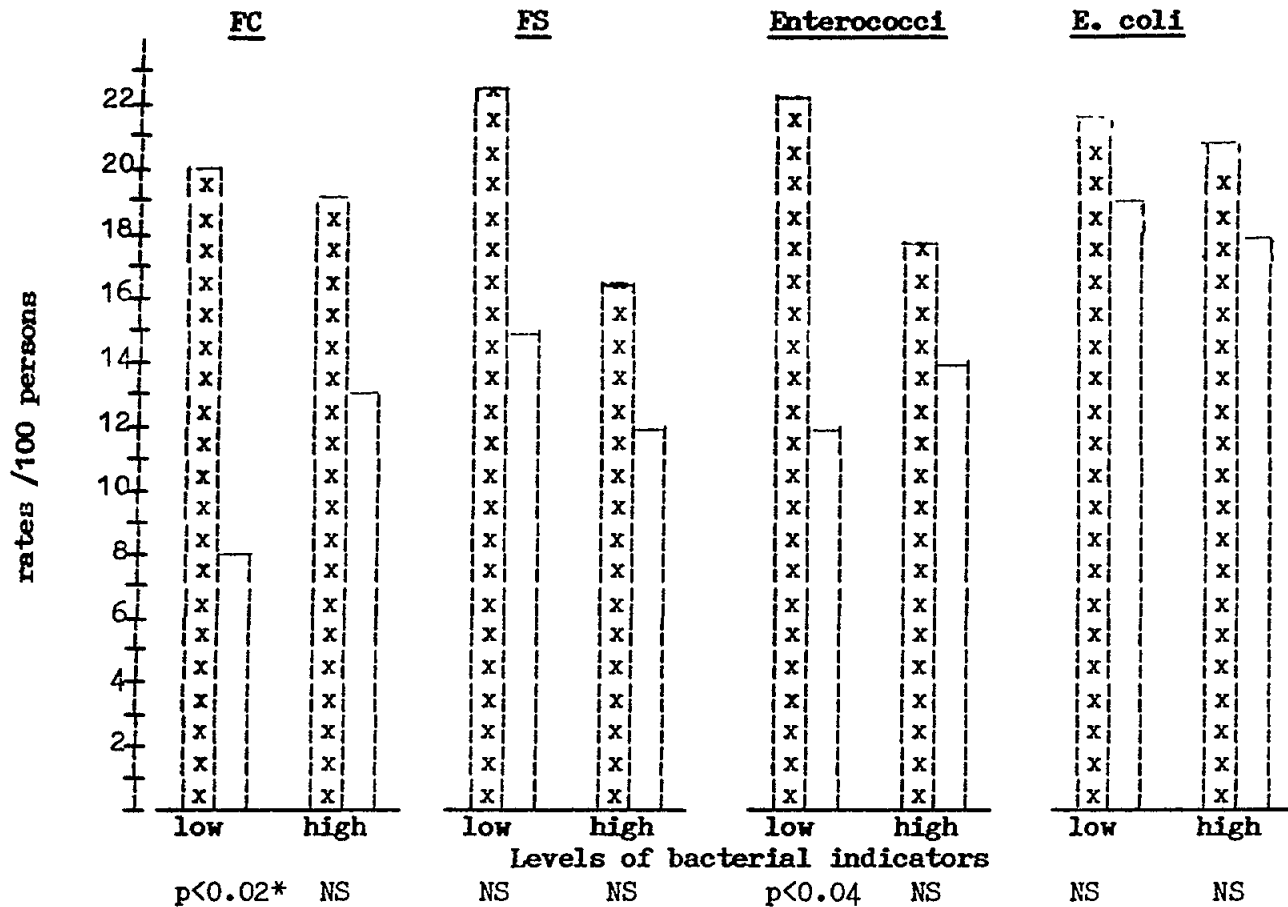
* Level of significance of differences between swimmers and non-swimmers (NS - not significant). Significant differences between swimmers in "high" vs "low" were found for FS (p<0.002) and enterococci (p<0.01). No significant differences were found between swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 395 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
 E. coli: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 268 CFU/100 ml

CFU - colony forming units

APPENDIX 27

Incidence of respiratory symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)



swimmers (The number ranged from 91 to 145 in "low" and from 118 to 159 in "high")

non-swimmers (The number ranged from 40 to 73 in "low" and from 81 to 99 in "high")

* Level of significance of differences between swimmers and non-swimmers (NS - not significant). No significant differences between swimmers in "high" vs "low" were found. Also no significant differences were found between non-swimmers in "high" vs "low" (for FC, p<0.1).

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
"high"- 51 to 650 CFU/100 ml

FS - Faecal streptococci: "low" - 0 to 50 CFU/100 ml
"high"- 51 to 395 CFU/100 ml

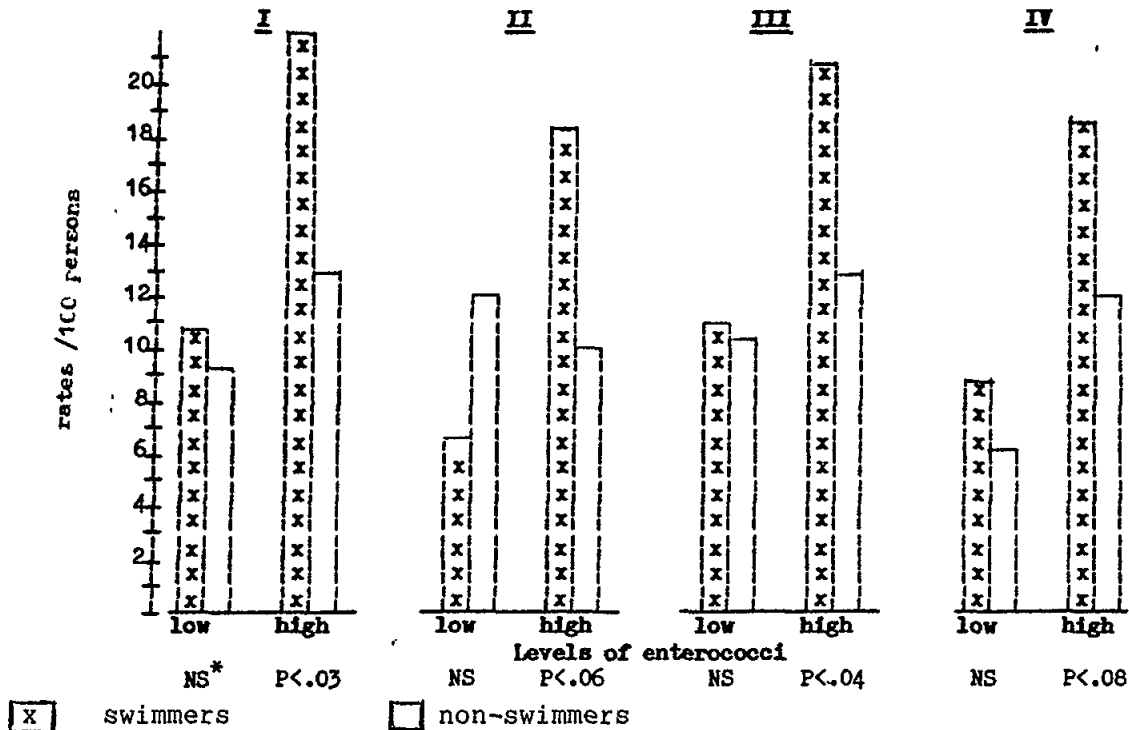
Enterococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 410 CFU/100 ml

E. coli: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 268 CFU/100 ml

CFU - colony forming units

APPENDIX 28

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of enterococci in seawater



* Level of significance of differences between swimmers and non-swimmers (NS - not significant). Significant differences were found between swimmers in "high" vs "low" for I (p<0.004), II (p<0.007), IV (p<0.01). No significant differences were found between non-swimmers in "high" vs "low"

Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml

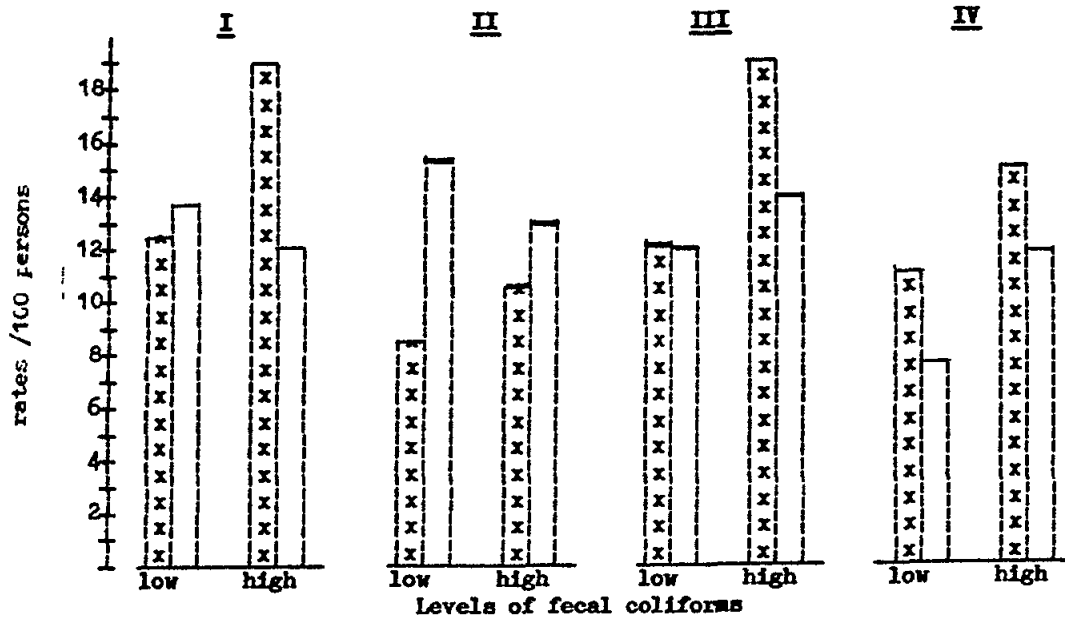
CFU - colony forming units

- I - all bathers
- II - bathers who did not visit any beach or swimming pool one week prior to beach interview
- III - all bathers (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)
- IV - bathers who did not have any enteric symptom one week prior to beach interview

	No. of swimmers		No. of non-swimmers	
	"low"	"high"	"low"	"high"
I	131	172	76	101
II	90	98	50	69
III	99	187	67	101
IV	114	149	63	91

APPENDIX 29

Incidence of enteric symptoms per 100 persons among bathers of 0-4 year old age group according to "low" and "high" levels of faecal coliforms in seawater



swimmers non-swimmers

* No significant differences were found between swimmers and non-swimmers (for "high" I, $p < 0.08$). No significant differences were found between swimmers or between non-swimmers in "high" vs "low" levels of faecal coliforms

Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml

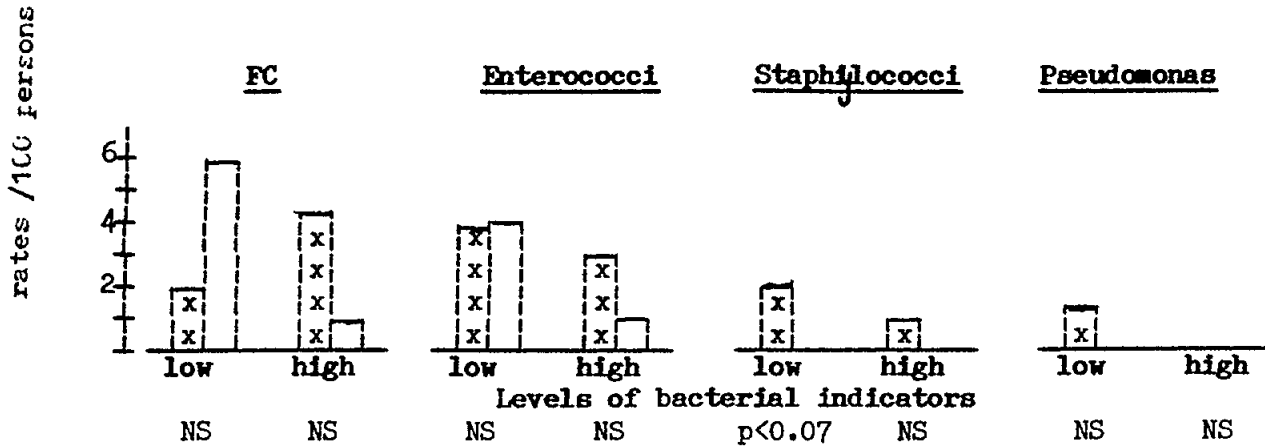
CFU - colony forming units

- I - all bathers
- II - bathers who did not visit any beach or swimming pool one week prior to beach interview
- III - all bathers (in case of two or more bacterial samples tested during the bathing time of the interviewee, the highest bacterial concentration was taken)
- IV - bathers who did not have any enteric symptom one week prior to beach interview

	No. of swimmers		No. of non-swimmers	
	"low"	"high"	"low"	"high"
I	106	184	51	108
II	72	108	33	75
III	90	183	50	100
IV	91	159	40	99

APPENDIX 30

Incidence of ear symptoms per 100 persons among all bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater
(Master Table MSPA)



swimmers (The number ranged from 44 to 131 in "low" and from 89 (Pseudomonas) to 184 in "high")

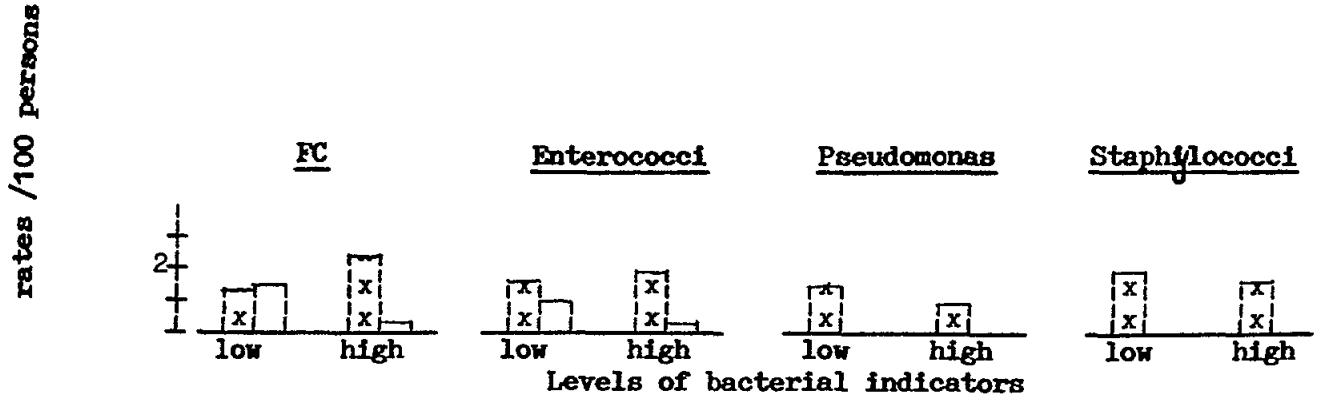
non-swimmers (The number ranged from 5 to 87 in "low" and from 2 (Pseudomonas) to 108 in "high")

* Level of significance of difference between swimmers and non-swimmers (NS - not significant). No significant differences were found between swimmers in "high" vs "low". No significant differences were also found between non-swimmers in "high" vs "low" (p<0.07 for FC)

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
 Staphylococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 70 CFU/100 ml
 Pseudomonas: "low" - 0 to 9 CFU/100 ml
 "high"- 10 to 45 CFU/100 ml
 CFU - colony forming units

APPENDIX 31

Incidence of ear symptoms per 100 persons among all bathers of all ages according to "low" and "high" levels of different bacterial indicators in seawater
(Master Table MSPA)



swimmers (The number ranged from 365 to 687 in "low" and from 117 (Pseudomonas) to 866 in "high")

non-swimmers (The number ranged from 201 to 302 in "low" and from 31 (Pseudomonas) to 427 in "high")

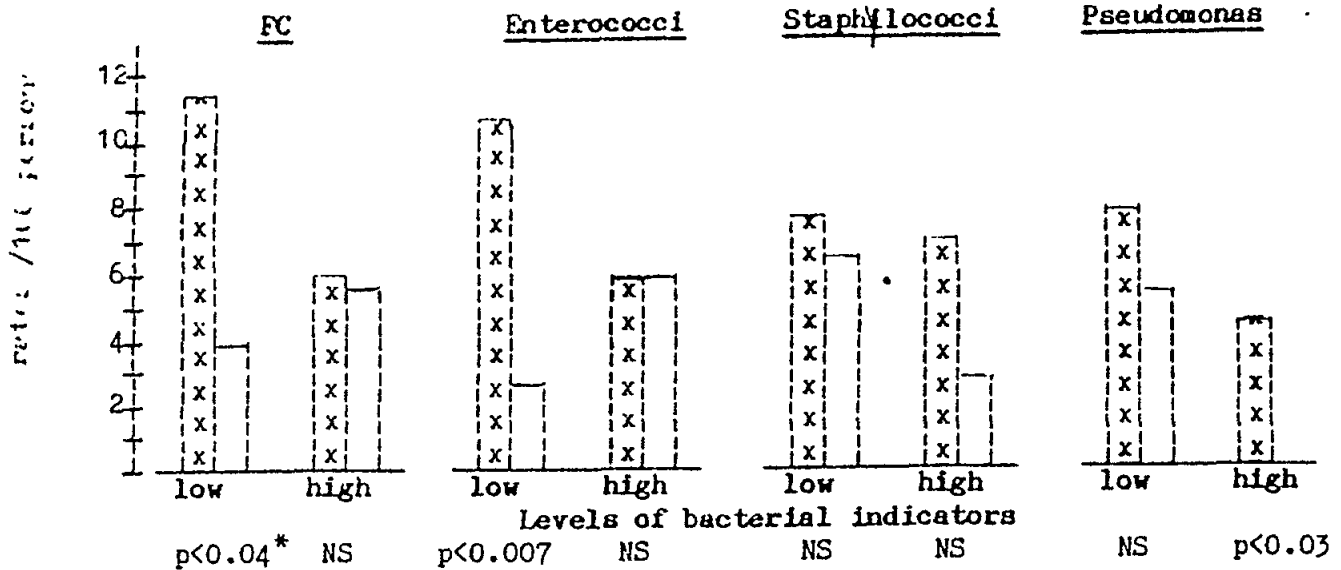
* No significant differences were found between swimmers and non-swimmers. No significant differences were found between swimmers or non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
"high"- 51 to 650 CFU/100 ml
Enterococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 410 CFU/100 ml
Staphylococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 70 CFU/100 ml
Pseudomonas: "low" - 0 to 9 CFU/100 ml
"high"- 10 to 45 CFU/100 ml

CFU - colony forming units

APPENDIX 32

Incidence of skin symptoms per 100 persons among all bathers of 0-4 year old age group according to "low" and "high" levels of different bacterial indicators in seawater



swimmers (The number ranged from 44 to 131 in "low" and from 89 (Pseudomonas) to 89 in "high")

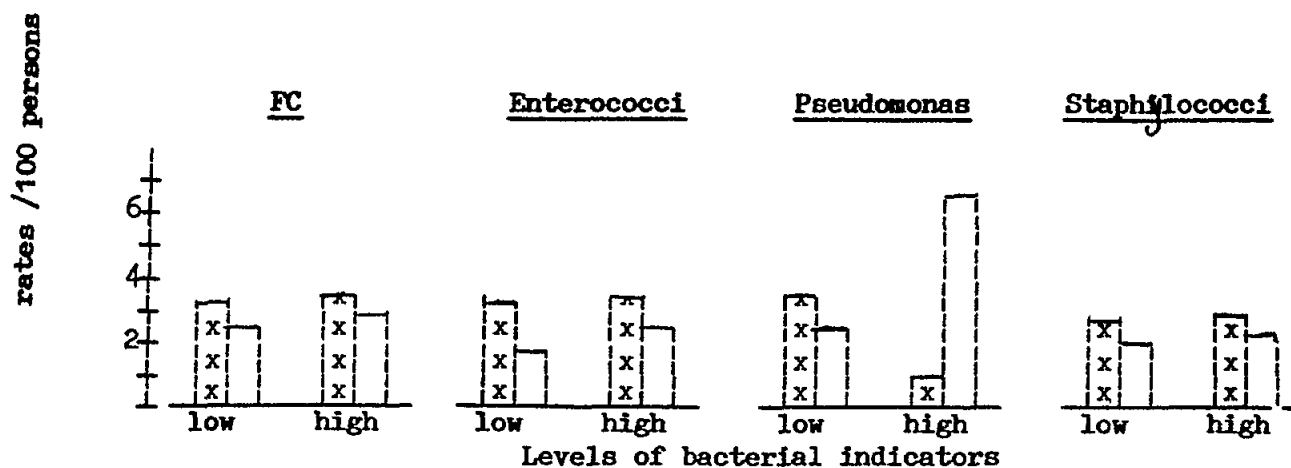
non-swimmers (The number ranged from 5 to 87 in "low" and from 2 (Pseudomonas) to 108 in "high")

* Level of significance of difference between swimmers and non-swimmers (NS - not significant). No significant differences were found between swimmers in "high" vs "low" (p<0.07 for FC and enterococci). No significant differences were also found between non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
 "high"- 51 to 650 CFU/100 ml
 Enterococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 410 CFU/100 ml
 Staphylococci: "low" - 0 to 24 CFU/100 ml
 "high"- 25 to 70 CFU/100 ml
 Pseudomonas: "low" - 0 to 9 CFU/100 ml
 "high"- 10 to 45 CFU/100 ml
 CFU - colony forming units

APPENDIX 33

Incidence of skin symptoms per 100 persons among all bathers of all ages according to "low" and "high" levels of different bacterial indicators in seawater
(Master Table MSPA)



swimmers (The number ranged from 365 to 687 in "low" and from 117 (Pseudomonas) to 866 in "high")

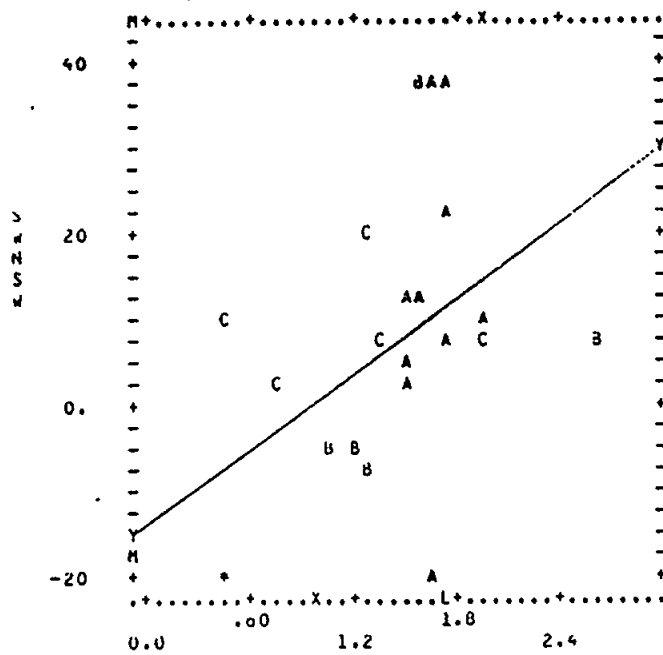
non-swimmers (The number ranged from 201 to 302 in "low" and from 31 (Pseudomonas) to 427 in "high")

* No significant differences were found between swimmers and non-swimmers. No significant differences were found between swimmers or non-swimmers in "high" vs "low"

FC - Faecal coliforms: "low" - 0 to 50 CFU/100 ml
"high"- 51 to 650 CFU/100 ml
Enterococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 410 CFU/100 ml
Staphylococci: "low" - 0 to 24 CFU/100 ml
"high"- 25 to 70 CFU/100 ml
Pseudomonas: "low" - 0 to 9 CFU/100 ml
"high"- 10 to 45 CFU/100 ml
CFU - colony forming units

APPENDIX 34(a)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of enterococci (entero) densities for three beaches for the 0-4 year old age group

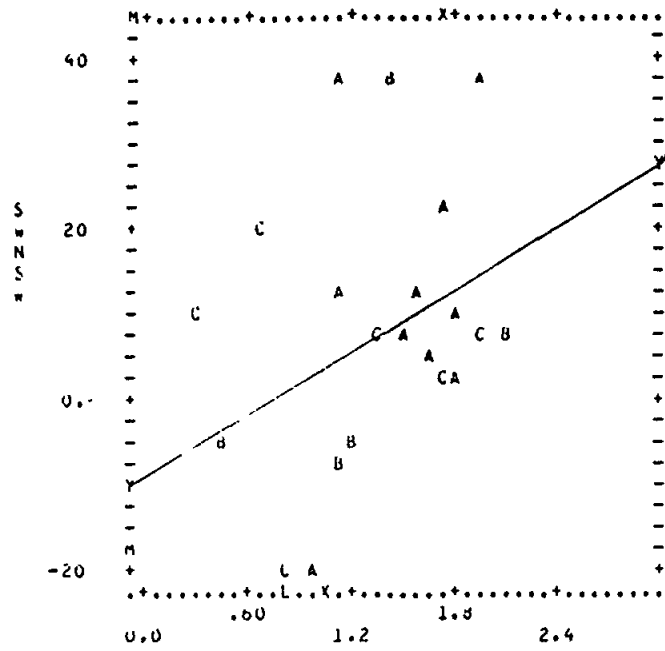


N = 22
 R = .4474
 P(R) .0272
 MEAN ST. DEV. REGRESSION LINE RES. MS.
 Y 7.4593 17.014 Y = 14.022 * X - 13.101 242.97

XVAR = ENTERO VS. YVAR = SWNS GROUP=GORDON, SYMBOL=A
 XVAR = ENTERO VS. YVAR = SWNS GROUP=SHERATON, SYMBOL=B
 XVAR = ENTERO VS. YVAR = SWNS GROUP=MISHAN, SYMBOL=C

APPENDIX 34(b)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of E. coli densities for three beaches for the 0-4 year old age group

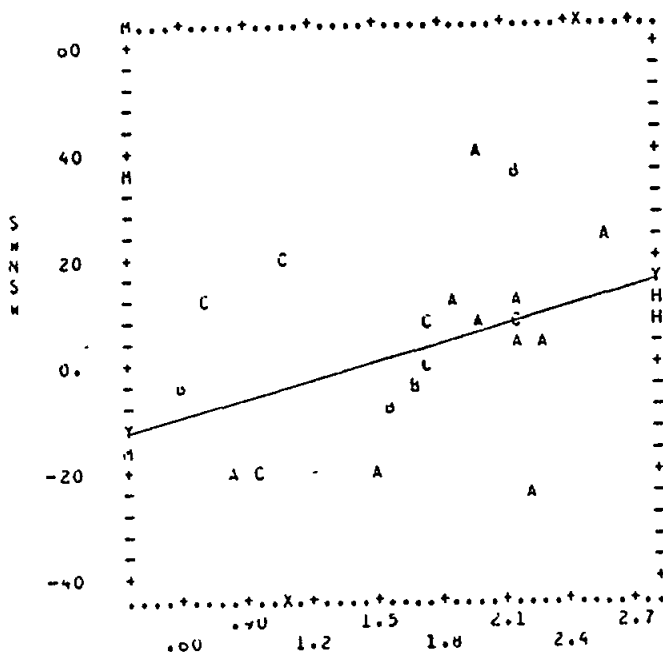


N = 22
 K = .3380
 P(R) .1004
 MEAN ST.DEV. REGRESSION LINE RES.MS.
 Y 7.4395 17.014 Y = 11.040X - 0.0708 269.21

XVAR =	ECOLI	VS.	YVAR =	SWNSW	GROUP=GORDON , SYMBOL=A
XVAR =	ECOLI	VS.	YVAR =	SWNSW	GROUP=SHERATON, SYMBOL=B
XVAR =	ECOLI	VS.	YVAR =	SWNSW	GROUP=RISHUN , SYMBOL=C

APPENDIX 34(c)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of faecal coliform (fcoli) densities for three beaches for the 0-4 year old age group

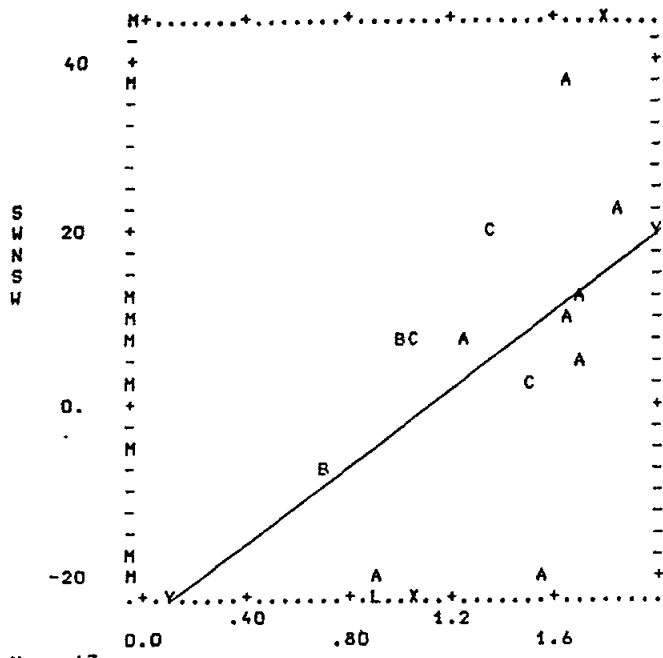


N = 20
 r = .3914
 P(R) = .0711
 MEAN ST. DEV. REGRESSION LINE RES. MS.
 Y 4.2010 17.981 Y = 12.188*X - 16.307 285.65

XVAR = FCOLI VS. YVAR = SWNSW GROUP=GORDON, SYMBOL=A
 XVAR = FCOLI VS. YVAR = SHNSW GROUP=SHERATON, SYMBOL=B
 XVAR = FCOLI VS. YVAR = SWNS GROUP=RISHUN, SYMBOL=C

APPENDIX 34(d)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of Staphylococcus aureus densities for three beaches for the 0-4 year old age group

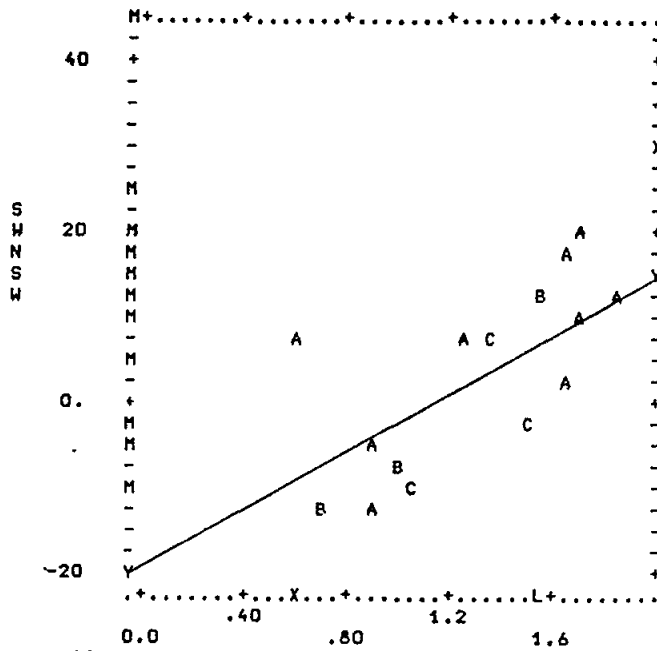


N = 13
R = .5054
P(R) .0538
MEAN ST.DEV. REGRESSION LINE RES.MS.
Y 6.7462 16.326 Y= 22.950*X-24.692 216.50

XVAR = STAPHIL VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
XVAR = STAPHIL VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
XVAR = STAPHIL VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

APPENDIX 34(e)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of Staphylococcus aureus densities for three beaches for the 0-9 year old age group

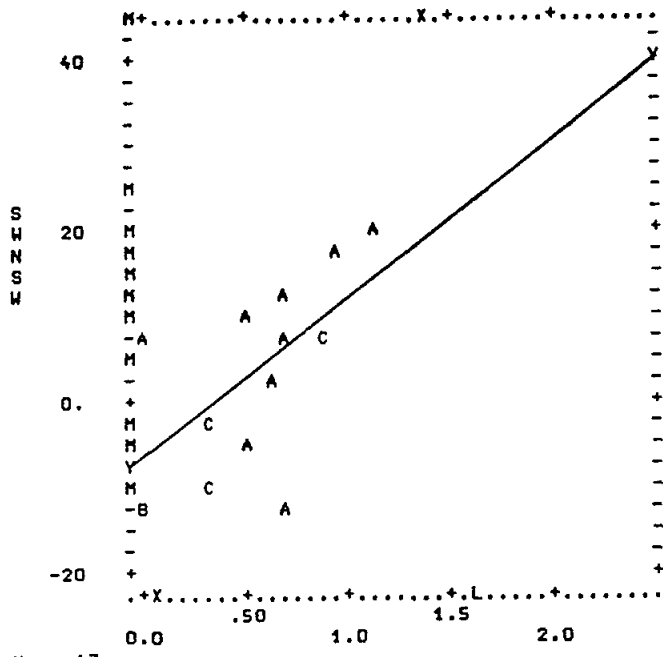


N = 15
 R = .6849
 P(R) .0017
 MEAN ST.DEV. REGRESSION LINE RES.MS.
 Y 3.2260 10.629 Y= 18.080*X-20.083 64.588

XVAR = STAPHIL VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
 XVAR = STAPHIL VS. YVAR = SWNSW GROUP=SHERATON , SYMBOL=B
 XVAR = STAPHIL VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

APPENDIX 34(f)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of Pseudomonas aeruginosa (pseudom) densities for three beaches for the 0-9 year old age group

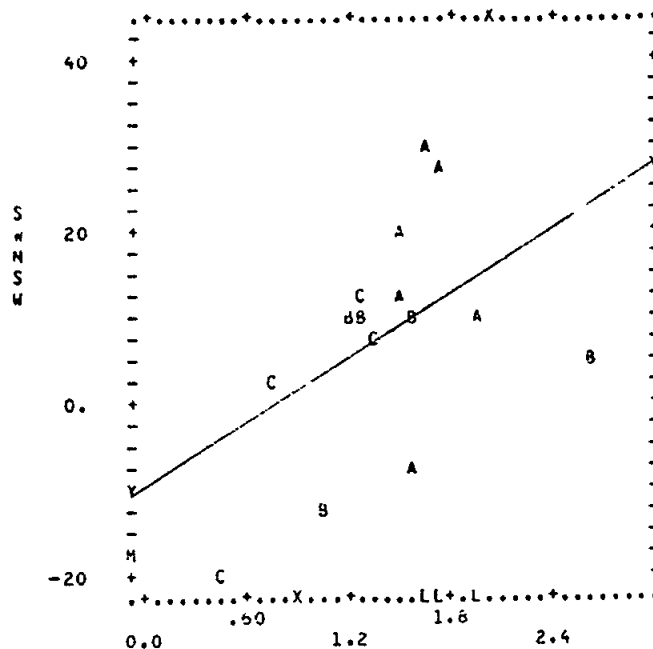


N = 13
R = .6138
P(R) .0133
MEAN ST. DEV. REGRESSION LINE RES. MS.
Y 3.1808 10.759 Y= 19.234*X-7.4728 78.702

XVAR = PSEODOM VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
XVAR = PSEODOM VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
XVAR = PSEODOM VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

APPENDIX 34(g)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of enterococci (entero) densities for three beaches for the 0-4 year old age group

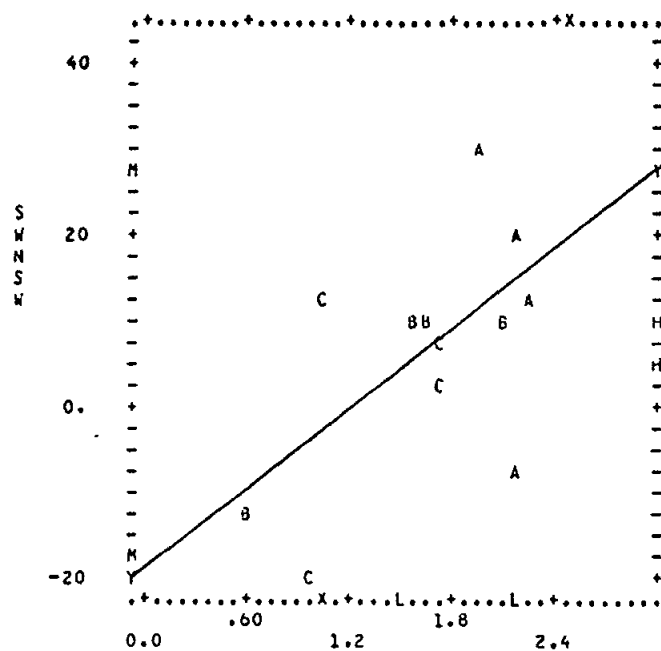


N = 15
 R = .4492
 P(R) .0703
 MEAN ST.DEV. REGRESSION LINE RES.MS.
 Y 7.8740 13.668 Y = 12.414*X - 9.8557 161.05

XVAR = ENTERO VS. YVAR = SWNSW GROUP=GORDON , SYMBOL=A
 XVAR = ENTERO VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
 XVAR = ENTERO VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

APPENDIX 34(h)

Scattergram of swimming-associated enteric symptoms (swns) (incidence among swimmers minus incidence among non-swimmers) and logs of faecal coliform (fcoli) densities for three beaches for the 0-4 year old age group



N = 12
R = .5738
P(R) .0303
MEAN ST.DEV. REGRESSION LINE RES.MS.
Y 6.4917 14.162 Y= 15.134*X-19.745 147.99

XVAR = FCOLI VS. YVAR = SWNSW GROUP=GODDON , SYMBOL=A
XVAR = FCOLI VS. YVAR = SWNSW GROUP=SHERATON, SYMBOL=B
XVAR = FCOLI VS. YVAR = SWNSW GROUP=RISHON , SYMBOL=C

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